

Iowa State University

Courses and Programs Catalog 2025 - 2026

The Iowa State University Catalog

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

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

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

Iowa State University does not discriminate on the basis of race, color, age, ethnicity, religion, national origin, pregnancy, sexual orientation, genetic information, sex, marital status, disability, or status as a U.S. veteran. Inquiries regarding non-discrimination policies may be directed to the Director, Office of Equal Opportunity, 2680 Beardshear Hall, Ames, Iowa 50011, Tel. 515 294-7612, email eooffice@iastate.edu.

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ABOUT THE CATALOG

The Iowa State University Catalog is a one-year publication, which lists all academic policies, and procedures. Versions prior to 2011 were two-year publications and available in hard copy as well as online.

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

New programs may be offered in the term (semester or summer session) following final approval by the Board of Regents, State of Iowa and any required accrediting bodies. New courses developed and offered since catalog publication are called experimental courses. A list can be found on the Web at www.registrar.iastate.edu/faculty-staff/courses/explistsings. (<http://www.registrar.iastate.edu/faculty-staff/courses/explistsings/>)

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Updates to the Catalog

The curriculum process is governed by the Faculty Senate. The ad hoc committee, Faculty Senate Curriculum Committee (<http://www.facsen.iastate.edu/councils/academicaaffairs/curriculum/>) considers new curricula proposals, changes and discontinuations to the catalog. Additional information may be in the college governance documents.

The curriculum approval process generally consists of a proposal from the department/program level, approved by the department/program curriculum committee (if applicable), college curriculum committee, and the dean. Additional approvals are needed from the Graduate College if the program proposal is a graduate program.

The program proposal is submitted to the Faculty Senate Curriculum committee for review. The Academic Affairs Committee reviews the proposal before passing it onto the Faculty Senate. The Board of Regents, State of Iowa approves all new programs and majors. For additional information about the approval process, see the link to Faculty Senate/ Faculty Handbook Curriculum Approvals – Section 10.8. See the Office of the Provost (<http://www.provost.iastate.edu/>) web site for more information.

Catalog updates are generally processed with approvals from department, college, and Faculty Senate Curriculum Committee (<http://www.facsen.iastate.edu/councils/academicaaffairs/curriculum/>) representatives. Editing begins in late February with course changes

due to the Office of the Registrar by June 1. Curriculum and other general information are due to the Office of the Registrar by December 1. Publication is the following February.

See the catalog editing website (<http://www.registrar.iastate.edu/catalog-editing/>) for more details on how to make changes to the catalog.

ACCREDITATION AND ADMINISTRATION

Accreditation

Iowa State University is accredited by the Higher Learning Commission.

Higher Learning Commission

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www.hlcommission.org (<https://www.hlcommission.org>)

Board of Regents, State of Iowa

www.regents.iowa.gov/ (<http://www.regents.iowa.gov/>)

The laws of the United States and of the State of Iowa provide for resident academic instruction, research, and extension education, and for the management of Iowa State University of Science and Technology. The university and two other state educational institutions of higher learning are governed by the Board of Regents, State of Iowa, which is composed of nine members nominated by the Governor of Iowa and confirmed by the Senate of Iowa. The immediate regulation and direction of the academic, research, and extension activities of the university are delegated by the Board of Regents, State of Iowa, to the president and faculty of the university. The board appoints an executive director with overall responsibility for the administration of the central office of the board located in Urbandale, Iowa.

Officers of Administration

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Senior Vice President for Operations and Finance

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Dan Grooms, D.V.M., Ph.D.

Dean of the College of Veterinary Medicine

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Dean of the Graduate College

Hilary T. Seo, M.S.

Dean of the Library

Dawn Bratsch-Prince, Ph.D.

Associate Provost for Faculty

Ann Marie VanDerZanden, Ph.D.

Associate Provost for Academic Programs

Sharron Evans, J.D.

Associate Vice President for Student Affairs and Dean of Students

ADMISSIONS

Office of Admissions

Executive Director of Admissions and New Student Programs

Katharine Johnson Suski

Admission

When to Apply

Applicants for the fall semester are encouraged to apply during the fall of the year preceding their entry to Iowa State University. Applications for other terms should be submitted well in advance of the desired entry date.

Application deadlines are available at www.admissions.iastate.edu. (<http://www.admissions.iastate.edu/>)

Completed applications for admission to the professional curriculum in the College of Veterinary Medicine, together with the required supporting transcripts, must be received by an established deadline. See College of Veterinary Medicine, Application and Admission.

How to Apply

Applications for admission are available online at www.admissions.iastate.edu. (<http://www.admissions.iastate.edu/>)

Iowa State University operates on a rolling admissions basis. Admission of applicants for fall semester begins in July of the preceding year. Admission for other terms begins approximately 12 months prior to the beginning of the term. Admission offers are issued for a specific term and are valid only for the term specified.

Undergraduate Admission Directly from High School

Admission decisions are made by admissions officers in accordance with the entrance requirements as set forth in the Iowa Administrative Code as well as the admission policies established by the Faculty Senate.

Students who seek admission must meet the following requirements and also any special requirements for the college or curriculum of their choice.

Applicants must submit an application for admission and the appropriate application fee (see www.admissions.iastate.edu (<http://www.admissions.iastate.edu/>) for current application fee information). In addition applicants must have their secondary school provide an official final transcript of their academic record, including cumulative grade point average and certification of graduation.

Applicants must also arrange to have their ACT or SAT scores reported to Iowa State directly from the testing agency. U.S. citizen and immigrant applicants who will not graduate from an approved U.S. high school and whose primary language is not English must meet university

communication proficiency requirements. This can be accomplished by achieving satisfactory scores on the TOEFL, IELTS, PTE, ACT, or SAT. In addition to these tests, the Duolingo English Test (DET) may be used for undergraduates only. Detailed information concerning test score requirements can be found at <http://www.admissions.iastate.edu/intl> (<http://www.admissions.iastate.edu/intl/>).

Applicants may be required to submit additional information or data to support their applications.

A. Iowa State is test-optional for first-year applicants. Students may choose whether they wish to self-report their ACT/SAT scores when they apply for admission.

REGENT ADMISSION INDEX FORMULA:

Applicants will be considered for admission based upon their Regent Admission Index (RAI) score. Below is the mathematical formula for calculating an RAI score:

$$\begin{aligned} & \text{ACT composite (or converted SAT (<https://www.iowaregents.edu/institutions/higher-education-links/regent-admission-index/rai-info/>)) score} \times 3 \\ & + \text{Cumulative GPA} \times 30 \\ & + \text{Number of years of core courses in high school} \times 5 \\ & = \text{RAI (Regent Admission Index)} \end{aligned}$$

Note: For purposes of calculating the RAI, SAT scores will be converted to ACT composite equivalents; high school GPA is expressed on a 4-point scale; and number of high school courses completed in the core subject areas is expressed in terms of years or fractions of years of study.

Applicants who achieve at least a 245 RAI score and who meet the minimum high school course requirements will automatically be offered admission.

Applicants who achieve less than a 245 RAI score and who meet the minimum high school course requirements may also be offered admission, based on individual academic review of their application materials.

For applicants who choose not to report an ACT or SAT score, admission will be based on high school grade point average and high school core course requirements.

Calculate your Regent Admission Index (<https://www.iowaregents.edu/institutions/higher-education-links/regent-admission-index/>)

A. Nonresidents of Iowa, including international students, may be held to higher academic standards, but must meet at least the same requirements as resident applicants.

B. Applicants who are graduates of nonapproved high schools will be considered for admission in a manner similar to applicants from approved high schools, but additional emphasis will be given to scores earned on standardized examinations.

C. Applications may be considered from students who did not graduate with their high school classes. They will be required to submit all academic data to the extent that it exists and achieve scores on standardized examinations which will demonstrate that they are adequately prepared for academic study.

D. Students with satisfactory academic records may be admitted, on an individual basis, for part-time university study while enrolled in high school or during the summers prior to high school graduation.

E. Exceptional students may be admitted as full-time students before completing high school. Early admission is provided to serve persons whose academic achievement and personal and intellectual maturity clearly suggest readiness for college-level study.

US freshman applicants are not required to submit ACT or SAT scores to be considered for admission. Applicants who do not provide their test scores will be considered for admission based on an individual review of their academic records with emphasis given to the high school cumulative GPA and core courses.

High School Preparation

Graduation from an approved high school shall ordinarily precede entrance into Iowa State University.

Students who wish to enter Iowa State University directly from high school (or transfer from another college or university with less than 24 semester hours of graded transferable college credit) must meet the level of academic performance described above and show evidence of the following high school preparation:

English/Language Arts

Four years, emphasizing writing, speaking, and reading, as well as an understanding and appreciation of literature

Mathematics

Three years, including one year each of algebra, geometry, and advanced algebra

Science

Three years, including at least two years of courses which emphasize elements of biology, chemistry, or physics

Social Studies

Two years

Additional Requirements for the College of Liberal Arts and Sciences and the College of Engineering

In addition to the high school preparation requirements described above, students applying to the College of Liberal Arts and Sciences must have

completed an additional year of social studies, for a total of three years, and two years of a single foreign language. Students applying to the College of Engineering must have completed two years of a single foreign language.

Students who do not meet the high school course preparation requirements listed here, but who are otherwise well qualified, may be admitted after individual review of their applications.

Undergraduate Admission - Nondegree Undergraduate

Students who wish to attend Iowa State University to take undergraduate courses but who do not plan to seek an undergraduate degree from Iowa State University should apply as nondegree undergraduate students. Credit taken under the nondegree undergraduate classification is applicable for undergraduate degree purposes for those who are later admitted as degree-seeking undergraduate students. Nondegree undergraduates who have already earned an undergraduate degree may not enroll in graduate credits. To take courses listed as available for graduate credit, a student must enroll as a nondegree graduate and pay graduate fees. Credit obtained under the nondegree undergraduate classification may not be applied toward a graduate degree.

Nondegree applicants are held to the same standards of admission as degree-seeking applicants, including English language proficiency.

Reentering Students - Undergraduate and Graduate

Reentering undergraduate students are those who have previously attended Iowa State University and are returning after an absence of at least one full year. See Index, Reentry Students.

International students need to reapply after an absence of one full semester, exclusive of summer session. International reentries must also contact the International Students and Scholars office to request the necessary visa application forms.

Reentering graduate students do not need to complete a reentry form but should notify their program and the Office of the Registrar of their intent to reenter Iowa State University. Graduate students returning after 24 months will need to complete the reinstatement process. See Index, Reentry Students.

Undergraduate Admission by Transfer from Other Educational Institutions

Students who seek admission must meet the following requirements and also any special requirements for the college and curriculum of their choice.

Applicants must submit an application for admission, and the appropriate application fee (see www.admissions.iastate.edu (<http://www.admissions.iastate.edu/>) for current application fee information). Applicants must also request that each institution they have attended send an official transcript of record to the Office of Admissions. Failure to

provide transcripts from all colleges or universities attended may result in denial of the application or dismissal from the university. If less than 24 semester hours of graded transferable college credit is completed prior to entry at Iowa State University, applicants must also request that their official high school transcript be sent to the Office of Admissions. Students may elect to also have their ACT or SAT scores sent to the Office of Admissions.

U.S. citizen and immigrant applicants who have not graduated from an approved U.S. high school and whose primary language is not English must meet the university's English communication requirement. This can be accomplished by achieving satisfactory scores on the Test of English as a Foreign Language (TOEFL), the International English Language Testing System (IELTS), Duolingo English Test (DET), ACT or SAT. Refer to <https://www.admissions.iastate.edu/intl/transfer> (<https://www.admissions.iastate.edu/intl/transfer/>) for minimum score requirements for each examination.

A. Transfer applicants with a minimum of 24 semester hours of graded transferable credit from regionally accredited colleges or universities will be admitted provided they have achieved a minimum 2.25 transfer grade point average (on a 4.00 grading scale) for all college work previously attempted. Applicants who have earned an associate's degree will be required to have earned a minimum 2.00 transfer grade point average.

Some programs may require a transfer grade point average higher than this minimum. Higher academic standards may be required of students who are not residents of Iowa, including international students.

Applicants who have not maintained the grade point average required by Iowa State University for specific programs or who are under academic suspension from the last college attended generally will be denied admission.

B. In addition to meeting the minimum transfer grade point average requirement described above, applicants who have completed fewer than 24 semester hours of graded transferable college credit prior to their enrollment at Iowa State must also meet the admission requirements for students entering directly from high school.

C. Transfer applicants under disciplinary suspension will not be considered for admission until information concerning the reason for the suspension has been received from the college assigning the suspension. Applicants granted admission under these circumstances will be admitted on probation.

D. Transfer applicants from colleges and universities not regionally accredited will be considered for admission on an individual basis, taking into account all available academic information.

Transfer Credit Practices

Iowa State University endorses the Joint Statement on Transfer and Award of Academic Credit approved by the American Council on Education (ACE) and the American Association of Collegiate Registrars and Admissions Officers (AACRAO).

The acceptance and use of transfer credit are subject to limitations in accordance with the educational policies of Iowa State University.

A. Students from regionally accredited colleges and universities.

Credit earned at regionally accredited colleges and universities is acceptable for transfer, except for the following, which may not be accepted, or may be accepted to a limited extent:

- credit in courses determined by Iowa State University to be of a developmental, vocational, or technical nature
- credit in courses or programs in which the institution granting the credit is not directly involved.

No more than 65 semester or 97 quarter credits earned at two-year colleges can be applied to a bachelor's degree from Iowa State University. While there is no limit to the number of credits that may be transferred from a four-year institution, the last 32 semester credits must be completed at Iowa State University.

B. Students from colleges and universities which have candidate status.

Credit earned at colleges and universities which have become candidates for accreditation by a regional association is acceptable for transfer in a manner similar to that from regionally accredited colleges and universities if the credit is applicable to the bachelor's degree at Iowa State University.

Credit earned at the junior and senior classification from an accredited two-year college which has received approval by a regional accrediting association for change to a four-year college may be accepted by Iowa State University.

C. Students from colleges and universities not regionally accredited.

Courses completed at colleges and universities that are not regionally accredited will be evaluated according to the recommendations made by the American Association of Collegiate Registrars and Admissions Offices or the American Council on Education.

In determining the acceptability of transfer credit from colleges which are not regionally accredited, acceptance practices indicated in the current issue of Transfer Credit Practices of Designated Educational Institutions will be used as a guide. For institutions not listed in the publication, guidance is requested from the designated reporting institution of the appropriate state.

D. Students from foreign colleges and universities.

Transfer credit from foreign educational institutions may be granted after a determination of the type of institution involved, its recognition by the

educational authorities of the foreign country, and an evaluation of the content, level, and comparability of the study to courses and programs at Iowa State University. Credit may be granted in specific courses or assigned to general areas of study. Extensive use is made of professional journals and references which describe the educational systems and programs of individual countries.

Additional Transfer Credit Policies

A. Students with credit obtained during military service.

Credit will be awarded for successful completion of technical or specialized schools attended while on active duty with the armed forces to the extent that the material is applicable toward degree requirements at Iowa State University. Application for such credit is made at the Office of Admissions, which follows many of the recommendations in the American Council on Education (ACE) publication *The ACE National Guide*.

B. Students with credit obtained through non-college sponsored instruction.

Credit will be awarded for successful completion of learning acquired from participation in formal courses sponsored by associations, business, government, industry, and unions to the extent that the material is applicable toward degree requirements at Iowa State University. Application for such credit is made at the Office of Admissions, which follows many of the recommendations in the American Council on Education (ACE) publication: *The ACE National Guide*.

C. Students with credit obtained through correspondence courses.

Although Iowa State does not offer correspondence courses, college level courses taken by correspondence from accredited colleges or universities are acceptable for transfer at the undergraduate level if the courses taken are those that do not require laboratory study.

D. College Level Examination Program (CLEP).

Iowa State University will award credit for each of the following 14 examinations: Financial Accounting, American Government, Biology, Calculus, French Language, German Language, Humanities, Principles of Macroeconomics, Principles of Microeconomics, Natural Sciences, Introductory Psychology, Social Sciences and History, Introductory Sociology, Spanish Language.

Application of CLEP credit to a degree program varies with the department, so students should consult with their department before they register for CLEP examinations. Additional information is available at www.admissions.iastate.edu/cbe/ (http://www.admissions.iastate.edu/cbe/cbe_clep.php).

E. Students with "test-out" credit.

Students who have earned credit at other colleges or universities through Advanced Placement (AP), College Level Examination Program (CLEP), or International Baccalaureate (IB) examinations may qualify for credit at Iowa State University. Scores from these examinations should be sent

directly to the Office of Admissions; credit will be awarded provided the scores satisfy Iowa State's requirements.

Credit earned at another college through locally designed test-out examinations may transfer to Iowa State University if accompanied by at least 12 transferable semester credits earned through coursework taken at that institution.

F. Credit for prior learning.

Credit for prior learning applies to learning acquired from, but not limited to, credit by examination (e.g., Advanced Placement Exam (AP), College Level Exam (CLEP), International Baccalaureate (IB), Departmental Exams, etc.), credit that has been recommended by non-degree granting institutions, and ACE-recommend military coursework and/or experience. Credit awarded for prior learning is documented, evaluated, and appropriate for the level of degree awarded. Iowa State University does not award credit for work or life experience nor does it award credit for a service member's military occupational experience.

Iowa State University will allow a maximum of 60 credits of prior learning to satisfy a student's undergraduate degree requirements, of which no more than 32 credits may come from the credit by examination.

Articulation/Transfer Agreements

A. Iowa Regent Universities General Education Articulation Agreement.

Iowa State University participates in an articulation agreement with the other two Iowa Regent universities concerning the acceptance of their general education programs into the Iowa State University College of Liberal Arts and Sciences. Under the terms of this agreement, students who have satisfied general education requirements at the University of Northern Iowa or in the College of Liberal Arts at the University of Iowa may transfer to Iowa State's College of Liberal Arts and Sciences with their general education requirements met (with the possible exception of the foreign language, diversity, and library requirements).

B. Associate of Arts (A.A.) Articulation Agreement with Iowa public community colleges.

Students who plan to enter the College of Liberal Arts and Sciences or the Ivy College of Business at Iowa State University with an associate of arts degree from an Iowa public community college, and who have at least a 2.00 cumulative grade point average, will be considered to have met the general education requirements of that college. Ivy College of Business students will still be required to take an ethics and a global course to satisfy general education requirements unless they are taken as part of the associate of arts degree.

C. Associate of Science (A.S.) Articulation Agreement with Iowa public community colleges.

Students who plan to enter the College of Liberal Arts and Sciences at Iowa State University with an associate of science degree from an Iowa public community college, and who have at least 60 prescribed semester credits acceptable for transfer and at least a 2.00 cumulative grade point average, will be enrolled at junior level status upon entry to Iowa State

University, College of Liberal Arts and Sciences. Transfer students with AS degrees will have their transfer credits evaluated course-by-course to determine how the courses will be applied to their intended Iowa State major/degree program requirements.

D. Career-technical credit from Iowa public community colleges.

Iowa State University will accept up to 16 semester (24 quarter) credits earned in career-technical courses where the sending Iowa public community college will accept such courses toward its associate of arts or associate in science degree. Certain career-technical courses at Iowa community colleges may be articulated to Iowa State University as academic credit. The credit hours earned in these articulated courses would transfer in addition to the 16 semester hour career-technical maximum. Please refer to the course equivalency guides on the Web (www.admissions.iastate.edu/equiv (<https://www.admissions.iastate.edu/equiv/>)) or contact the Office of Admissions for more information.

E. AP and CLEP credit from Iowa public colleges and universities.

Iowa State University has an agreement with the Iowa public colleges and universities which allows credit earned through AP and CLEP examinations to transfer directly to Iowa State University if accompanied by at least 12 transferable semester credits earned through coursework taken at the sending institution.

On-line Transfer Articulation System (TRANSIT)

TRANSIT is Iowa State's online system, which displays how credits from a community college or another university may transfer to a degree program at Iowa State. In TRANSIT, prospective or current students can generate a transfer credit evaluation showing how their courses and degrees from a community college or university transfer to Iowa State University. In addition, students can request an unofficial degree audit, which will display how their transfer courses are applied within a particular Iowa State major/degree program. TRANSIT is easy to use and can be accessed by going to <http://transit.iastate.edu>.

Transfer of Credits

Credits presented from another institution are evaluated initially by the Office of Admissions to determine whether the courses are acceptable for transfer credit. In addition, credits applied toward a particular degree will be determined by the student's college, based on relevance to the students' program requirements as well as the level of performance deemed necessary for successful progress in that program. For example, courses that are deemed important to a program but were earned with less than a C grade may or may not be approved for a program. This policy also applies to students already enrolled at Iowa State University and to new transfer students. Grades earned in courses transferred to Iowa State University will not be used in calculating a transfer student's Iowa State cumulative grade point average.

Students should consult with their academic advisors and the Office of Admissions before taking coursework at other colleges and universities to be certain the credits will transfer and will be applicable to their program of study. Students who believe that any transfer credits have not been correctly evaluated should consult with their academic advisor and with the Office of Admissions. Questions concerning how transfer credits are applied toward a degree program should be referred to the academic advisor and college office.

No more than 65 semester or 97 quarter credits earned at two-year colleges can be applied to a bachelor's degree from Iowa State University. While there is no limit to the number of credits that may be transferred from a four-year institution, the last 32 semester credits before receiving a degree from Iowa State University must be completed at Iowa State University. Credits earned while students participated in an ISU Study Abroad or National Student Exchange program are exempt from this requirement.

Iowa State University students who attend one of the other Iowa Regent universities under the Regent Universities Student Exchange Program will have the credits earned at the other university counted as resident credit and grades received included in their Iowa State University cumulative grade point average, even if the credits are included in the last 32 semester credits. For information on applying to the program see Index, Regent Universities Student Exchange Program (<http://catalog.iastate.edu/azindex/>).

Credit by Examination (CBE)

It is Iowa State University policy to grant academic credit by examination in many of the undergraduate courses listed in the university bulletin. Credit is awarded primarily in the introductory level classes in mathematics, natural, physical, and social sciences, and the liberal arts. Students with superior high school backgrounds or those with college-level proficiency in certain subject areas are strongly encouraged to investigate and attempt testing in the CBE programs available.

Types of Credit By Examination Programs (CBE)

Students may earn academic credit in any of six ways and have that credit recorded on their academic record when they enroll. Programs accepted at Iowa State include the Advanced Placement (AP) Program, the International Baccalaureate (IB) Examinations, the Global Assessment Certificate (GAC), Cambridge International AS and A Level Subject examinations, departmental examinations, and the College Level Examination Program (CLEP). Iowa State's policies for awarding credit for each of these programs may be found at www.admissions.iastate.edu/cbe (<http://www.admissions.iastate.edu/cbe/>).

Advanced Placement (AP) Program of the College Board

This program allows students, while still in high school, to take examinations for credit at the college level. Iowa State University awards credit or advanced placement through the Advanced Placement

Program in art, biology, chemistry, computer science, economics, English, environmental science, foreign languages, geography, government and politics, history, mathematics, music, physics, psychology and statistics. High school counselors and teachers will assist with testing arrangements.

Generally, students scoring 3 or better on the exams will be considered for course credit based on departmental review of the exams. In some departments, only scores of 4 or better will be considered for credit.

Detailed information concerning the Advanced Placement Program can be found at <https://apstudent.collegeboard.org/home> (<https://apstudent.collegeboard.org/home/>).

International Baccalaureate Examinations

The International Baccalaureate (IB) Program, offered at many high schools in the United States and abroad, allows students the opportunity to take examinations for credit at the college level. These examinations are offered at standard and higher levels.

Iowa State University awards credit for most higher level examinations and some standard level examinations. Students must receive a minimum score of 4 to qualify for academic credit in most subject areas. Some departments require higher scores. Official IB examination results must be sent directly to the Office of Admissions from the International Baccalaureate Americas Office. Results listed on high school transcripts are not considered official.

Detailed information concerning the IB Program can be found at <http://ibo.org/iba/>. Course equivalencies and minimum scores required by Iowa State can be at <https://www.admissions.iastate.edu/cbe/ib.php>

Global Assessment Certificate

The Global Assessment Certificate (GAC) is a university preparation program that provides students with the academic knowledge, skills, and confidence to thrive in an English-language bachelor's degree program as well as preparation for the ACT university admissions test. Students who complete all three levels of the GAC and provide official confirmation of their completion/graduation by submitting a GAC Academic Transcript can earn university credit for GAC coursework. Details regarding transfer credit for the GAC can be reviewed at <https://www.admissions.iastate.edu/cbe>.

Cambridge international AS and A level subjects

Cambridge Advanced offers college preparatory courses worldwide. At the conclusion of course studies and examinations, an official GCE Certificate must be received in order to award transfer credits. Official AS- and A-Level examination certificates must be sent directly to the Office of Admissions. Results listed on school transcripts are not considered official. Course equivalencies can be found at <https://www.admissions.iastate.edu/cbe>.

Departmental Examinations

Students may take locally constructed departmental examinations for undergraduate credit in specified subject areas for which they and the department feel they have the necessary preparation. These exams are generally administered by the department which offers the course (for exceptions, see CLEP offerings below). Students interested in taking departmental (or CLEP) examinations should contact the appropriate department for specific information on the course covered by the exam and the exam itself. A nonrefundable fee is charged for each departmental examination requested.

If an acceptable exam score is achieved, a grade of T will be reported to the Office of the Registrar. The T grade represents performance equivalent to a C or better in the course. T grades are not used in computing students' grade point averages; however, the credit does become part of their official academic record and may be applied toward their graduation requirements.

Most examinations for credit are prepared by the departments offering the courses. In some cases, the examination used is part of the College Level Examination Program (CLEP), where the content of the CLEP test has been judged to be an equivalent to the content of the course.

College Level Examination Program

CLEP is available on computer only and Iowa State University only accepts the CLEP tests listed in this section. Up to six semester credit hours in each of these three CLEP general tests is awarded: Social Sciences and History, Humanities, and Natural Sciences. In addition, the College of Engineering does not allow credit earned from CLEP Social Sciences and History, Humanities, and Natural Sciences tests to be used in their students' degree programs.

CLEP tests accepted at Iowa State University include American Government, Financial Accounting (engineering majors should consult with their academic advisor before registering for this examination), Biology (not for biology or engineering majors), Calculus, Introductory Psychology, Introductory Sociology, Principles of Macroeconomics, and Principles of Microeconomics.

In addition, Iowa State University will award up to 9 semester credit hours for CLEP French Language, up to 9 semester credit hours for CLEP German Language, and up to 9 semester credit hours for CLEP Spanish Language.

For more information on required scores and credit that will be awarded, please refer to the Credit by Exam website www.admissions.iastate.edu/cbe (<https://www.admissions.iastate.edu/cbe/>).

Information about testing centers and registration can be found at <https://clep.collegeboard.org/search/test-centers> (<https://clep.collegeboard.org/search/test-centers/>). For information on whether to take any of the CLEP tests, contact your academic advisor.

Additional information on the CLEP exam is available at <https://clep.collegeboard.org/>.

Policies and Procedures Governing CBE Tests

1. Departmental and CLEP tests are offered to newly admitted or currently enrolled students at Iowa State University. Former and future students will receive credit only if they enroll sometime during the twelve months immediately following the test(s).

2. Permission to take a departmental examination is obtained from the department. Students may be denied permission because (a) the nature of the course is such that proficiency cannot be measured by such a test, (b) the student does not appear to have adequate background to pass the examination for the course, or (c) the student would not otherwise be allowed to enroll in the course. Students may appeal such a denial to the dean of the college in which the department is administered and subsequently to the provost.

3. Students may ordinarily attempt a CBE test only once in any course or area. Under special circumstances a retest may be taken upon approval of the department in which the course is offered.

4. Credit by examination will not be granted if it duplicates courses previously passed or failed.

5. Departmental examinations and CLEP subject tests cover only a single course and students may not test out of independent study or special topic courses.

6. There is a nonrefundable fee for all departmental tests. The fee is set by the Board of Regents, State of Iowa, and is subject to change.

7. Departmental examinations are usually given just prior to, or within two weeks of, the beginning of fall and spring semesters. For more information, students should contact the department that offers the class. CLEP tests are given throughout the year.

8. Credit for the CLEP examinations Social Sciences and History, Humanities, and Natural Sciences is not evaluated as equivalent to any specific course and cannot be used in place of specific course requirements for the major. All colleges (except Engineering, which does not accept these tests) allow these CLEP credits to be used for either general requirements (not in Liberal Arts and Sciences) or elective credit. Students are responsible for checking with their academic advisors to determine whether such credit is to their benefit.

9. Listed below are policies for transferring CBE from another college or university to Iowa State University:

a. AP or CLEP credit which is earned at an Iowa public college or university may be transferred directly to Iowa State University provided it is accompanied by at least 12 semester credits earned in residence at the sending institution. AP or CLEP credit which is

earned at any other college or university may not be transferred directly to Iowa State. However, the scores from these examinations may be sent to Iowa State University from the testing agency, and credit will be awarded based on Iowa State's AP and CLEP policies.

b. IB credit earned at another college or university may not be transferred directly to Iowa State University. However, the scores from IB examinations may be sent to Iowa State from the testing agency, and credit will be awarded based on Iowa State's IB policies.

c. Credit earned at another college or university through local test-out examinations may be transferred directly to Iowa State University provided it is accompanied by at least 12 semester credits earned in residence at the sending institution.

d. Credit earned at another college or university for GAC or Cambridge Advanced exams may not be transferred directly to Iowa State University. However, the official GAC Academic Transcript or officially certified copies of GCE AS or A Level examination certificates may be submitted directly to Iowa State University from the respective testing authority, and credit will be awarded based on Iowa State's policies.

10. Credit earned from CBE will be posted to the student's academic record at the end of the term. CBE credits will be counted toward the projected year in school classification used to establish registration start dates.

11. Some professional programs do not accept T (test-out) credit in preprofessional courses. Students who anticipate applying to such programs should inquire about the acceptability of such credit before registering for such CBE tests.

12. Credit established at Iowa State University will usually transfer to other colleges and universities; however, the final decision rests with the institution reviewing the transcript.

Below is detailed information concerning Iowa State University admission policies and procedures. Prospective students are also encouraged to visit the following websites for additional information:

Office of Admissions: www.admissions.iastate.edu (<http://www.admissions.iastate.edu/>)

Apply: www.admissions.iastate.edu/apply/online/ (<https://www.admissions.iastate.edu/apply/online/>)

Visits to Campus: <http://www.admissions.iastate.edu/visit/index.php> (<http://www.admissions.iastate.edu/visit/>)

Freshman Admissions: www.admissions.iastate.edu/freshman/ (<https://www.admissions.iastate.edu/freshman/>)

Transfer Admissions: <https://www.admissions.iastate.edu/transfer/>
International Admissions: www.admissions.iastate.edu/intl/ (<http://www.admissions.iastate.edu/intl/>)

Graduate Admissions: www.admissions.iastate.edu/graduate/ (<http://www.admissions.iastate.edu/graduate/>)

Veterinary Medicine Admissions: www.vetmed.iastate.edu/students/future-dvm-students/ (<http://www.vetmed.iastate.edu/students/future-dvm-students/>)

Orientation: www.admissions.iastate.edu/orientation (<https://www.admissions.iastate.edu/orientation/>)

Destination Iowa State: <https://www.admissions.iastate.edu/destination/index.php> (<https://www.admissions.iastate.edu/destination/>)

Admissions Partnership Program: www.admissions.iastate.edu/partnership/ (<http://www.admissions.iastate.edu/partnership/>)

On-line Transfer Articulation System (TRANSIT): www.transit.iastate.edu/ (<https://transit.iastate.edu/>)

Credit by Exam (CLEP, AP, IB): www.admissions.iastate.edu/cbe/ (<https://www.admissions.iastate.edu/cbe/>)

Veterans and Military Students: www.admissions.iastate.edu/military/ (<https://www.admissions.iastate.edu/military/>)

Student Housing and Dining Department of Residence (DOR)

Welcome to your Cyclone Home! The university provides housing for over 10,000 students in university owned on-campus residence halls and apartments.

- Single (non-family) student housing is available in all residence halls and the Frederiksen Court and University Village apartment communities.
- Family housing is available to students and their partners, children, and other relatives in the Schilleter Village apartments.

While newly admitted freshmen 18 and under are assigned to the halls, all halls and apartments have a diverse mix of freshmen, sophomores, juniors, seniors, and graduate students, making on-campus housing a great place to live and learn. Visit <http://housing.iastate.edu/> for details.

ISU Dining

With over 20 locations, a fresh meal or snack is right around the corner! We offer flexible meal plans for students living both on- and off-campus. Our dining centers serve a wide variety of fresh-made items and are a great place for a sit-down meal. Locations like our cafes, restaurants, and markets are perfect for coffee breaks, meals, and snacks when you're on the go. Our culinary team is ready to serve you!

If you're a first-year student living in Birch-Welch-Roberts, Barton-Lyon-Freeman, Maple, Willow, Larch, Geoffroy, Buchanan, Eaton, Martin, Helser, or Friley Halls, you can choose from the following plans. A quick

explanation of each plan is below, and you can learn more on our website. (<https://www.dining.iastate.edu/meal-plans/residence-halls/>)

- **Cardinal Plan:** This convenient plan not only lets you eat where you want, but you get unlimited access to any of our dining centers. Breakfast, lunch, dinner, snacks, and late-night dining with friends all without counting your meal swipes. Enjoy added flexibility with Dining Dollars. This plan also has 5 guest meals to use for friends or family.
- **Gold Plan:** This is a declining meal balance plan. You have 210 meals of dining center meals each semester, along with Dining Dollars.
- **CyFlex:** This is our hybrid plan and combines the functionality of the other two types of plans above.

Each plan also gives you a set number of Dining Dollars (<https://www.dining.iastate.edu/meal-plans/flex-meals-dining-dollars-explained-2/>) and GET & Go (<https://www.dining.iastate.edu/meal-plans/flex-meals-dining-dollars-explained-2/>) meals.

- **Dining Dollars:** These spend dollar-for-dollar and are intended for things like snacks and convenience items.
- **GET & Go:** For one dining center swipe, you can grab a quick meal on the go at one of our five GET & Go locations! Order your meal on the GET app and be on your way. You can use your dining center meals at these locations up to two times a day.

Residents in Wallace, Wilson, and Linden may choose from meal plans (<https://www.dining.iastate.edu/meal-plans/linden-wallace-and-wilson-students/>) if they'd like although they aren't required to. There are also options (<https://www.dining.iastate.edu/meal-plans/apartmentsoff-campus/>) available to support students in apartments or off-campus housing so food is easy to access between classes.

Questions about choosing a plan? Email us at dining@iastate.edu

TUITION, FEES, AND EXPENSES

Tuition And Fees

Tuition and fees are based on the number of credits in which a student is enrolled as of 5:00 p.m. on the 10th day of class. Maximum charges start at 12 credits for undergraduate and veterinary medicine students. Maximum charges start at 9 credits for graduate students.

Students who are not residents of Iowa pay a higher tuition rate each semester. Nondegree undergraduate students and noncollegiate students pay the same fees as undergraduates. Tuition and fees are assessed in accordance with regulations of the Board of Regents, State of Iowa. Information about these regulations is found in this catalog under Admissions and Registrar.

All tuition, fees, expenses, and policies are subject to change without notice by Iowa State University and the Board of Regents, State of Iowa. For the most current and complete information see <http://www.registrar.iastate.edu/fees/>

Residency Classification for Admission and Tuition Purposes

These criteria are contained in the Policy Manual, Board of Regents, State of Iowa and or the Iowa Administrative Code: Board of Regents, State of Iowa. For additional information regarding the administrative code addressing residency classification: Section 681–1.4 "Classification of residents and nonresidents for admission, tuition, and fee purposes" <https://www.legis.iowa.gov/docs/aco/chapter/681.1.pdf> (Chapter 1, pg. 4).

GENERAL INFORMATION

A. A person enrolling at one of the three state universities shall be classified as a resident or nonresident for admission, tuition, and fee purposes by the registrar or someone designated by the registrar. The decision shall be based upon information furnished by the student and other relevant information.

B. In determining resident or nonresident classification, the issue is essentially one of why the person is in the state of Iowa. If the person is in the state primarily for educational purposes, that person will be considered a nonresident. For example, it may be possible that an individual could qualify as a resident of Iowa for such purposes as voting, or holding an Iowa driver's license, and not meet the residency requirements as established by the Board of Regents, State of Iowa, for admission, tuition, and fee purposes.

C. The registrar, or designated person, is authorized to require written documents, affidavits, verifications, or other evidence deemed necessary

to determine why a student is in Iowa. The burden of establishing that a student is in Iowa for other than educational purposes is upon the student. A student may be required to file any or all of the following:

1. A statement from the student describing employment and expected source of support
2. A statement from the student's employer
3. A statement from the student's parents verifying nonsupport and the fact that the student was not listed as a dependent on tax returns for the past year and will not be so listed in future years
4. A statement from the student's spouse related to sources of family support, length of residence in Iowa, and reasons for being in the state of Iowa
5. Supporting statements from persons who might be familiar with the family situation
6. Iowa state income tax return.

D. Applications for resident classification for a given semester or session are due no later than the fifteenth-class day of that semester or session. Applications received after the fifteenth-class day of that semester or session will be considered for the next semester or session. Appeals of any nonresident classification decision resulting from applications for resident classifications are due no later than midterm of that semester or session. Change of classification from nonresident to resident will not be made retroactive beyond the term in which application for resident classification is made.

E. A student who gives incorrect or misleading information to evade payment of nonresident fees shall be subject to serious disciplinary action and must also pay the nonresident fees for each term previously attended.

F. Review committee. These regulations shall be administered by the registrar, or someone designated by the registrar. The decision of the registrar or designated person may be appealed to a university review committee. The finding of the review committee may be appealed to the Board of Regents, State of Iowa.

GRADUATE ASSISTANTS

Graduate students appointed to a graduate assistantship appointment of 1/4-time or more for at least 3 months in fall and spring terms and for 4 weeks in summer term, are assessed tuition at the full-time resident (in-state) rate for the fall and spring term. Nonresident students with graduate assistantships of 1/4-time or more retain their non-residency classification but are assessed resident tuition and fees as long as the graduate assistantship is continued.

The spouse of a 1/4-time or more graduate assistant who is a nonresident is eligible for resident tuition and fees during the period of the assistantship appointment. Iowa residency is not granted, but a waiver of nonresident tuition and fees is in effect. When the graduate assistantship ends, the tuition and fee waiver for the spouse is terminated. (Board of Regents, State of Iowa, Minutes March 15, 1995, p. 801).

The graduate student must request the resident tuition assessment by midterm of the term in question. The benefit will not be granted retroactively.

GUIDELINES

The following guidelines are used in determining the resident classification of a student for admission, tuition, and fee purposes:

1. A financially dependent student whose parents move from Iowa after the student is enrolled remains a resident provided the student maintains continuous enrollment. A financially dependent student whose parents move from Iowa during the senior year of high school will be considered a resident provided the student has not established domicile in another state.

2. In deciding why a person is in the state of Iowa, the person's domicile will be considered. A person who comes to Iowa from another state and enrolls in any institution of postsecondary education for a full program or substantially a full program shall be presumed to have come to Iowa primarily for educational reasons rather than to establish a domicile in Iowa.

3. A student who was a former resident of Iowa may continue to be considered a resident provided absence from the state was for a period of less than 12 months and provided domicile is reestablished. If the absence from the state is for a period exceeding 12 months, a student may be considered a resident if evidence can be presented showing that the student has long-term ties to Iowa and reestablishes an Iowa domicile. A person or the dependent of a person whose domicile is permanently established in Iowa, who has been classified as a resident for admission, tuition, and fee purposes, may continue to be classified as a resident so long as domicile is maintained, even though circumstances may require extended absence of the person from the state. It is required that a person who claims Iowa domicile while living in another state or country will provide proof of the continual domicile as evidence that the person:

- (1). Has not acquired domicile in another state;
- (2). Has maintained a continuous voting record in Iowa; and
- (3). Has filed regular Iowa resident income tax returns during absence from the state.

4. A student who moves to Iowa may be eligible for resident classification at the next registration following 12 consecutive months in the state provided the student is not enrolled as more than a half-time student (6 credits for an undergraduate or professional student, 5 credits for a graduate student) in any academic year term, is not enrolled for more than 4 credits in a summer term for any classification, and provides sufficient evidence of the establishment of an Iowa domicile.

5. A student who has been a continuous student and whose parents move to Iowa may become a resident at the beginning of the next term provided the student is dependent upon the parents for a majority of financial assistance.

6. A person who has been certified as a refugee or granted asylum by the appropriate agency of the United States, who enrolls as a student at a university governed by the Board of Regents, State of Iowa, may be accorded immediate resident status for admission, tuition, and fee purposes where the person:

(1). Comes directly to the state of Iowa from a refugee facility or port of debarkation, or

(2). Comes to the state of Iowa within a reasonable time and has not established domicile in another state.

Any refugee or individual granted asylum not meeting these standards will be presumed to be a nonresident for admission, tuition, and fee purposes and thus subject to the usual method of proof of establishment of Iowa residency.

7. An alien who has immigrant status establishes Iowa residency in the same manner as a United States citizen.

8. At the Regent institutions, American Indians who have origins in any of the original people of North America and who maintain a cultural identification through tribal affiliation or community recognition with one or more of the tribes or nations connected historically with the present state of Iowa, including the Iowa, Kickapoo, Menominee, Miami, Missouri, Ojibwa (Chippewa), Omaha, Otoe (Otto), Ottawa (Odawa), Potawatomi, Sac and Fox (Sauk, Meskwaki), Sioux, and Winnebago (HoCak/Ho-Chunk), will be assessed Iowa resident tuition and fees. (Board of Regents, State of Iowa, Minutes October 15-16, 1997, p. 299)

**Section B below is under revision. For current information, go to <https://www.registrar.iastate.edu/students/in-state-tuition-benefit> (<https://www.registrar.iastate.edu/students/in-state-tuition-benefit/>).

B. Additional guidelines are used in determining the resident classification of a veteran, qualified military person, and dependent children and spouses of a veteran or qualified military person for purposes of admission and undergraduate tuition and mandatory fees:

1. A person who is stationed on active duty at the Rock Island arsenal as a result of military orders, or the dependent child or spouse of such person, is entitled to resident status for purposes of undergraduate tuition and mandatory fees. However, if the arrival of the person under orders is subsequent to the beginning of the term in which the dependent child or spouse is first enrolled, nonresident fees will be charged in all cases for the dependent child or spouse until the beginning of the next term in which the dependent child or spouse is enrolled. If the qualified military person is transferred, deployed, or restationed while the person's spouse or dependent child is enrolled in an institution of higher education under the control of the board of regents, the spouse or dependent child shall continue to be classified as a resident under this subparagraph until the close of the fiscal year in which the spouse or dependent child is enrolled.

2. A veteran who is domiciled or moves to the state of Iowa and who is eligible for benefits or has exhausted benefits under the federal post-9/11 Veterans Educational Assistance Act of 2008, is entitled to resident status for purposes of undergraduate tuition and mandatory fees. The dependent child or spouse of a veteran who meets these requirements is entitled to resident status for undergraduate tuition. However, if the arrival of the veteran in Iowa is subsequent to the beginning of the term in which the dependent child or spouse is first enrolled, nonresident fees will be charged in all cases for the dependent child or spouse until the beginning of the next term in which the dependent child or spouse is enrolled.

3. A person who is moved into the state as the result of military or civil orders from the government for other than educational purposes, or the dependent child or spouse of such a person, is entitled to resident status. However, if the arrival of the person under orders is subsequent to the beginning of the term in which the dependent child or spouse is first enrolled, nonresident fees will be charged in all cases until the beginning of the next term in which the dependent child or spouse is enrolled. Legislation, effective July 1, 1977, requires that military personnel who claim residency in Iowa (home of record) will be required to file Iowa resident income tax returns.

FACTS

A. The following circumstances, although not necessarily conclusive, have probative value in support of a claim for resident classification:

1. Reside in Iowa for 12 consecutive months and be primarily engaged in activities other than those of a full-time student, immediately prior to the beginning of the term for which resident classification is sought.
2. Reliance upon Iowa resources for financial support.
3. Domicile in Iowa of persons legally responsible for the student.

4. Former domicile in the state and maintenance of significant connections therein while absent.
5. Acceptance of an offer of permanent employment in Iowa.
6. Military orders, if for other than educational purposes.
7. Other facts indicating the student's domicile will be considered by the universities in classifying the student.

B. The following circumstances, standing alone, do not constitute sufficient evidence of domicile to affect classification of a student as a resident under these regulations:

1. Voting or registration for voting.
2. Employment in any position normally filled by a student.
3. The lease of living quarters.
4. Admission to a licensed practicing profession in Iowa.
5. Automobile registration.
6. Public records; for example, birth and marriage records, Iowa driver's license.
7. Continuous presence in Iowa during periods when not enrolled in school.
8. Ownership of property in Iowa, or the payment of Iowa taxes.

Fee Payment

The Accounts Receivable Office bills students for tuition, room, meal plan, and various other university charges. A statement of charges, adjustments, payments, and refunds is available on the first of each month in the Workday Financials Hub. Students will receive a monthly email notifying them that their U-Bill is available. It is the student's responsibility to ensure that the university has the correct email address and to regularly check their Iowa State email account. Students who do not receive a billing statement before the term begins or are unable to use Workday to view their U-Bill should contact the Accounts Receivable Office to learn the amount of their account balance and due date. Failure to receive a billing statement or view the U-Bill in Workday will not exempt students from late penalties or from having a hold placed on their registration.

- Payments for the fall semester are due August 20.
- Payments for the spring semester are due January 20.
- Payments for the summer semester are due May 20.

Payment Options:

1. Students may pay their U-Bill online through the Workday Financials Hub.

2. Students may also mail in their payment by sending a check or money order (along with the remittance portion of the billing statement printed from Workday) to:

Iowa State University Treasurer's Office
1220 Beardshear Hall
515 Morrill Road
Ames, IA 50011-2103

3. Payment can be made in person by taking a personal check or certified funds to the drop box located on the ground floor of Beardshear Hall.

Deferred Billing Plan (payment over three months): Students can select to pay their U-Bill over three installments each semester. There is a \$20 deferred billing fee assessed each semester (fall, spring, and summer) to pay over three installments. Students can sign up for this option in Workday.

Employer Reimbursement Deferment: Iowa State University offers a deferment option for students whose employer is providing tuition reimbursement to cover their tuition and fees. To enroll in the Employer Reimbursement Deferment Plan, please complete the online request form found in Workday using the Employer Reimbursement Deferment Plan Agreement request.

With successful enrollment in the deferment plan prior to each semester, all applicable charges will be due 30 days after grades are presented.

A non-deferrable \$35 enrollment fee will be assessed to the student U-Bill after enrollment into the deferment plan. Students will be responsible for payment of any non-deferred charges on their U-Bill in accordance with statement due dates.

For more information about the Employer Reimbursement Deferment Plan, contact the Accounts Receivable Office at (515) 294-7388 or ubill@iastate.edu.

Iowa State University employees will need to submit a tuition reimbursement request prior to the posted deadline using the Tuition Reimbursement Form request in Workday and obtain approval through University Human Resources. For additional information about eligibility requirements and semester application periods for the Tuition Reimbursement Program, please visit the University Human Resources website (<https://www.hr.iastate.edu/benefits/addlbenefits/>).

Past Due Accounts: If students have past due accounts receivable charges they will have a hold placed on their account for future registration. If a student with a past-due account gets registered they may be dropped from enrollment if these past-due charges are not paid by the Friday before the first day of class. Students who are subject to being dropped will be notified via their Iowa State email.

Refunds: Refunds are available for students who drop or withdraw a class within the appropriate period of time. To cancel their registration, students must drop all coursework before the first day of the semester to avoid tuition assessment. Beginning on the first day of the semester, it will be necessary for students to complete a separation process (leave of absence or institutional withdraw) to separate from the semester. More information can be found at <http://www.registrar.iastate.edu/registration/responsibilities.shtml>. (<http://www.registrar.iastate.edu/registration/responsibilities.shtml/>)

Tuition adjustments for all students are made for course drop and withdraws of registration according to the following schedule:

Course Drop/Withdraw Date/Student Pays

Before first day of classes: 0%
During class days 1-5: 10%
During class days 6-10: 25%
During class days 11-15: 50%
During class days 16-20: 75%
After the twentieth day of classes: 100%

Students who wish to appeal tuition and fee assessment for a leave of absence should contact the Tuition & Fees area of the Office of the Registrar (tuition@iastate.edu). Decisions of the Office of the Registrar will be based on the existence of extenuating circumstances beyond the control of the student.

Students who wish to appeal the decision of the Office of the Registrar must do so in writing within 10 calendar days after receiving the decision. Such appeals will then be reviewed by the Tuition Appeals Review Committee. Students who wish to appeal the decision of the Tuition Appeals Review Committee may make a request to do so in writing to the Office of the Provost.

Fee refund for students with a reduction in credits below full-time: 100 percent if change is made through the 10th day of classes. No adjustment is made after the 10th day of classes. Prorated adjustments in the tuition adjustment schedule are made for summer session courses, or any courses which are less than one semester in length (79 days).

Workshop and Short Courses Refunds: Students who drop workshops or short courses of one or two weeks on or before the first-class meeting receive a 100% tuition adjustment for the course. No tuition adjustment will be made after the first day of classes. Students who drop three-week courses receive a 100% adjustment if they drop on or before the first day of classes, a 90% adjustment if they drop on the second day of classes, and no adjustment after the second day of classes.

Veterans and Eligible Dependents Receiving Educational Assistance:

In accordance with the requirements of the Servicemembers Improved Transition through Reforms for Ensuring Progress Act (SIT-REP Act, December 31, 2018), the University will not impose any late fee, deny access to classes or facilities, or assess any other penalty to a Veteran or eligible dependent due to a late payment from the Veterans Administration (VA).

This policy is only applicable to Veterans or eligible dependents who are receiving educational assistance under Chapters 31 (VR&E) or 33 (Post 9/11 and Fry Scholarship) of title 38, United States Code (U.S.C.). In accordance with the SIT-REP Act, students receiving VA educational benefits from Chapter 31 or 33 must provide a certification of eligibility for entitlement of educational assistance to the Office of the Registrar. Nothing in this policy precludes the University from assessing a late fee, denial of access, or any other penalty in relation to payments due to the University that are not covered under the SIT-REP Act.

For purposes of this policy, the following terms will be defined as:

- **Late Fee:** A financial penalty, equal to approximately 1% of the outstanding balance, charged to discourage late payment of the U-Bill.
- **Denial of Access:** To prohibit entry, participation, or attendance to an event or facility otherwise afforded to all registered students.
- **Any Other Penalty:** Any other fee/cost, prohibition, or assessment levied upon a student for failure to pay required tuition, fees, and any other billed charges.

Student Financial Aid

The Office of Student Financial Aid helps families afford Iowa State University. Scholarships, grants, loans, and part-time employment opportunities are available to assist students and families in meeting college expenses. For more information see:

<http://www.financialaid.iastate.edu>

STUDENT SERVICES

Dean of Students Office

www.dso.iastate.edu (<http://www.dso.iastate.edu/>)
1010 Student Services Building
(515) 294-1020

The Dean of Students Office (DSO) at Iowa State University uses an integrated approach to support student-centered learning through personal, community and academic development culminating in a transformative experience. Reporting through the Division of Student Affairs, the DSO provides numerous opportunities for students to engage in learning beyond the classroom. The twelve departments and four programs that comprise the DSO collaborate to create and support a common community experience for Iowa State University students. Our common goal across all areas within the DSO is to support student success.

Sharron Evans # Associate Vice President for Student Affairs and Dean of Students

For more information see the individual DSO department and program websites.

Academic Success Center

www.asc.dso.iastate.edu (<http://www.asc.dso.iastate.edu/>)
2157 Hixson-Lied Student Success Center
(515) 294-6624

First Scholars

www.dso.iastate.edu/cs/es (<https://www.dso.iastate.edu/cs/es/>)
3220 Memorial Union
(515) 294-0210

Hixson Opportunity Awards

www.hixson.dso.iastate.edu (<http://www.hixson.dso.iastate.edu/>)
1080 Hixson-Lied Student Success Center
(515) 294-6479

International Students and Scholars Office

www.isso.iastate.edu (<https://www.isso.iastate.edu/>)
4530 Memorial Union
(515) 294-1120

Margaret Sloss Center for Women and Gender Equity

[www.sloss.dso.iastate.edu](https://sloss.dso.iastate.edu/) (<https://sloss.dso.iastate.edu/>)
205 Sloss House

(515) 294-4154

Military-Affiliated Student Center

[www.masc.dso.iastate.edu](https://masc.dso.iastate.edu/) (<https://masc.dso.iastate.edu/>)
5600 Memorial Union
(515) 294-9801

Multicultural Student Affairs

www.multicultural.dso.iastate.edu (<http://www.multicultural.dso.iastate.edu/>)
Memorial Union
(515) 294-6338

National Student Exchange

www.nse.dso.iastate.edu (<http://www.nse.dso.iastate.edu/>)
1080 Hixson-Lied Student Success Center
(515) 294-6479

OFF-Campus Student Support Program

<https://www.dso.iastate.edu/off-campus-support> (<https://www.dso.iastate.edu/off-campus-support/>)
1010 Student Services Building
(515) 294-1020

Parent and Family Programs

www.parents.dso.iastate.edu (<https://www.parents.dso.iastate.edu/>)
1010 Student Services Building
(515) 294-1020

Sorority and Fraternity Engagement

www.greek.iastate.edu (<http://www.greek.iastate.edu/>)
0355 Memorial Union
(515) 294-1023

Student Accessibility Services

www.sas.dso.iastate.edu (<http://www.sas.dso.iastate.edu/>)
1060 Hixson-Lied Student Success Center
(515) 294-7220

Student Assistance

www.studentassistance.dso.iastate.edu (<http://www.studentassistance.dso.iastate.edu/>)
1010 Student Services Building
(515) 294-1020

Student Conduct

www.studentconduct.dso.iastate.edu (<http://www.studentconduct.dso.iastate.edu/>)
1010 Student Services Building

(515) 294-1020

Student Legal Services

www.studentlegal.dso.iastate.edu (<http://www.studentlegal.dso.iastate.edu/>)

6660 Memorial Union

(515) 294-0978

Student Support Services Program

www.trio.iastate.edu/student-support-services/ (<https://trio.iastate.edu/student-support-services/>)

3220 Memorial Union

(515) 294-0210

Student Counseling Service

Director of Student Counseling Services: Dr. Kristen Sievert

The Student Counseling Service (SCS) assists students in enhancing their academic success and personal well-being with a staff of professional psychologists and counselors. Services are available to help students sort through their feelings, strengths, and options to develop new perspectives and coping skills.

Services include:

- One-on-one counseling for any issue of personal concern, such as depression, anxiety, stress management, relationship issues, identity issues, and other forms of personal challenge. Students may also receive therapeutic services to deal with more severe mental health issues.
- Couples counseling for ISU students and their partners during times of relationship difficulty.
- Eating disorders assessment and treatment for students concerned with eating or body image issues. Students receiving treatment for eating disorders might also work with physicians, nutritionists, and personal trainers as their needs require.
- Substance abuse assessments to help students determine the nature and extent of their alcohol or other drug use and the impact of this use on their well being. Counselors offer recommendations and referrals for any concerns identified through the assessment.
- Career counseling to assist students having difficulty choosing a major or making decisions about their future after college.
- Group counseling is offered to facilitate personal growth and social skills learning. A list of the current semester's groups is available on the SCS web site.

- A variety of outreach programs are also available.

Counseling services are offered at no cost to ISU students. However, a nominal fee for testing may be required. Nominal fees are also charged for uncanceled missed appointments. Counseling is strictly confidential. SCS staff will not release any information to anyone outside of the Student Counseling Service without the written permission of the client unless an imminent harm condition exists.

In addition to providing counseling and outreach services to students, SCS provides training and consultation to faculty and staff to assist them in addressing the psychological needs of students.

SCS hours are Monday through Friday 8 a.m. - 5 p.m. The Student Counseling Service phone number is 515-294-5056.

Thielen Student Health Center

Thielen Student Health Center is a full-service medical clinic in Ames, Iowa, that specializes in students. The clinic is staffed with physicians, advanced registered nurse practitioners and nurses. The medical team is available to care for your primary health care needs.

The clinic offers a full range of medical services including illness and injury care, women's health, allergy and travel care, immunizations, mental health care, laboratory and x-ray services, physical therapy and a full-service pharmacy. After hour service is available for urgent or emergency problems at McFarland Urgent Care Clinic or Mary Greeley Medical Center Emergency Room.

The Prevention Services department provides campus-wide leadership for a comprehensive approach to reduce health risks for students. In collaboration with our campus and community partners, they strive to foster a healthy campus environment and support the academic success of our students. Areas of focus include high-risk drinking and sexual and interpersonal violence.

The mission of the Thielen Student Health Center is to promote the optimal health of our university community by providing high quality, accessible, affordable and accountable health care that encompasses prevention, wellness and education and to support the academic success of the Iowa State University students while building healthy habits for a lifetime.

We provide an inclusive, non-judgmental environment for our diverse student body and are conveniently located on the corner of Sheldon Avenue and Union Drive, right across from State Gym.

Student Health receives no funding from the state of Iowa and relies on the health fee for approximately 50% of its operating budget. Please note that the health fee is not health insurance. All students are encouraged

to maintain adequate health insurance coverage while enrolled at Iowa State University. Those taking 4 or fewer credits may still access services by paying the health fee. Spouses/domestic partners of students who opt to pay the health fee also have access to services.

Clinic hours:

Monday, 8 a.m.-6 p.m.; Tuesday, Thursday and Friday, 8 a.m.-5 p.m.; Wednesday, 9 a.m.-5 p.m.; Saturday, 9 a.m.-12 noon. Hours vary during breaks and summer session. Patients are seen by appointment. Please call 515-294-5801.

The University Library

<http://www.lib.iastate.edu/>

Dean of the Library Services: Hilary Seo

General Information (515) 294-3642

The University Library provides extensive research collections, services and information literacy instruction/information for all students. Facilities consist of the main Parks Library, the Veterinary Medical Library, Design Reading Room, and a remote library storage building.

The library's extensive collections include electronic and print resources that support research and study for all undergraduate and graduate programs. Nationally recognized collections support the basic and applied fields of biological and physical sciences. Library holdings include more than 2,858,448 volumes and approximately 121,125 current serial titles. The library has access to 447,689 electronic books.

The library's instruction program includes an undergraduate information literacy course as well as a wide variety of subject-based seminars on effective use of library resources for undergraduate and graduate students.

The library website provides access to local and web-based resources including electronic journals and books, local collections, online indexes, electronic course reserves and guides, and a broad range of subject research guides. Assistance in using this vast body of electronic resources is available at the Help Desk on the first floor, on the library website through the Ask Us! link, and through individually arranged appointments with librarian liaisons. The Digital Repository @ Iowa State provides free, public access to the research and scholarship of Iowa State's faculty, students and staff.

A limited number of semiprivate study rooms available for graduate students, intended for research and other scholarly activities that require extensive use of library material, are available. Parks Library has group study rooms, multi-media production studios, a presentation room and collaborative multi-media study areas. The library has over 232 public computers and a laptop checkout program with over 100 Apple and Windows laptops, iPads, Apple Pencils, and iPad chargers that may be

checked out from the Tech Lending room (Rm 117 Parks Library). Also located in Parks Library - ITS Solution Center, Online Learning Hub, and The Bookends Café.

Career Services Offices

Agriculture and Life Sciences: 15 Curtiss Hall

Business: 1320 Gerdin Business Building

Design: 297 College of Design

Engineering: 3200 Marston Hall

Graduate Business: 1420 Gerdin Business Building

Human Sciences: 131 MacKay Hall

Liberal Arts and Sciences: 150 Carver Hall

Veterinary Medicine: 2270A Veterinary Medicine Complex

Career Services is a coordinated network of career services offices offering a broad range of programs and services for undergraduate, professional, and graduate students, faculty, staff, alumni, and employers. These services include career exploration, career development, experiential learning, and professional career search assistance programs. The goal is to provide constituents with life-long skills to assist with career development and exploration.

Programs and services are offered including online registration, position listing and interview scheduling; résumé referral; coordination of co-op and internship programs; workshops and seminars on career exploration, résumé preparation, letter writing, job search techniques, interview skills, applying to graduate and professional schools, and adjusting to the first job.

Each year career services sponsors multiple career fairs, which bring to the ISU campus hundreds of employers. The career services offices also coordinate on-campus interview opportunities. Each college career services office serves as a point of entry for students, alumni, and employers to the entire ISU network of coordinated, decentralized career services.

In addition to the college-based career services offices, the Career Exploration Service provides a variety of services to students who are unsure about their major or future career path. Students can work one-on-one with a trained career counselor, use the many books and electronic resources in the Career Exploration Center, or enroll in UST 104, Personal Career Development.

Additional information on career services is available at <http://www.career.iastate.edu/>.

Child Care

Child Care Administration, a unit of Human Resource Services, supports Iowa State University families by linking them with programs and services that can help meet their child care needs. The university child

care coordinator is available to assist families in accessing services available both on the campus and in the community.

Child care programs located on campus include:

- Center for Child Care Resources: Assistance in locating campus and community child care services, 100 University Village, Suite 1010, 515-294-8833 or 1-800-437-8599
- University Community Childcare, Family Resource Center, 100 University Village, 515-294-9838
- The Comfort Zone: Childcare for kids who don't feel so good, 100 University Village, 515-294-3333.
- Flex-Care: Part time care for children of ISU students, 100 University Village, 515-294-9838.
- University Child Care Center at Veterinary Medicine, 1700 Christensen Drive, 515-294-2273.
- ISU Child Development Laboratory School, Palmer HDFS Building, 515-294-3040.

For more information about child care options, contact the university child care coordinator at 515-294-8827.

STUDENT LIFE

Memorial Union

The Memorial Union completes the college experience by developing leadership, community, and career readiness. As the living room of campus, the "MU" serves students and the campus community through a variety of programs and activities.

515-296-6848; www.mu.iastate.edu (<http://www.mu.iastate.edu>)

Arts, Entertainment, Recreation:

- CyBowl & Billiards: bowling, billiards, video arcade, table tennis
- Maintenance Shop: live music, comedy, open mic nights
- Student Engagement, an office in the Memorial Union dedicated to providing community and events for all students
- Student Union Board: weekly films, comedy, music, programs, special events, much more
- Memorial Union Art Gallery
- Art in the MU, Art for Rent
- Workspace: drop-in crafts, paint your own pottery, workshops, and open studios for woodworking, jewelry, and clay
- TVs, lounges, study spaces

Student Organizations

- Student organization offices and meeting space; recognition process.
- Leadership skills development, training, and events.
- Community-service opportunities and trips

Dining & Shopping

- Food Court & MU Market & Café
- Panda Express
- Sushi-Do
- ISU Bookstore

Study Spots

- Multicultural Center
- Lounges: Main Lounge, West Lounge, and 3rd floor

Services

- Meeting rooms
- Event Management Office
- ISU Catering
- Parking ramp
- Soult's Family Visitor Center
- ATMs, Universal Changing Station, Mother's Room, Baby Changing Stations

- M-Shop Ticket Office
- MU Marketing & Graphics
- Student Legal Services
- Campus Organization Accounting
- Military-Affiliated Student Center
- Center for LGBTQIA+ Student Success
- Sorority and Fraternity Engagement
- Student Government
- University Lectures
- International Students and Scholars Office
- New Student Programs
- NCORE/ISCORE
- The Center for Student Educational Success

Distinctive Feature

- Gold Star Hall, a living memorial to Iowa State service personnel lost in the nation's conflicts
- *Fountain of the Four Seasons*, the iconic four *Maidens* make this campus landmark a favorite among all students and visitors
- The Zodiac, it is advised to walk around the Zodiac to avoid any unlucky event, like failing your next exam!

Memorial Union Student Engagement Director of Student Engagement, Associate Director, Memorial Union

Kristine Heflin

Assistant Director - Student Organizations, Leadership and Service

Kevin Merrill

Service Learning and Student Organizations Coordinator Leadership and Student Organizations Coordinator

Mara Spooner

Coordinator for Art Programs and the Workspace

Letitia Kenemer

M-Shop and Entertainment Coordinator

Jim Brockpahler

CyBowl and Entertainment Operations Specialist

Hannah Walton

Student Activities Specialists

Erin McCollum and Teresa Stulus

Office Coordinator

Zoe Bardin

Memorial Union Student Engagement is committed to helping students learn inside and outside the classroom by offering countless ways to get involved at Iowa State through leadership, service, arts, entertainment and recreation activities.

Student Engagement includes: The Workspace (arts studio), the Maintenance Shop "M-Shop" (entertainment and live music venue), CyBowl & Billiards (recreation center/ bowling alley), Cyclone Cinema, leadership and service programs, Memorial Union Art Gallery, and management of the recognition of over 800 campus and student organizations. For a complete list of recognized organizations, visit <http://www.stuorg.iastate.edu>.

The staff provides assistance to student and campus organization leaders, members and advisors on an individual or group basis. Available on the Student Engagement website are resources for student and campus organizations including the event authorization process, publicity and promotion ideas, constitution writing guidelines, and officer transition information. MU Student Engagement is home to the Student Consultants that provide hands on support for students interested in leadership and service opportunities and student organization officers looking to better their clubs.

Annual events include: Fall and Spring ClubFest (organization involvement fairs), WelcomeFest (Ames and ISU opportunity fairs), ISU AfterDark (substance-free alternative program- six times per year), Iowa Student Leadership Experience (one-day leadership conference), and Winterfest (celebration of all things winter).

More information is available at the Memorial Union Student Engagement, located in the East Student Office Space in the MU (across from Panda Express); online at www.studentengagement.iastate.edu (<https://studentengagement.iastate.edu/>) or by calling (515) 294-8081.

Lectures

www.lectures.iastate.edu/ (<http://www.lectures.iastate.edu/>)

The Committee on Lectures, funded by Student Government, brings to campus dozens of distinguished speakers in national and international affairs, the sciences, and the arts. In addition to giving formal lectures, many speakers meet with students for small-group discussions.

Through the Lectures Program, students have access to a broad range of presentations, including popular culture, educational and economic topics, social issues, music and comedy, and technological and scientific development. Past speakers include writer Ta-Nehisi Coates, physicist Michio Kaku, activist Edward Snowden, attorney Gloria Allred, U.S. Rep. Katie Porter, and U.S. Senator Ben Sasse. The Committee on Lectures

also co-sponsors events hosted by student organizations and academic units.

Students are encouraged to contact the Lectures Program office and become involved in the planning of these events.

Honor Societies

Honor societies at Iowa State University provide opportunities for students who excel in the classroom and want to network with others in their major. Members of these honor societies are eligible for transcript recognition through the Office of the Registrar. The complete list of honor societies (<https://www.stuorg.iastate.edu/organizations/12/type/>) can be found on the student organization website.

EXCHANGE PROGRAMS & STUDY ABROAD

Regent Universities Student Exchange Program

Iowa State University students may take courses at either of the other two Regent universities for Iowa State resident credit. Regular, degree-bound students in good standing at any of the three Regent universities may attend another Regent university for a maximum of two semesters, and the credits earned at the other university will be counted as resident credit at the home institution. Approval for participation and credit in the exchange program must be obtained well in advance of registration since the department head must approve the acceptance of such credits if these are to apply to the major, and to ensure complete processing of the application between the cooperating universities within specified dates for enrollment. Detailed information and application forms for the exchange program are available from the Office of the Registrar.

National Student Exchange (NSE)

Iowa State University is a member of National Student Exchange. The NSE Consortium has 200 colleges and universities throughout North America providing academic and experiential exchange opportunities. Iowa State students with a cumulative GPA of at least 2.50 are eligible to apply. Credits earned as an NSE participant will be recorded on the students Iowa State transcript. Approval for credit in the NSE program should be sought from a student's academic advisor in advance of application. Detailed information and applications forms are available from:

National Student Exchange
1080 Hixson-Lied Student Success Center
(515) 294-6479
nse@iastate.edu

www.dso.iastate.edu/nse (<http://www.dso.iastate.edu/nse/>)

Study Abroad

Studying abroad helps prepare students to meet the challenges of an increasingly interdependent global community. It's an adventure that challenges the student academically and provides real opportunities to interact with other cultures, languages, and lifestyles. The skills students gain while studying abroad will make them top candidates for internship placements and full-time positions post-graduation.

As a leading international university, Iowa State has a major commitment to study abroad, and the Study Abroad Center (SAC) is the central administrative office responsible for providing these opportunities.

We offer advising on study abroad, international internships, volunteer opportunities, and scholarships.

With over 50 study abroad programs available, from one week to an academic year in length and in nearly every major, students are able to find a program that meets their needs and interests so they can discover for themselves why study abroad is the most exciting academic adventure.

Exchange Programs offer students the opportunity to study abroad at a partner university while paying Iowa State tuition.

Semester in Australia, Germany, Ireland, Italy, New Zealand, Scotland and Wales offers unlimited placement opportunities for students to study at some of our most popular destinations for the fall, spring, or summer.

Programs led by our faculty offer Iowa State courses around the world. Short-term options can take you from the Antarctica to Uganda and to more than 40 other destinations.

For additional information, contact or stop by the Study Abroad Center. No appointment necessary!

Study Abroad Center
281 Parks Library
(515) 294-6792
www.studyabroad.iastate.edu (<http://www.studyabroad.iastate.edu>)

STUDENT RECORDS

Student Records

Iowa State University maintains various records concerning students, to document their academic progress as well as to record their interactions with university staff and officials. In order that their right to privacy be preserved and to conform with federal law, the university has established certain policies to govern the handling of student records. All policies conform with FERPA, the Family Educational Rights and Privacy Act (also known as the Buckley Amendment).

Student Addresses

Students have the responsibility to notify the Office of the Registrar each time their information changes. Information changes can be made from the student's Profile via the Personal Information application in Workday (<https://workday.iastate.edu/>).

Graduate Assistants and student employees must also report an address change to the office of University Human Resource Services (<http://www.hrs.iastate.edu/hrs/>). Information changes can be made through the Personal Information application in Workday (<https://workday.iastate.edu/>).

When Records May Be Withheld

An appropriate university official may request that records be withheld in instances when disciplinary action has been taken against a student, or in instances where students have not completed all requirements placed upon them by the institution. Authorization for these actions is supported by The Iowa Code and The Iowa Administrative Code.

In order for such an action to be rescinded, the Office of the Registrar must receive written authorization from the official who originally requested the action, indicating that the student has met the obligation.

Review and Challenge of Records

A student may challenge the accuracy of handling of records maintained by the university on grounds that the records are inaccurate, misleading, or otherwise violate the privacy or other rights of the student. The university has established the following procedures to provide an opportunity for the student to correct or delete inaccurate records, or to insert into the record a written explanation of the content. Students who question their records should discuss the issue first with the individual staff person who established or maintains the records. Presumably most issues can be resolved at this level. If a satisfactory resolution cannot be reached, the student should submit the question to the head of the department in which the record is maintained.

The department head will discuss the issue with the staff person and the student challenging the record. If resolution cannot be reached after

meeting with the department head, the student may submit the question to the dean or director to whom the department head is responsible. The dean or director will investigate, and will respond in writing.

If the record has not been reconciled through these measures, the student may direct a written request to the president of the university. The president will convene an Ad Hoc Hearing Panel of Access and Confidentiality of Educational Records, composed of two faculty members, two students, and one administrator, appointed by the president for a period of one year, with the president or a designee serving as nonvoting chairperson. The student shall be given an opportunity to present to the panel evidence relevant to the issues raised, and the panel will issue a written response.

Posting Grades and Test Scores

Instructors who wish to inform students of their performance may post grades and test scores on a secure course website as long as individual students may only access their own grades. The test scores or course grades of students may not be posted in any public location unless the instructor posts the information using a code for each student that is known only by the instructor and the student.

Release of Grades

Students who choose to release their grades to parents or other trusted third parties may do so using the Workday (<https://workday.iastate.edu/>) Friends and Family Third Party Proxy option. Reports of a student's grades are not routinely sent to the student's parents.

ISUCard and Identification Number

Each student is assigned a random university identification number on entry to the university. This number appears on the ISUCard that is provided to each student at the time of first registration. The ISUCard, may be required for some services and/or activities.

Loss of an ISUCard should be reported immediately to the ISUCard Office, where the lost card will be invalidated and replaced for a charge. Disciplinary sanctions may be imposed for improper use of the ID card or attempts to obtain, by fraudulent means, any form of identification.

Social Security Number

Social security numbers are collected from prospective and current students, for administrative coordination and record identification purposes only. Although procedures have been established by the registrar for assignment of an alternative number upon request, students who wish to be employed on campus, desire to claim federal educational tax benefits, or are applying to receive financial aid, are required by law to provide their social security numbers for administrative use. The social security number is a confidential record and is maintained as such by the

university in accordance with the Family Educational Rights and Privacy Act.

Student Names

Iowa Regent universities have a common policy regarding student names and name changes. The name on the student record should be the student's complete and legal name; however, we understand and respect that not all students identify with their legal name. If a student does not have the official legal documentation required in the standard Name Change Policy to support their legal name change, the Office of the Registrar will work with the student to still process the name change. A student may indicate a preferred name in Workday, which will be the name that is primarily visible across the student information system. In evaluating and processing all name change requests, the university reserves the right to require adequate and appropriate documentation, as warranted. After a name change, a current student must obtain a new ISU Card; a replacement fee may apply.

Consumer Information

The Higher Education Opportunity Act of 2008 (HEOA) requires that postsecondary institutions participating in federal student aid programs make certain disclosures to enrolled and prospective students, parents, employees, and the public. The consumer information policy is available at <https://web.iastate.edu/about/consumer> (<https://web.iastate.edu/about/consumer/>). Students without electronic access can obtain the information from the Office of the Registrar, 214 Enrollment Services Center, 515-294-1840 or from the Office of Admissions, 100 Enrollment Services Center, 515-294-5836. A paper copy of the information will be provided upon request.

Iowa State University Online Directory Information

The ISU Online Directory (<https://www.info.iastate.edu/>) differentiates between verified and guest users:

Verified Users - those accessing the directory from an on-campus server or via Iowa State University's virtual private network (VPN) or other authenticated means.

Information available for display to **verified users** include:

- Name
- Program of Study
- Class Standing
- ISU Email Address

Guest Users - those who are external, unauthenticated individuals.

Information available for display to **guest users** include:

- Name
- Program of Study
- Class Standing

Guest users do not have access to view Iowa State University email address, but they do have the ability to send an email to the student via a webform.

Students can set their Online Directory Privacy Settings via the Personal Information application, Additional Data tab in Workday (<https://workday.iastate.edu/>). It is important to note that students can determine what information from the above items is displayed in the Online Public Directory. Students who have safety or harassment concerns should contact the Department of Public Safety.

Public Information at Iowa State University

Online directory information and public information may be released to the public upon request, except in cases where the student has suppressed the release of their information. Iowa State reserves the right to review and respond to the requests for release of public information on a case-by-case basis. While FERPA may authorize the release of student information, it does not obligate a school official to do so. See list below for specific types of public data.

Online Directory Information

- Name
- Major
- Classification
- ISU Email Address (for verified users)

Other Public Information

- Hometown
- Dates of Attendance at ISU
- Expected date of graduation
- College
- Awards and academic honors
- Iowa State degree(s) and date(s) awarded
- Previous educational institutions attended, degrees received, dates of attendance
- Full-time or part-time status
- Participation in officially recognized activities and sports
- Weight and height of members of athletic teams

Confidential Information

With the exception of the online public directory and public information, all student records are considered to be confidential and are open only to university officials. A university official is a person employed by the university in administrative, supervisory, academic, research, or

support staff position (including law enforcement unit personnel and health staff); graduate assistants; a person or company with whom the university has contracted; or a student serving on an official committee, such as a disciplinary or grievance committee, or assisting another university official in performing their tasks. A university official has a legitimate educational interest if the official needs to review an education record in order to fulfill their professional responsibility. Iowa State University's notification of rights under FERPA can be found at <http://www.registrar.iastate.edu/policies> (<http://www.registrar.iastate.edu/policies/>).

The following policies govern access to student records:

1. Each type of student record is the responsibility of a designated university official, and only that person or the dean or director to whom that person reports has authority to release the record. The following is a list of the responsible officials:

- a. Academic records: University Registrar
- b. Admissions records: Director of Admissions
- c. Financial aid records: Director of Student Financial Aid
- d. Student financials: Director of Accounts Receivable
- e. Traffic and security records: Director, ISU Department of Public Safety
- f. Medical records: Director, Thielen Student Health Center
- g. Counseling records and test scores: Director, Student Counseling Service
- h. Actions of Academic Standards Committees: College Deans
- i. Disciplinary records: Dean of Students, Office of Student Conduct
- j. Residence hall records: Director of Residence
- k. Evaluations for admission to ISU graduate or professional programs: College Deans or Department Chairs
- l. Special academic programs: Faculty member in charge of the program and the Dean of the college
- m. Student employment: Director of University Human Resources

2. The designated official may release records to other university officials who have a legitimate need for the information.

3. The retention period for student records is reviewed periodically and updated when appropriate.

4. Students have the right to review upon request any records that pertain directly to them. This provision does not apply to records to which the student has waived their right to review (e.g. letters of recommendation), nor does it apply to medical and counseling records.

5. A student may waive the right to review a specific record by submitting in writing a statement to this effect to the official responsible for that record.

6. A file containing copies of records pertinent to advising is maintained on each student for use by the student's advisor. This file may be maintained in hard copy or electronic format. Ordinarily this file is kept in the possession of the advisor, but for convenience it may be stored elsewhere such as in the dean's office or department office. When the student changes programs of study, or changes advisors within the same program of study, the file is transferred to the new advisor. Under the university's student records policy, the student is considered to have the right of access to this file.

7. Medical and counseling records shall be released at the written request of the student to medical or psychological professionals outside the university or to university officials.

8. University personnel who have access to student records in the course of carrying out their university responsibilities shall not be permitted to release the record to persons outside the university, unless authorized in writing by the student or unless one of the exceptions stated earlier is involved.

9. Confidential information may be released by students to their parents or other trusted third parties through the Workday (<https://workday.iastate.edu/>) Friends and Family Third Party Proxy option. Confidential information may also be released by obtaining the student's written consent via a Authorization to Release Information to a Third Party form, which is available on the Student Forms (<https://registrar.iastate.edu>) page of Office of the Registrar website, or by having the parent establish the student's dependency as defined by the Internal Revenue Code of 1954, section 152, by furnishing a certified copy of the parent's most recent federal income tax return.

10. The officials responsible for custody of student records will maintain records of requests and disclosures of personally identifiable nonpublic information. The records of requests will include the person or agency requesting the information and the purpose of the release. These records of requests and disclosures will be available to the student on request. Records of requests and disclosures are not necessary for requests made by the student, by university officials in carrying out their official responsibilities, by persons employed by agencies and offices conducting audits and accreditation of university programs, or any of the other exceptions listed previously.

For the purposes of FERPA, Iowa State University defines Directory Information to include both Online Directory and Other Public Information as defined on Public Information (<https://catalog.iastate.edu/registrar/#publicinformationtext>) of the University Catalog.

It is the policy of the university to respect the privacy of students; therefore, only lists containing Directory Information may be made available to members of the public when deemed appropriate and necessary, and in accordance with all applicable Iowa State policies and

procedures. While FERPA allows for the release of such information, it does not obligate the university to do so; Iowa State University reserves the right to review and respond to requests for release of information on a case-by-case basis.

A sub-set of Directory Information is available via the Online Directory (<https://www.info.iastate.edu/>); please note that the Online Directory differentiates between verified and guest users and displays information accordingly. More information on this can be found in the Public Information section of the University Catalog.

Disclosures Permitted by FERPA

Iowa State University retains the discretion to disclose Directory and Confidential Information as indicated in Section 4 (<http://www.registrar.iastate.edu/policies/>) of Iowa State University's Notification of Rights Under FERPA. Specifically, the university may disclose to the public or to specific individuals, Directory and Confidential Information for reasons of safety if the disclosure meets the criteria under Section 4 (<http://www.registrar.iastate.edu/policies/>).

ACADEMICS

Classification/Class Standing

Undergraduate class standing (i.e., year in school) is determined by the number of credits completed, and it is based on credit hours earned, not merely credit hours attempted. The grades F and NP and the marks I and W do not contribute toward credit hours earned and thus are not considered in determining class standing. See Grades for information about the grading system at Iowa State University.

Class standing in all academic colleges, except Veterinary Medicine, is as follows:

Sophomore: 30 credit hours earned

Junior: 60 credit hours earned

Senior: 90 credit hours earned

Students who have a bachelor's degree and are working toward another undergraduate degree, licensure, or admission to a specific graduate or professional program, typically have a class standing of senior.

Transfer students without a degree will have a class standing on the basis of credits accepted by Iowa State University.

Veterinary medicine students are promoted from the first- to the second-, third-, and fourth-year classes based upon satisfactory completion of the required courses for each year. To be promoted to the second-year class, students must have a cumulative grade-point average of at least 1.67 for all courses in the first year of the veterinary medicine curriculum. To be promoted to the third- and fourth-year classes, students must have a cumulative grade point average of at least 2.00 for all courses in the professional curriculum.

A student, who is attending Iowa State and decides not to work toward an undergraduate degree, will be classified as a special (non-degree) student. Admission requirements and academic standards regulations are the same as regular students. Credits taken as a special (non-degree) student are applicable for undergraduate degree purposes if the student is admitted later as a regular undergraduate. Credits obtained as an undergraduate special student may not, however, be applied toward a graduate degree.

Degree Planning/Academic Progress Report

ISU Degree Audit / Academic Progress Report

In addition to being properly registered, students are responsible for knowing the requirements for their degree and planning their schedule to

meet those requirements. One way to monitor progress toward a degree is with the academic progress report (APR).

Students may access their academic progress report in Workday. The academic progress report displays academic requirements the student must complete in order to complete their program of study. The APR shows courses that have been completed and how they are being applied to fulfill academic requirements as well as the students currently enrolled courses.

Students should use this information to help them review progress towards their degrees(s), plan their course of study to complete academic requirements, and plan for courses for the next term. Graduation evaluators in the Office of the Registrar use the academic progress report during the term a student will graduate to determine if the student will meet all academic requirements upon successful completion of the courses on the student's schedule that term.

Students may use the evaluate academic requirements task in Workday to determine their completion of academic requirements for any program of study available at Iowa State. This "what if" report will show how the student's completed and in-progress coursework applies toward other programs of study offered at the University.

For further information about how completed courses fulfill academic requirements or how other courses will apply toward their academic requirements, students should see their advisor.

Catalog in Effect (Academic Requirement Effective Date)

A student may choose to graduate under the catalog in effect at the time of graduation or a catalog for the previous six years, provided it covers a period of the student's enrollment at an accredited college or university. Full requirements of the chosen catalog must be met except that adjustments will be made in instances where courses are no longer available or where programs have been changed.

Bachelor's Degree

To receive a degree, a student must meet the requirements of the program of study in which the degree is to be awarded. Verification that the student has met those requirements is made by the dean of the college, who also has the authority to waive a requirement under exceptional circumstances.

A minimum of 120-semester credits and a cumulative grade point average of at least 2.00 in all work taken at Iowa State University is required for graduation.

A student admitted as a transfer student from another college or university is required to have a 2.25 cumulative grade point average at the time of entrance. A transfer student who has earned an associate degree

is required to have a 2.00 cumulative grade point average at the time of entrance.

No more than 65 semester or 97 quarter credits earned at two-year colleges can be applied to a bachelor's degree from Iowa State University. There is no limit to the number of credits that may be transferred from a four-year institution.

To qualify for a bachelor's degree, a student must take a minimum of 32 credits in residence at Iowa State University. Also required is that the last 32 credits must be completed at Iowa State University, although under special circumstances, with prior written approval of the student's major department, six of the last 32 credits may be transferred and applied toward a degree at Iowa State University. Credits earned while students participated in an ISU Study Abroad or National Student Exchange program are exempt from this requirement.

A student who takes work at another college or university after having been enrolled at Iowa State must submit transcripts of all work attempted to the Office of Admissions at Iowa State. Failure to submit such transcripts will be grounds for dismissal.

In unusual circumstances, the Academic Standards Committees of the respective colleges may review and give further consideration to the records of students who, except for grade-point average, have satisfactorily completed all graduation requirements. If the appropriate college Academic Standards Committee considers that the educational and professional needs of such a student have been satisfactorily met, or can be satisfactorily met by imposing further conditions, the committee may recommend to the dean of the college that the student be graduated or that a supplemental program be accepted in place of the fully unqualified grade point average. The college Academic Standards Committee chairperson reports such exceptional actions to the Faculty Senate Committee on Academic Standards and Admissions.

Multiple Bachelor's Degrees

Students may receive multiple bachelor's degrees if the degree requirements for each major are met, including those for general education requirements. To receive multiple degrees, the majors must be of different degree types or from different colleges. A student may only pursue multiple degrees from the same college if the degree types are different (e.g. B.A., B.S.) and the degrees are different majors. Colleges and departments may be more restrictive in their requirements for multiple degrees. The diploma and academic transcript will designate each degree and major that are completed at the same time.

Students should request approval to pursue multiple degrees by completing the "Curriculum Change Form," available from advisors and classification offices. The appropriate department and college must approve each degree program.

One degree should be designated as primary for purposes of record keeping, but the student's rights and responsibilities are the same in both degrees. Students should have an academic advisor in each degree. The advisor of the primary degree will serve as the student's registration advisor, but each advisor will have access to the student's information.

Students who have earned a bachelor's degree or higher and wish to earn an additional bachelor's degree may be eligible for a college waiver of certain basic and general education requirements. Students should contact the department offering the major for advice and appropriate planning.

Specific requirements and/or restrictions are available from the colleges, departments or programs offering the degrees. Some students may have to exceed the graduation credit requirement set by their college in order to meet the requirements of the multiple degrees.

A student with multiple majors within the College of Engineering is permitted to earn only multiple degrees. All requirements for each major/degree must be met plus an additional 30 credits for each major/degree being pursued beyond the major/degree which requires the most credits.

All students pursuing multiple degrees within the Ivy College of Business are required to have a minimum of 15 credits of coursework in each major that is not used in other majors. Students are limited to three business majors/degrees/certificates/minors within the Ivy College of Business. This limit is on business majors/degrees/certificates/minors only and does not apply to multiple majors/degrees/certificates/minors taken outside the Ivy College of Business.

If students pursue multiple degrees, they may no longer qualify for federal financial aid once they have completed all of the requirements for one degree. This means students should arrange their course schedule in such a way that they complete the requirements for all of the degrees at the same time.

Multiple Major

A multiple major is a program for a single bachelor's degree in which all requirements for two or more majors have been met. The majors may be in different colleges or within the same college or department and may be the same or different degree type. The diploma and academic transcript will designate the degree of the primary major and all majors that are completed at the same time.

Students should request approval to pursue multiple majors by completing should complete the "Curriculum Change Form." This form, available from advisors and classification offices, should be completed at least one term prior to graduation.

Degree programs must be approved for each major by the appropriate department and college. One of the majors may subsequently be canceled using the same form.

One major should be designated as primary for purposes of record keeping, but the student's rights and responsibilities are the same in each major. Students should have an academic advisor in each major. The advisor of the primary major will serve as the student's registration advisor, but each advisor will have access to the student's information.

Specific requirements and/or restrictions are available from the departments or programs offering the majors. Some students may have to exceed the graduation credit requirement set by their college in order to meet the requirements of the multiple majors.

Students in the College of Engineering are able to earn a degree with a multiple major as long as the additional major is within another college, meets all requirements of the additional programs and contains a minimum of 15 additional credits beyond the requirements for a B.S. degree in engineering for each additional major.

Students with a primary major in another college who wish to take an additional major in the College of Liberal Arts and Sciences are not required to meet the Liberal Arts and Sciences General Education requirements. They must, however, meet all requirements for the major, including complementary courses. Students in the Bachelor of Liberal Studies curriculum in the College of Liberal Arts and Sciences do not have majors.

All students pursuing multiple majors within the Ivy College of Business are required to have a minimum of 15 credits of coursework in each major that is not used in other majors. Students are limited to three business majors/degrees/certificates/minors within the Ivy College of Business. This limit is on business majors/degrees/certificates/minors only and does not apply to multiple majors/degrees/certificates/minors taken outside the Ivy College of Business.

If students pursue multiple majors or multiple degrees, they may no longer qualify for federal financial aid once they have completed all of the requirements for one degree. This means students should arrange their course schedule in such a way that they complete the requirements for all of the majors or degrees at the same time.

Secondary Major

A secondary major is a major that can only be earned in conjunction with a primary major. Requirements for a secondary major are specified by many departments and programs in the university. Students should check with the offering department for the requirements for the secondary major.

The diploma and academic transcript will designate all majors that are completed at the same time.

A secondary major has the following requirements and understandings:

1. All secondary majors require at least 24 credits, including
 - a. at least 12 credits in courses numbered 3000 or above.
 - b. at least 6 credits taken at Iowa State University.
2. Credits used to meet the secondary major requirements may also be used to satisfy the credit requirement of graduation and to meet credit requirements in courses numbered 3000 or above
3. Some students may have to exceed the graduation credit requirement set by their college in order to meet the requirements of both the primary major and secondary major.
4. Courses taken for a secondary major may not be taken on a pass-not pass basis.

If students pursue multiple majors, they may no longer qualify for federal financial aid once they have completed all of the requirements for one degree. This means students should arrange their course schedule in such a way that they complete the requirements for all of the majors or degrees at the same time.

Multiple Major Completed after the Bachelor's Degree

After receiving a bachelor's degree, a person may wish to complete all requirements for another major. Approval of the department of the additional major is needed before study for the program is begun. At the completion of the program a notation will be made on the academic transcript, but no change will be made on the diploma received at the time of graduation. A degree program must be approved for the multiple major by the department and by the college.

Changing Major

A student's freedom to change their major, and the procedure that should be followed, depend on the student's academic standing and on policies of individual colleges as approved by the provost.

If students have never been dismissed and reinstated, they may change their major by consulting first with their advisor. Procedures for changing their major are as follows:

1. If the change involves majors within the same college, they should check with the college office to obtain instructions as to how to make the change.
2. If the change involves majors in different colleges, they should obtain a Curriculum Change Form (<https://www.registrar.iastate.edu/sites/default/files/uploads/forms/Curriculum%20Change%20Form%201%2021.pdf>) and their file from their advisor, present these materials to the student services office of their present college,

then to the student services office of the college to which they are transferring, and finally to the office of their new major.

3. Students on academic probation (P) may be restricted by rules outlined in the section on Additional Academic Standards Regulations.
4. Students who have been reinstated may not transfer to another college within the university during the first term following reinstatement, and they may not at any time transfer back to the college that originally dismissed them without the permission of the academic standards committee of that college.

Undergraduate Certificate

An undergraduate certificate provides a way to give formal recognition of focused study in a specialized area that is less comprehensive than required for an undergraduate major. The requirements of the certificate program will determine if an associate or baccalaureate degree is required for the award of the certificate.

Specific requirements and/or restrictions are available from the college, departments or programs offering the certificates.

An undergraduate certificate has the following requirements and understandings:

1. A student has received either an associate of arts (AA) or associate of science (AS) degree or a baccalaureate degree from any accredited institution or will earn an ISU baccalaureate degree at the same time or before the requirements for the certificate are completed.
2. Admissions Criteria
 - a. Students earning a certificate with a baccalaureate degree must meet all ISU admission requirements for either freshman (<https://www.admissions.iastate.edu/freshman> (<https://www.admissions.iastate.edu/freshman/>)) or transfer students (<https://www.admissions.iastate.edu/transfer> (<https://www.admissions.iastate.edu/transfer/>))
 - b. Students earning a certificate without an ISU baccalaureate degree apply as a non-degree seeking student and will be asked by Admissions if their intent is to declare a certificate. Students must have earned an associate of arts, an associate of science, or baccalaureate degree prior to being admitted to the certificate program. Students should refer to the admissions website (https://www.admissions.iastate.edu/nondegree/undergraduate_requirements (https://www.admissions.iastate.edu/nondegree/undergraduate_requirements/)) for admission requirements for nondegree undergraduate students. Students must meet any additional admission requirements for the certificate.
3. Requirements for Certificates

- a. All certificates require at least 20 credits, including
 - i. at least 9 credits in courses numbered 3000 or above.
 - ii. at least 6 credits taken at Iowa State University.
 - iii. all prerequisite requirements for the certificate must be met as part of fulfilling the requirements for the certificate.
 - b. Credits used to meet the certificate requirements may be used to satisfy the credit requirement for graduation and to meet credit requirements in courses numbered 3000 or above.
 - c. Courses taken for a certificate may not be taken on a pass-not pass basis.
 - d. A cumulative grade point average of at least 2.00 is required in all courses taken at ISU towards the certificate.
 - e. A student may not receive both an undergraduate major and a certificate of the same name.
4. Awarding of Certificates
 - a. The following criteria must be met prior to the award of a certificate:
 - i. For students earning an ISU baccalaureate degree, a certificate is awarded concurrent with or after the ISU baccalaureate degree.
 - ii. For students that have received a baccalaureate, associate of arts, or an associate of science degree from any accredited institution, a certificate is awarded upon completion of the certificate requirements.
 - b. A notation of a completed certificate will be made on a student's transcript and a printed certificate will be awarded.

Undergraduate Minor

To declare a minor, students must submit a completed "Curriculum Change Form" to their college office at least one term before graduation. The minor may be from the catalog in effect at the time of graduation or a catalog for the previous six years, provided it covers a period of the student's enrollment at an accredited college or university. A minor must be earned in conjunction with another degree. Requirements for an undergraduate minor are specified by many departments and programs in the university; a record of completion of such requirements appears on a student's transcript. Specific requirements and/or restrictions are available from the department or program offering the minor.

An undergraduate minor has the following requirements and understandings:

1. All minors require at least 15 credits, including
 - a. at least 9 credits in courses numbered 2000 or above, of which at least 6 credits are in courses numbered 3000 or above.
 - b. at least 3 credits taken at Iowa State University.

- c. at least 3 credits that are not used to meet any other department, college, or university requirement.
2. Credits used to meet the minor requirements may also be used to satisfy the credit requirement for graduation and to meet credit requirements in courses numbered 3000 or above.
3. Some students may have to exceed the graduation credit requirement set by their college in order to meet the requirements of both the minor and the major.
4. Courses taken for a minor may not be taken on a pass-not pass basis.
5. A student may not receive both an undergraduate major and a minor of the same name.

Financial Aid Considerations

If students pursue multiple majors or multiple degrees, they may no longer qualify for federal financial aid once they have completed all of the requirements for one degree. This means students should arrange their course schedule in such a way that they complete the requirements for all of the majors or degrees at the same time.

Communication Proficiency Policy

Basic Principles: The faculty of Iowa State University believe that all educated people should be able to communicate effectively in a variety of settings and media, including electronic. Consequently, Iowa State University graduates are expected to develop competence in three interrelated areas of communication: written, oral, and visual.

This communication competence can best be achieved through the following five principles:

- Communication instruction and practice are distributed over the student's entire undergraduate experience, both in and out of the classroom, from the first year through the senior year.
- Communication instruction and practice are distributed across the curriculum, both in communication courses and in courses in the student's major.
- Active learning and higher-order thinking are fostered through communication.
- Faculty across the university share responsibility for the student's progress in communication practices.
- Both faculty and students engage in ongoing assessment for continuous improvement of the student's communication practices.

Iowa State University's communication curriculum, based on these five principles, seeks to enrich the student's understanding of the various subjects studied as well as prepare the student to communicate successfully in professional, civic, and private life.

Foundation Courses

To ensure that broad communication competence is addressed and developed at the beginning of a university career, all students will earn six credits in the two-course introductory sequence (ENGL 1500 Critical Thinking and Communication and ENGL 2500 Written, Oral, Visual, and Electronic Composition), normally taken in the first and second years. Students will focus on writing and critical reading, with complementary instruction in visual, oral, and electronic communication; they will concentrate on civic and cultural themes; and they will enter work in a communication portfolio to document their current level of proficiency.

Communication Proficiency Grade Requirement: At a minimum, students must demonstrate their communication proficiency by earning a grade of C or better in ENGL 2500; some majors/degree programs may set higher requirements for communication proficiency.

Upper-Level Curricula

Continuing development of communication skills will be directed by the student's major department. Using the university's basic principles as a guide, each department will specify a set of intended learning outcomes and design communication experiences by which students in the major can achieve the desired level of communication proficiency.

Departments may select from or combine a variety of communication options that best match their faculty, students, and curriculum:

- designated communication-intensive courses that integrate written, oral, and visual communication into a course in the major;
- a sequence of courses within the major that incorporates communication tasks of increasing complexity;
- linked courses—one in communication, one in the major—that integrate readings and assignments;
- advanced composition course(s) appropriate to the student's major and offering instruction in written, oral, and visual communication;
- communication-intensive activities within or beyond course work, such as communication portfolios, discipline- or course- specific student tutoring, community service projects, internships, electronic presentations, informational fairs, juried competitions, entrepreneurial projects, newsletters, Web sites.

Departments will retain the authority for regularly assessing the degree to which their students achieve the specified learning outcomes and for making curricular improvements based on departmental assessment data.

Non-Native Speakers of English: Students admitted to the university who are graduates from non-U.S. high schools and whose first language is not English are required to take the English Placement Test before the beginning of their first semester of enrollment as students at Iowa State. This requirement includes freshmen as well as those who have

transferred credit from other institutions. The test is administered by the English Department and is offered before the beginning of each semester. Students whose performance on this placement examination is satisfactory will follow the regular university communication proficiency requirements. Students who have deficiencies will enroll in special English classes, as determined by the test results.

U.S. Cultures and Communities and International Perspective Requirements

One of Iowa State University's goals is to prepare its students to meet the challenges of responsible civic engagement and effective professional roles in a culturally diverse global community and workplace. To help achieve this goal, all undergraduate students must fulfill graduation requirements in two areas: U.S. Cultures and Communities and International Perspectives. At a minimum, students can fulfill this requirement with three credits of course work (or the equivalent in some alternative academic experience) for each area. In most cases, courses used to meet the U.S. Cultures and Communities and International Perspectives requirements can also be used to fulfill general education requirements of the student's college or requirements of the student's major. Students should consult with advisors for details of the requirements in particular majors.

The focus of the U.S. Cultures and Communities requirement is understanding the social complexity of human beings based on analytical categories such as race, ethnicity, or gender, and the ways those categories have excluded historically marginalized groups. Intersectional understandings of diversity consider other categories of identity (e.g. sexuality, culture, and religion) related to race and ethnicity. A diverse and robust education means exploring these social complexities in a structured learning environment to familiarize students with the historical, societal, and political contributions of diverse populations.

List of approved U.S. Cultures and Communities Courses (<https://www.registrar.iastate.edu/students/div-ip-guide/usdiversity-courses/>) - please refer to this list for the most up-to-date courses approved as U.S. Cultures and Communities (this list will continue to be updated following the publication of this document).

Through completion of the U.S. Cultures and Communities requirement, students will achieve at least three learning outcomes such as those listed below.

Students will be able to:

- Identify the experiences and contributions of underrepresented or marginalized groups and how they have shaped the history and culture of the United States.

- Understand the analytical concepts of culture, ethnicity, race, gender, sexuality and/or religion and be able to apply these concepts to an analysis of the United States.
- Analyze systemic oppression and personal prejudice and their impact on marginalized communities and the broader U.S. society.
- Evaluate important aspects of diversity, equity, and inclusion so they can live, work, and collaborate with others in the 21st century United States.

The focus of the International Perspectives requirement is the global community. Its objective is to promote students' understanding of cultural diversity and interdependence on a global scale. A period of immersion in a foreign culture is often a particularly effective way of meeting these objectives, so Iowa State University encourages the use of study-abroad experiences as a means of fulfilling the International Perspectives requirement. International students, because they are "studying abroad" from their home country's perspective, are normally deemed to have met the International Perspectives requirement. The International Perspective requirement shall be waived for U.S. military veterans who have completed at least three months of service stationed outside of the United States.

List of approved International Perspectives Courses (<https://www.registrar.iastate.edu/students/div-ip-guide/IntlPerspectives-current/>)

Through completion of the International Perspectives requirement, students will achieve at least two learning outcomes such as those listed below.

Students will be able to:

- Analyze the accuracy and relevancy of their own worldviews and anticipate how people from other nations may perceive that worldview.
- Describe and analyze how cultures and societies around the world are formed, are sustained, and evolve.
- Analyze and evaluate the influence of global issues in their own lives.
- Describe the values and perspectives of cultures other than their own and discuss how they influence individuals' perceptions of global issues and/or events.
- Communicate competently in a second language.

Academic Grievances and Appeals

Students who believe a faculty member (in his or her academic capacity) has behaved unfairly or unprofessionally may have their grievance reviewed through the procedure described below. A student may not initiate an academic grievance more than one year following completion

of the course, and may not initiate the grievance of a course grade beyond midterm of the semester following completion of the course.

Prior to initiating a formal grievance, a student may wish to discuss the situation informally with the Dean of Students or designee, who can offer advice as to the most effective way to deal with it.

Grievances arising out of classroom or other academic situations should be resolved, if at all possible, with the student and the instructor involved. If resolution cannot be reached, or if the grievance involves sexual or racial harassment and the student prefers not to deal directly with the instructor, the student should discuss the grievance with the instructor's department chair and submit it in writing to him or her. The department chair will investigate the grievance, including discussing it with the instructor involved and/or referring it to a departmental grievance committee. The department chair should respond in writing within five class days of receipt of the written notice of the grievance.

If the student is not satisfied with the resolution of the grievance proposed by the department chair, the student may appeal within 45 calendar days in writing to the dean of the instructor's college. (In the case of a grievance involving a Graduate College policy or procedure, an appeal of the chair's decision should be directed to the Dean of the Graduate College rather than to the dean of the instructor's college.)

The dean will hear the explanations of the department chair and instructor, and should respond to the student in writing within ten class days of receipt of the written notice of the appeal. If the grievance cannot be resolved with the dean, the student may forward within 45 calendar days a written appeal to the provost, who will convene a Committee to Review Student Grievances (see below) to consider the appeal within fifteen calendar class days of receipt of the written notice of the appeal.

Within ten calendar days following the convening of the committee, the provost will make a decision with regard to the grievance and will transmit this decision in writing to the grievant, the dean, the department chair, and the instructor. An appeal of the provost's decision may be made within 45 calendar days to the president of the university. The time limit specified at each level may be extended by mutual agreement of all parties concerned.

The Committee to Review Student Grievances is composed of faculty members named by the president of the Faculty Senate and students named by the president of the Student Government. The provost may serve as a chairperson for the committee, or may designate another chairperson for a specific grievance hearing. A minimum of two faculty members, two students, and the chairperson shall constitute a quorum for the convening committee.

Attendance and Absences

Class Attendance

In order to attend a given class, a student must be registered for that class for credit or audit. Exceptions to this policy are at the discretion of the instructor of the course. See Index, Validating Enrollment for regulations concerning attendance to validate students' enrollment in a class.

Students are expected to attend class meetings as scheduled. Each instructor sets his or her policy with respect to class attendance, and excuses for absence from class are handled between the student and instructor. The instructor is expected to announce his or her policy at the beginning of the course.

Additional information regarding discretionary accommodation for disability and religion are available at <http://www.hrs.iastate.edu/AAO/eod/reasonaccom.shtml> (<http://www.hrs.iastate.edu/AAO/eod/reasonaccom.shtml/>)

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In accordance with the requirements of the Servicemembers Improved Transition through Reforms for Ensuring Progress Act (SIT-REP Act, December 31, 2018), the University will not deny access to classes or facilities to a Veteran or eligible dependent due to a late payment from the Veterans Administration. This is only applicable to Veterans or eligible dependents who are receiving educational assistance under Chapter 31 (VR&E) or 33 (Post 9/11 and Fry Scholarship) of title 38, United States Code (U.S.C.). For the purposes of this policy, "Denial of Access" shall be defined as "to prohibit the entry, participation, or attendance to an event or facility otherwise afforded to all registered students." More information about this policy is available at <https://catalog.iastate.edu/tuitionfees/#feepaymenttext>.

Students who receive benefits from the Veterans Administration required by the V.A. to attend class regularly to maintain their V.A. eligibility. If the instructor knows that a student receiving V.A. benefits is not attending class, the instructor is obligated to notify the Office of the Registrar and a notification will be forwarded to the Veterans Administration. More information about veteran benefits is available at <http://www.veterans.iastate.edu>. (<http://www.registrar.iastate.edu/veterans/>)

Field Trips/Curricular-Related Activities

Trips away from campus as part of a course are often appropriate educational experiences. They may not, however, take place during the first or last week of the semester, nor may they extend over more than two consecutive class days (Monday-Friday); these regulations may be waived only by special permission of the dean of the college in which the course is offered. Students should consult with instructors whose classes will be missed. If a mutually satisfactory agreement between the

instructors and the student cannot be reached, the student cannot be required to attend the curricular-related activity or be penalized by the instructor for missing the curricular-related activity.

Special fees are often charged to cover the costs of field trips. Field trip fees are noted in the course section information in Workday (<https://workday.iastate.edu/>) and in the Schedule of Classes (<http://classes.iastate.edu/>).

Excusable Absences for Non-Curricular Reasons

Students who miss class for non-curricular reasons are responsible for completing all assigned course requirements in a timely manner. Instructors should provide timely opportunities for students to make-up or replace missed scheduled examinations and/or assignments resulting from an excusable absence. While instructors are free to change the format of make-up examinations or assignments, students will be evaluated by the same standards as other members of the class.

In all cases, the person responsible for the event or activity should provide participants with a letter explaining the proposed absence and its duration including travel times for off-campus events and activities. Students must provide this documentation to instructors at least 10 days in advance of the activity or event, except when such notice is not possible.

Course instructors retain final authority regarding student absences and how they impact course grades and the acceptability of a student's work toward passing their course. If a student must miss, for any reason, a portion of a course that, in the considered opinion of the course instructor, is critical to the student's ability to meet the course objectives, the instructor must recommend alternative actions to the student, which may include dropping the class.

Extra-Curricular Activities as a Representative of the University

Students may seek to or be asked to participate as an Iowa State University representative in non-credit events (competitions, conferences, presentations, programs, and performances) scheduled by academic or athletic units of the university at times that conflict with scheduled classes.

Instructors shall excuse students who miss class while representing Iowa State University in official department-or university-sponsored activities, including:

- Academic or professional conferences and workshops
- Intercollegiate athletic, academic, and judging competitions
- Musical, theatrical, dance and other artistic performances
- Presentations or programs given to external audiences.

Other Extra-Curricular Activities

Instructors will determine whether other absences not officially sponsored by a unit of the University (e.g., conference attendance, job interviews), will be treated as excused.

Military Service

Instructors shall excuse absences due to Veteran or military service obligations (including service-related medical appointments, military orders dictating appointments, and National Guard Service obligations). When a student's military or veteran obligations are for more than two weeks, the student should meet with their advisor to discuss the situation and academic options and work with their instructors to discuss potential accommodations. University procedures are in place for such situations and should be followed. In all instances, students have a responsibility to communicate with their instructors to ensure they are continuing to meet course expectations and requirements. Faculty, staff, and students are encouraged to utilize the Military-Affiliated Student Center and review information at [veterans.iastate.edu](https://www.veterans.iastate.edu/) (<https://www.veterans.iastate.edu/>).

Court Appearances

Instructors shall excuse absences due to officially mandated court appearances including jury duty.

Examinations and Evaluation Evaluation Procedures

It is university policy that the instructor shall inform the students at the beginning of each course of the evaluation procedures planned for use in the course.

Retention of Records

Records of all graded work must be retained by the instructors until midterm of the semester following completion of a course or until all pending appeals and incompletes are resolved, whichever is later. Instructors leaving the university must file records of all graded work with their department office before departure.

Examinations

Examinations are one of the most common ways instructors assess student performance. In order that examinations can be a useful part of the educational process, the following policies have been instituted:

1. One purpose of examinations is to help students' learning. Therefore, examinations should be evaluated as soon as possible after they are given and the results should be made available to the students in a timely way to enhance learning.
2. All tests and examinations administered between the beginning of the term and final examination week shall be held during a regularly scheduled lecture or laboratory class period for that course.

A department may obtain approval to administer a separately scheduled examination if all of the following criteria are met:

- a. The course is multi-sectioned.
- b. A common departmentally developed examination will be administered to all students in all sections at the same time.
- c. The test scores will be used as a basis for a uniform grading procedure for all sections of the course. To allow students to plan in advance, requests to hold separately scheduled examinations must be made to the Registrar and approved by the Provost prior to the start of course registration for that term. Only under unusual circumstances will a course be approved for separately scheduled examinations once student course registration has begun. Whenever a separately scheduled examination is administered, a regular class meeting during that week shall be omitted.

Students who are unable to take a separately scheduled examination at the designated time, due to a course conflict or other legitimate reason, must notify the instructor in advance and must be given the opportunity to be examined at another time mutually convenient for the student and the instructor. The instructor shall decide to administer the same examination, an alternate examination, or use an alternate assessment procedure.

3. At the end of the semester, a week is set aside for final examinations or other term evaluations, with a two-hour period normally scheduled for each course. The following policies govern the responsibilities of students and faculty members during this week:

- a. Final exams may not be given at a time other than that for which the exam is scheduled by the Registrar. An instructor may not give a final exam prior to final exam week nor change the time of offering of the final examination as it appears in the final exam schedule. Permission to change the time for which an exam is scheduled may be given only by the dean of the college. If the instructor elects not to give a final exam in a course of two or more credits, the class is required to meet at the scheduled final exam period for other educational activity such as a review of the course or feedback on previous exams.
- b. Final exam periods are determined according to the regularly scheduled meeting time of the class. However, certain courses are assigned special group exam times so that several sections of the same course may be tested together. The criteria for establishing special group exams are similar to those listed for separately scheduled exams listed in number 2 above. If this results in conflicting group examination periods, students should inform the instructor in charge of the first of the two conflicting courses as listed on the final exam schedule within the special

groups in question; that instructor is responsible for arranging a special examination or making some other adjustment.

- c. Evening courses with lectures scheduled at 6:00 p.m. or later should give their examinations during finals week from 7:00-9:00 p.m. on the day the class normally meets. If this exam conflicts with an evening group exam, the instructor responsible for the latter must arrange a special examination for any students who have a conflict.
- d. If unusual circumstances involve the need for students to change the time of their final examination, they must obtain the approval of the instructor of the course.
- e. If a student has three examinations scheduled on the same calendar day and wishes to change one to another day, the instructor of the course having the smallest number of students is responsible for arranging an alternate examination time for the student unless make-up exam times are available in one of the other courses.
- f. All faculty members and teaching assistants with instructional or grading responsibilities are considered to be on duty throughout the entire final examination week and are expected to be available to students during that week for discussion of any matters pertaining to the final examination and final grade or to other aspects of the course.

Prep Week

For each Fall and Spring semester, the last full week of classes before final examinations is designated as Prep Week. The intent of this policy is to establish a one-week period of substantial and predictable study time for undergraduate students. During the Prep Week period, regular lectures are expected to continue, including the introduction of new content, as deemed appropriate by the instructor. The restrictions established by this Prep Week policy are:

- Due dates for mandatory graded submissions of any kind that fall within Prep Week must be listed on the syllabus provided at the start of the course.
- Mandatory final examinations may not be given during the Prep Week period except for laboratory courses or courses that meet weekly and for which there is no contact during the normal final examination week.
- No in-class quizzes or exams may be given on the Thursday and Friday of Prep Week. Quizzes/exams that are administered outside of class such as take-home exams, online exams, or exams given in the testing centers must: 1) open no later than Wednesday at noon

of Prep Week, and 2) only cover material presented on or before the Tuesday of Prep Week.

Exceptions to this policy include the following:

- Classes that only meet on Thursdays or Fridays
- Lab components of courses
- Half-semester courses
- Make-up exams due to excused absences
- Regularly used formative assessments intended to enhance student engagement and guide course delivery

All other exceptions require approval by the Office of the Senior Vice President and Provost.

- Registered ISU Student Organizations may not hold any meetings, functions, or sponsored events during the Prep Week period. Any exception to these restrictions must be authorized in advance by the Office of the Senior Vice President for Student Affairs.

Instructors are reminded that most students are enrolled in several courses each semester, and the widespread violation of this policy can cause student workloads to be excessive as students begin their preparation for final examinations.

Students are reminded that their academic curriculum is their principal reason for being in college and they have a responsibility to study in a timely fashion throughout the entire semester.

Policy approved by Faculty Senate, Senior Vice President and Provost, and President, 2013; Amended and approved by Faculty Senate, Senior Vice President and Provost, and President, 2017.

Scholastic Recognition

The university recognizes those students who are doing exceptionally well in several ways, including the following.

1. Dean's List. Each semester the university issues a dean's list made up of those students who have carried at least 12 credit hours of graded or S-F courses with a 3.50 grade-point average or above for the semester. Courses taken on a P-NP basis do not count as part of the 12-credit hour requirement. No Dean's List is issued for summer session. The list can be viewed from the Office of the Registrar website (<http://www.registrar.iastate.edu>).

2. President's List. Each semester the university issues a President's List made up of those students who have carried at least 24 credit hours of graded or S-F courses with a 4.00 grade-point average for their two most recent semesters of enrollment at Iowa State University (summer not considered). Courses taken on a P-NP basis do not count as part of the 24-credit hour requirement. No President's List is issued for summer

session. The list can be viewed from the Office of the Registrar website (<http://www.registrar.iastate.edu>).

3. Graduation with Distinction. Undergraduates who have a cumulative grade point average of 3.50 or higher (based on a 4.0 scale) are eligible to graduate "with distinction" provided they have completed the following criteria for their degree. The student's distinction will be based upon their cumulative grade point average after all degree requirements have been satisfied.

These students are recognized as follows:

- Summa Cum Laude: cumulative grade point average of 3.90 or higher.
- Magna Cum Laude: cumulative grade point average of 3.70 to 3.89.
- Cum Laude: cumulative grade point average of 3.50 to 3.69.

The recognition appears on the student's official transcript and diploma.

Candidates for a bachelor's degree may graduate "with distinction" provided they have completed 60 semester credits of coursework at Iowa State University at the time of graduation, including a minimum of 50 graded or Satisfactory-Fail course credits.

Candidates for the bachelor of liberal studies degree may graduate "with distinction" provided that they have (a) completed 45 semester credits of coursework at the three Iowa Regent universities at the time of graduation, and (b) earned at least a 3.50 cumulative grade point average at ISU. The graduation with distinction recognition will be based on their combined grade point average for coursework taken at the three Iowa Regent universities.

Candidates for the bachelor of science in nursing degree may graduate "with distinction" provided that they have completed 32 semester credits of coursework at ISU at the time of graduation.

Honors Program. Students who are full members of the University Honors Program need a cumulative grade point average of 3.50 at the beginning of their final term. In addition to meeting the appropriate grade point requirement, students will have completed an approved honors program of study and an honors project prior to graduation. This recognition appears on the student's permanent record, diploma, and in the commencement program.

Graduation

Seniors must file a graduation application with the Graduation Office, 214 Enrollment Services Center. Students will be notified of their graduation status approximately mid-semester of their graduation term. For graduation application instructions and deadlines, see the Graduation and Commencement website (<http://www.graduation.iastate.edu/>).

Iowa State University commencement ceremonies are held at the end of fall and spring semesters. Undergraduate students expected to graduate at the end of summer semester are invited to participate in the spring ceremony preceding their graduation term or the fall ceremony following their graduation term. In addition to the formal University commencement ceremony, the undergraduate colleges host graduation activities take place at the end of fall and spring semesters. For more information, see the Graduation and Commencement website (<http://www.graduation.iastate.edu/>).

Verification of satisfactory final grades will be completed approximately two weeks after the end of the semester and diplomas will be mailed to all successful degree candidates. Students must ensure the following before they can graduate:

1. The date of graduation is correct on the student's academic record.
2. Sufficient credits, acceptable toward graduation, have been earned to meet the minimum requirements for their program of study. (Some examples of credit not acceptable toward graduation are: elective credits beyond those allowed in a program of study, credits earned in passing the same course more than once, more than four credits of Athletics 1010, and credit in two courses for which the catalog states that only one may count toward graduation.)
3. They have achieved a set of communication competencies established by the department as appropriate for the major.
4. A cumulative grade point average of at least 2.00 was earned in all work taken at Iowa State; and student has met all special grade point average requirements established by their college, department, or program in specified courses.
5. Students who have taken work at another college or university prior to or after having been a student at Iowa State, must have submitted a transcript of all such college study attempted to the Office of Admissions. Failure to submit such a transcript is grounds for dismissal.
6. Incompletes in courses required for graduation have been removed by midterm of the term of graduation.
7. At least 32 credits have been earned in residence at Iowa State University, and the final 32 credits were taken at Iowa State. (Six of the last 32 credits may be transferred to Iowa State, with prior permission of their major department.) Iowa State University must receive an official transcript of all transfer work by midterm of the term of graduation.
8. Outstanding financial obligations owed the university have been paid in full. Students who owe an outstanding obligation to the university will have a hold placed on their records and they will not receive their transcripts. If students have questions about this policy, they should contact the transcripts area of the Office of the Registrar.

Posthumous Degrees

To provide survivors of deceased students with a meaningful acknowledgement of the student's accomplishments and legacy at Iowa State University, the University may grant degrees posthumously.

Consideration for a posthumous degree may be initiated by student's department/graduate program, by the Office of Student Assistance and Outreach, or by family members or other survivors. The student's death should be reasonably proximate to their enrollment at Iowa State; special consideration should be granted for circumstances such as departure due to military deployment or critical illness or injury.

For undergraduate and professional students, the student's College may recommend conferral of the posthumous degree, which will be forwarded to the Provost for consideration and a final decision.

For graduate students, their department or interdepartmental graduate program may recommend conferral of the posthumous degree to the Graduate College. The Graduate College will review the request with the disciplinary college of the student and forward the request to the Provost for consideration and a final decision.

After a request is approved, the University can issue the diploma to the survivors of the deceased student. The student's permanent record, and the commencement program, will indicate the degree was conferred posthumously, but no notation that the degree was awarded posthumously will be made on the diploma.

Grading

Detailed information on grading can be found here: catalog.iastate.edu/academics/grading

Academic Conduct

Class Attendance

In order to attend a given class, a student must be registered for that class for credit or audit. Exceptions to this policy are at the discretion of the instructor of the course. See Validating Enrollment for regulations concerning attendance to validate students' enrollment in a class.

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Court Appearances

Instructors shall excuse absences due to officially mandated court appearances including jury duty.

Academic Misconduct

Academic misconduct is any action or attempted action that may result in creating an unfair academic advantage for oneself or an unfair academic advantage or disadvantage for any other member or members of the academic community. Such behavior is disparaging to the university and students found responsible for academic misconduct can face a number of disciplinary sanctions such as a disciplinary reprimand, conduct probation, deferred suspension, suspension, or expulsion. Instances of academic misconduct ultimately affect all students and the entire university community by degrading the value of degrees when some are obtained dishonestly, and by impacting the grades of students working honestly.

Examples of academic misconduct include, but are not limited to the following:

1. **Obtaining or use of unauthorized information:** It is a violation to obtain or use unauthorized assistance or prohibited materials and texts, tools, or study aids, unapproved use of cell phones, internet, or other electronic devices, unauthorized collaboration or copying on a test or assignment. Other examples may include working with another student on a take-home test or homework when not specifically permitted to do so by the instructor, looking at your notes or other work during an examination when not specifically permitted to do so, unauthorized sharing of questions or answers with another student or students whether in the classroom, via group chat or messages or another internet platform, or where posted by another student at an online academic warehouse (Course Hero, Chegg, Study Blue, etc.).
2. **Misrepresentation, falsification or fabrication of information.** It is a violation for students to misrepresent or falsify coursework. Examples of this may include purchasing or downloading for use a paper from a term paper service or online academic warehouse, working jointly on a project and then submitting it as one's own, requesting, hiring, or otherwise encouraging someone to take a course, exam, test, or complete assignments on your behalf or for another student.

Students may not engage in or submit falsified or fabricated course work such as falsifying research, inventing or falsely altering data, citing fictitious references, falsely recording or reporting attendance, hours, or engagement in activities such as internships, externships, field experiences, clinical activities.

It is additionally a violation for students to tamper with or attempt to alter grades, academic records, or an instructor's evaluation of work by altering materials or documents, tampering with evaluation tools, or other means of interfering.

3. **Plagiarism:** Plagiarism is a form of misrepresentation. Students may not present the work, words, theories, data, expressed ideas, or artistry of another person or persons as their own, neither word-for-word nor paraphrasing of another person's work. It is a violation for students to reproduce another person's paper, work or artistry, even with modifications, and submit it as their own. Students may not use another person's work or words (including unpublished material) without appropriate source documentation or citation.

It is a violation for students to submit substantially the same work to satisfy requirements for one course or academic requirement that has been submitted in satisfaction of requirements for another course or academic requirement without permission of the instructor of the course for which the work is being submitted.

4. **Other academic misconduct:** Students are prohibited from any action that helps another student engage in academic misconduct. Examples may include providing or selling coursework or materials to another person where this is not permitted or where they plan to use it in an unauthorized manner or otherwise submit it as their own work; unauthorized provision or discussion of exam questions or answers with students that will be taking the same or similar exam; posting coursework created by an instructor without their permission at an online academic warehouse (Course Hero, Chegg, Quizlet, etc.); taking an exam/completing an assignment for someone else; or otherwise seeking to acquire, selling, bribing, paying or accepting payment for unauthorized academic work or assistance that contributes to academic misconduct.

Students are prohibited from the recording and/or sale or dissemination (including posting) of instructional content without the express permission of the instructor(s) or through an approved accommodation coordinated via Student Accessibility Services.

Students, faculty, and staff who would like more information are encouraged to visit the Student Conduct (<https://www.studentconduct.dso.iastate.edu/>) website for resources pertaining to academic integrity.

Reporting Academic Misconduct and Academic Outcomes

Academic misconduct is a violation of the behavior expected of a student in an academic setting as well as a student conduct violation. A student found responsible for academic misconduct is subject to appropriate academic penalty, to be determined by the instructor of the course, as well as sanctions under the university Student Code of Conduct (<https://www.studentconduct.dso.iastate.edu/>).

www.policy.iastate.edu/policy/SDR/). If an instructor believes that a student has behaved dishonestly in a course, the following steps **are recommended**:

1. Contact the student to indicate there are concerns with the coursework; this can be done via email or another appropriate student learning platform.
2. Provide the student an opportunity to respond and indicate whether they admit or deny responsibility.
 - a. Where students request to meet, instructors can facilitate this as plausible (in-person or virtual), involving the relevant and appropriate instructors for the referral (e.g., teaching assistant for the course and/or supervising faculty.)
 - b. In cases involving multiple students, it is recommended that meetings are with individuals.
3. If the student denies responsibility, the instructor will not assign a grade for the assignment or course (leave grade as **N for grade processing**), until the Office of Student Conduct has shared the student disciplinary conclusions. If the student admits the misconduct, the instructor may assign a grade as outlined in the syllabus.
4. Refer the case and information to the Office of Student Conduct via their website reporting form, including related materials such as exams, coursework, reports, websites, external resources, syllabi, summary of the interaction with student(s), and other relevant information, as requested.

In cases involving denial of responsibility, when an outcome is determined by the Office of Student Conduct, both the student and the instructor will be notified of the disciplinary process conclusions.

A student accused of academic misconduct has the option to stay in the course or to drop the course if the drop is made within the approved time periods and according to the regulations established by the university. If the student chooses to drop the course and if the student is later found responsible for academic misconduct, then, at the discretion of the instructor, academic repercussions may follow, per the course syllabus, up to and including receiving an 'F' for the course on the transcript.

Student records concerning academic dishonesty are maintained in the Dean of Students Office for a period of seven years, after which the file records are purged. These student records are subject to state and federal laws and regulations guiding confidentiality of student records. However, when the student is expelled, suspended, or their admission is revoked, a notation will appear on the academic transcript that the student has been dropped due to disciplinary action and is not eligible to enroll. In the event that an instructor is uncertain how to handle an incident of suspected academic dishonesty, the Office of Student

Conduct is available to consult with the instructor in deciding a proper course of action to be taken.

For questions regarding the process, contact the Office of Student Conduct.

The complete Student Code of Conduct policy and process pertaining to academic misconduct can be found at <https://www.policy.iastate.edu/policy/SDR/> (<https://www.policy.iastate.edu/policy/SDR/>).

Response to Classroom Disruption

Should any student officially enrolled for credit or audit in a class disrupt the instructor's ability to ensure a safe learning environment, control the class agenda, and/or deliver the approved curriculum, the instructor has the right to ask that the disruptive action cease immediately. The instructor may find it useful to include general guidelines about disruptive behavior on the course syllabus; and in the event of a classroom or learning environment disruption, the instructor may, if they find it necessary, explain to the student and the class why the particular action is deemed disruptive. The responsible student should cease the disruption and utilize non-disruptive means for expressing disagreement or concern. If the disruption continues, the instructor can pursue various forms of intervention as discussed in more detail in the Faculty Handbook. (<https://www.provost.iastate.edu/faculty-success/faculty-handbook/>)

Additional guidance and resources for managing classroom disruption are available from CELT (<https://www.celt.iastate.edu/teaching/effective-teaching-practices/classroom-behavior/>).

Course Ownership

Ownership of Course-related Presentations

The presenter owns course-related presentations, including lectures. Individuals may take written notes or make other recordings of the presentations for educational purposes, but specific written permission to sell or post the notes or recordings for sale or subscription must be obtained from the presenter. Selling notes by students without the required permission is a violation of the Student Conduct Code (<https://www.policy.iastate.edu/policy/SDR/#4225>).

Recording and Transmission of Classes

Recordings and transmission of classes may take place for a variety of legitimate reasons, including providing educational opportunities for those who cannot attend classes on campus, assisting students with disabilities that impair classroom note taking, and giving the instructor feedback on their classroom performance.

Because the lectures of faculty represent their intellectual labors, individuals are expected to obtain permission to make recordings of lectures and other classroom interactions. Recordings may be used for

the purposes of the particular class, although in some cases, and with permission of faculty, the recordings may be preserved and used for other classes as well.

Grading

GRADING SYSTEM

Grades represent the permanent official record of a student's academic performance. The grading system at Iowa State University operates according to regulations outlined on the Grade Policies tab. The following provides quality points assigned for each letter grades:

Grade	Quality Points
A	4.00
A-	3.67
B+	3.33
B	3.00
B-	2.67
C+	2.33
C	2.00
C-	1.67
D+	1.33
D	1.00
D-	0.67
F	0.00

Grade	Description
P	Passing mark obtained under the Pass-Not Pass system.*
NP	Non-passing mark obtained under the Pass-Not Pass system.*
S	Satisfactory completion of a course offered on a Satisfactory-Fail grading basis. May also be reported to indicate satisfactory performance in R (required-credit) courses, and in courses numbered 290, 490, 590, and 690.
T	Satisfactory performance (equivalent to a grade of C or better in courses numbered 100-499, and a grade of B or better in courses numbered 500-699) in a special examination for academic credit.
W	The course was officially dropped by the student after the first week of the term.

N	No report was submitted by the instructor. An N is not a recognized grade or mark, it merely indicates the instructor has not submitted a grade and that a grade report has been requested. A nonreport (N) will automatically change to a grade of 'F' after one calendar year whether or not the undergraduate student enrolled during that period. If the N is outstanding at the time of graduation, it will be converted to a grade of 'F'. Undergraduate students will not graduate with N on their permanent record. Repeating a course will not resolve the N.

I	Incomplete. An incomplete mark may be assigned when the student is passing at the time of the request, but special circumstances beyond the student's control prevent completion of the course. In general, failing the final exam or project or not submitting course work as a result of inadequate preparation or learning are not valid excuses.***

*See Pass Not Pass Grading.

***See Incomplete Marks in the Grade Policies tab.

POLICY INFORMATION

Grades represent the permanent official record of a student's academic performance. The grading system at Iowa State operates according to the following regulations:

1. Student performance or status is recorded by the grades and marks described in the Grading System tab. A student's grade point average is calculated on the basis of credits earned at Iowa State with the grades and quality points shown below. Credits earned with S, P, NP, or T are not used in calculating the grade point average but may be applied toward meeting degree requirements. A cumulative grade point average of 2.00 is required for a bachelor's degree.

2. Students who want to protest a grade submitted by an instructor should follow the procedures described in the section, Academic Grievances and Appeals.

3. Incomplete Marks - An incomplete may be assigned when special circumstances beyond the student's control prevent completion of the course and the student could pass the course if all coursework, agreed upon by the instructor and student, is completed. In general, failing the final exam or project or not submitting course work as a result of inadequate preparation or learning are not valid justification for an Incomplete.

If the instructor and student agree that an Incomplete is appropriate, they should complete an Incomplete (I) Contract (downloadable from the Office of the Registrar Faculty & Staff Forms (<https://www.registrar.iastate.edu/resources/forms/faculty---staff-forms/>) website) to document the reason for the I, the requirements for resolving it, the grade if no further work is completed (score of 0 for assessments not completed), and the date by which it must be resolved, not to exceed one calendar year or the student's graduation term (whichever is earlier). If the student is not available to sign the Incomplete (I) Contract, the instructor must document the conditions for the Incomplete by communicating directly with the student by e-mail. A copy of this communication must be retained by the instructor and the chair (or designated representative) of the department until after the I is resolved in case there are any questions in the future regarding the terms of the Incomplete. The instructor also needs to enter the Incomplete (I) electronically as part of the end of term final grade submission.

Resolving an Incomplete: When a student completes the requirements specified on the Incomplete Contract, the instructor submits the appropriate grade. The resolved grade is recorded for the term the student enrolled for the course with a notation that the grade resolved an Incomplete. The resolved grade becomes part of the student's term and cumulative grade point average. The student's academic standing for the term the Incomplete was assigned will not be affected when the I is resolved.

A final course grade, once submitted to the registrar, **may not** be changed to an Incomplete except to correct an error at the request of the instructor, and with the approval of the instructor's department head and the dean of the instructor's college. The Incomplete (I) Contract should be used by the instructor to document the conditions for the Incomplete as specified above. The Assign Student Grades for Student Course Section task should be used to initiate the request to change the grade to an Incomplete with appropriate alternate letter grade, and will route for approval by the department head and dean of the instructor's college, then to the Office of the Registrar.

Incomplete grades in all courses must be resolved by the middle of the student's term of graduation. Repeating a course will not resolve an I mark. A mark of I will automatically change to the grade indicated in the contract (based on completed and incomplete

assessments) after one calendar year (whether or not the student was enrolled during the period).

4. To change a grade or mark already reported to the registrar, the instructor submits the Assign Student Grades for Student Course Section task in Workday (<https://workday.iastate.edu/>). This task is used for resolving an I with a grade, for correcting an instructor error, or for the late report of a grade.

5. Interim Grades. The registrar will collect C-, D+, D, D- and F interim grades and nonattendance notifications from the instructor and report this information to students and their advisors in the student information system. In addition to submitting the interim grades, the instructor is responsible for informing the class of the basis on which they were calculated.

The purpose of interim grades is to provide the student and advisor with a timely warning that the student's academic performance to that point in the course may be lower than desirable. Students who receive interim grades C- and below are encouraged to discuss their academic performance with the course instructor and their advisor.

6. Grades in all courses attempted remain on each student's record. If a course is repeated, the record will show the grade obtained on the initial attempt as well as grades received on subsequent attempts.

7. The cumulative grade point average is calculated by dividing the total number of quality points earned by the total number of credits in all courses attempted. Grades of S, P, NP, and T are not counted in calculating the grade point average.

8. Repeating Courses.

- The most recent grade for a course a student initially takes and repeats at Iowa State will be used to compute the student's cumulative grade point average rather than the previous grade(s), up to a limit of 18 credits. This could result in a lower cumulative grade point average if the most recent grade is lower than the previous grade or even loss of credit if the most recent grade earned is an F. All grades will remain on the student's record.
- Students may repeat any course for which an F grade, an NP grade, or any passing grade was received. A course initially taken for a grade must be repeated as a graded course. A course initially taken as Pass/Not Pass may be repeated as a graded or Pass/Not Pass course.
- Beyond the 18 credit limit of repeats, all grades will be included in computing the cumulative grade point average. Please refer to items #1 and #7 above regarding how to calculate the grade point average.
- Courses should be repeated as soon as possible, preferably within three semesters in residence, because of changes that occur with

course updating, change in course number, or revision in the number of credits.

- Approval to repeat a course in which the course number or number of credits has changed must be noted on a Designation of Repeated Course form, which can be obtained from departmental offices. This form must be signed by the head of the department offering the course and by the student's advisor, and then submitted to the Office of the Registrar. Deadlines for filing repeated course forms for full-semester and half-semester courses are published in the university calendar.
- Courses taken at institutions other than Iowa State University do not impact the 18 credit Designated Repeat limit.
- A student who has taken a course at Iowa State University may repeat the course at another institution. The credits earned at another institution may be applied toward graduation requirements at Iowa State. However, the grade earned at another institution will not replace the grade earned at Iowa State University or be used in computing a cumulative grade point average.
- Repeated courses may affect Federal or other financial aid. See the Financial Aid website (<https://financialaid.iastate.edu/>) for further information.

PASS-NOT PASS GRADING

Students may choose to attempt a maximum of 9 semester credit hours on a Pass-Not Pass basis, meaning that only a P or NP will be recorded as their final grade in the course. The purpose of P-NP grading is to encourage students to broaden their education by taking courses outside the usual program of study for their major and minor disciplines. The following policies apply:

1. Undergraduate students who are not on academic probation at the beginning of the semester are eligible. A special (nondegree) student must obtain approval from their academic advisor and college dean.
2. Only elective courses may be taken on a P-NP basis. In specific majors, some restrictions may apply, so students should consult with their academic advisor.
3. Except for restrictions on its own undergraduate majors, a department may not deny the availability of any of its course offerings on a P-NP basis.
4. Courses offered on a satisfactory-fail basis may not be taken P-NP.
5. Students should register for a P-NP course in the same manner and at the same time that they register for their other courses. From their Current Classes tab in Workday, students should then edit their registration for the course to change the grading basis to P-NP in the student information system.
6. Students who elect to change back to a graded basis should process the change from their Current Classes tab in Workday to edit their

registration for the course to change the the grading basis back to Graded.

7. Changes to or from a P-NP basis may not be done after the last day to drop (usually the Friday of week 10 of the term) without college approval. Changes from a P-NP basis to a Graded basis that occur after the last day to drop will still count against a student's 9 maximum allowable P-NP credits.
8. Registration on a P-NP basis is not indicated on the instructor's class list. Students will receive a P if their grade is D minus or better and an NP if their grade was F.
9. Neither P (earned grade of D minus or better) nor NP (earned grade of F) is counted in calculating a student's grade point average (GPA).
10. When students change their curriculum, any P credits that they have accumulated will be accepted by the new department if such credits are in courses normally accepted by the department.
11. Credits taken on a P-NP basis at another institution and transferred to Iowa State may be applied as electives in a student's degree program if the credits are otherwise acceptable in that program. The number of P-NP transfer credits that can be accepted depends on the number permitted by the institution from which the student is transferring. If a student transfers more than nine semester P-NP credits, no additional Iowa State P-NP credits can be applied to the student's degree program.

EXAMINATIONS

Examinations are one of the most common ways instructors assess student performance. In order that examinations can be a useful part of the educational process, the following policies have been instituted:

1. One purpose of examinations is to help students' learning. Therefore, examinations should be evaluated as soon as possible after they are given and the results should be made available to the students in a timely way to enhance learning.
2. All tests and examinations administered between the beginning of the term and final examination week shall be held during a regularly scheduled lecture or laboratory class period for that course. A department may obtain approval to administer a separately scheduled examination if all of the following criteria are met:
 - a. The course is multi-sectioned.
 - b. A common departmentally developed examination will be administered to all students in all sections at the same time.
 - c. The test scores will be used as a basis for a uniform grading procedure for all sections of the course. To allow students to plan in advance, requests to hold separately scheduled examinations must be made to the Registrar and approved by the Provost prior to the start of course registration for that term. Only under unusual circumstances will a course be approved for separately scheduled examinations once student course registration

has begun. Whenever a separately scheduled examination is administered, a regular class meeting during that week shall be omitted.

Students who are unable to take a separately scheduled examination at the designated time, due to a course conflict or other legitimate reason, must notify the instructor in advance and must be given the opportunity to be examined at another time mutually convenient for the student and the instructor. The instructor shall decide to administer the same examination, an alternate examination, or use an alternate assessment procedure.

3. At the end of the semester, a week is set aside for final examinations or other term evaluations, with a two-hour period normally scheduled for each course. The following policies govern the responsibilities of students and faculty members during this week:

- a. Final exams may not be given at a time other than that for which the exam is scheduled by the Registrar. An instructor may not give a final exam prior to final exam week nor change the time of offering of the final examination as it appears in the final exam schedule. Permission to change the time for which an exam is scheduled may be given only by the dean of the college. If the instructor elects not to give a final exam in a course of two or more credits, the class is required to meet at the scheduled final exam period for other educational activity such as a review of the course or feedback on previous exams.
- b. Final exam periods are determined according to the regularly scheduled meeting time of the class. However, certain courses are assigned special group exam times so that several sections of the same course may be tested together. The criteria for establishing special group exams are similar to those listed for separately scheduled exams listed in number 2 above. If this results in conflicting group examination periods, students should inform the instructor in charge of the first of the two conflicting courses as listed on the final exam schedule within the special groups in question; that instructor is responsible for arranging a special examination or making some other adjustment.
- c. Evening courses with lectures scheduled at 6:00 p.m. or later should give their examinations during finals week from 7:00-9:00 p.m. on the day the class normally meets. If this exam conflicts with an evening group exam, the instructor responsible for the latter must arrange a special examination for any students who have a conflict.
- d. If unusual circumstances involve the need for students to change the time of their final examination, they must obtain the approval of the instructor of the course.
- e. If a student has three examinations scheduled on the same calendar day and wishes to change one to another day, the instructor of the course having the smallest number of students is responsible for arranging an alternate examination time for the student unless make-up exam times are available in one of the other courses.
- f. All faculty members and teaching assistants with instructional or grading responsibilities are considered to be on duty throughout the entire final examination week and are expected to be available to students during that week for discussion of any matters pertaining to the final examination and final grade or to other aspects of the course.

Prep Week

For each Fall and Spring semester, the last full week of classes before final examinations is designated as Prep Week. The intent of this policy is to establish a one-week period of substantial and predictable study time for undergraduate students. During the Prep Week period, regular lectures are expected to continue, including the introduction of new content, as deemed appropriate by the instructor. The restrictions established by this Prep Week policy are:

- Due dates for mandatory graded submissions of any kind that fall within Prep Week must be listed on the syllabus provided at the start of the course.
- Mandatory final examinations may not be given during the Prep Week period except for laboratory courses or courses that meet weekly and for which there is no contact during the normal final examination week.
- No in-class quizzes or exams may be given on the Thursday and Friday of Prep Week. Quizzes/exams that are administered outside of class such as take-home exams, online exams, or exams given in the testing centers must: 1) open no later than Wednesday at noon of Prep Week, and 2) only cover material presented on or before the Tuesday of Prep Week.

Exceptions to this policy include the following:

- Classes that only meet on Thursdays or Fridays
- Lab components of courses
- Half-semester courses
- Make-up exams due to excused absences
- Regularly used formative assessments intended to enhance student engagement and guide course delivery

All other exceptions require approval by the Office of the Senior Vice President and Provost.

- Registered ISU Student Organizations may not hold any meetings, functions, or sponsored events during the Prep Week period. Any exception to these restrictions must be authorized in advance by the Office of the Senior Vice President for Student Affairs.

Instructors are reminded that most students are enrolled in several courses each semester, and the widespread violation of this policy can cause student workloads to be excessive as students begin their preparation for final examinations.

Students are reminded that their academic curriculum is their principal reason for being in college and they have a responsibility to study in a timely fashion throughout the entire semester.

Policy approved by Faculty Senate, Senior Vice President and Provost, and President, 2013; Amended and approved by Faculty Senate, Senior Vice President and Provost, and President, 2017.

SCHOLASTIC RECOGNITION

The university recognizes those students who are doing exceptionally well in several ways, including the following.

1. Dean's List. Each semester the university issues a dean's list made up of those students who have carried at least 12 credit hours of graded or S-F courses with a 3.50 grade-point average or above for the semester. Courses taken on a P-NP basis do not count as part of the 12-credit hour requirement. No dean's list is issued for summer school. The list can be viewed from the Office of the Registrar website (<http://www.registrar.iastate.edu>).

2. President's List. Each semester the university issues a President's List made up of those students who have carried at least 24 credit hours of graded or S-F courses with a 4.00 grade-point average for their two most recent semesters of enrollment at Iowa State University (summer not considered). Courses taken on a P-NP basis do not count as part of the 24-credit hour requirement. No President's List is issued for summer session. the list can be viewed from the Office of the Registrar website (<http://www.registrar.iastate.edu>).

3. Graduation with Distinction. Undergraduates who have a cumulative grade point average of 3.50 or higher (based on a 4.0 scale) are eligible to graduate "with distinction" provided they have completed the following criteria for their degree. The student's distinction will be based upon their cumulative grade point average after all degree requirements have been satisfied.

These students are recognized as follows:

- Summa Cum Laude: cumulative grade point average of 3.90 or higher.
- Magna Cum Laude: cumulative grade point average of 3.70 to 3.89.
- Cum Laude: cumulative grade point average of 3.50 to 3.69.

The recognition appears on the student's official transcript and diploma.

Candidates for a bachelor's degree may graduate "with distinction" provided they have completed 60 semester credits of coursework at Iowa

State University at the time of graduation, including a minimum of 50 graded or Satisfactory-Fail course credits.

Candidates for the bachelor of liberal studies degree may graduate "with distinction" provided that they have (a) completed 45 semester credits of coursework at the three Iowa Regent universities at the time of graduation, and (b) earned at least a 3.50 cumulative grade point average at ISU. The graduation with distinction recognition will be based on their combined grade point average for coursework taken at the three Iowa Regent universities.

Candidates for the bachelor of science in nursing degree may graduate "with distinction" provided that they have completed 32 semester credits of coursework at ISU at the time of graduation.

Honors Program. Students who are full members of the University Honors Program need a cumulative grade point average of 3.50 at the beginning of their final term. In addition to meeting the appropriate grade point requirement, students will have completed an approved honors program of study and an honors project prior to graduation. This recognition appears on the student's permanent record, diploma, and in the commencement program.

EVALUATION PROCEDURES

It is university policy that the instructor shall inform the students at the beginning of each course of the evaluation procedures planned for use in the course.

RETENTION OF RECORDS

Records of all graded work must be retained by the instructors until midterm of the semester following completion of a course or until all pending appeals and incompletes are resolved, whichever is later. Instructors leaving the university must file records of all graded work with their department office before departure.

Academic Standing Academic Standards Regulations

Each college has an academic standards committee that is responsible for monitoring the academic progress of all undergraduate students in that college, based on policies and minimum requirements set by the Faculty Senate Committee on Academic Standards and Admissions and ratified by the Faculty Senate. Individual college faculties may, with the approval of the Faculty Senate Committee on Academic Standards and Admissions, set additional program admission and curriculum requirements that are more stringent than those established for the university. These additional requirements must be reviewed at least every third catalog by the college academic standards committee to determine if the requirements should be continued. Requirements approved by the college academic standards committees will then be

forwarded to the Faculty Senate Committee on Academic Standards and Admissions for final approval. The college committees are responsible for actions involving individual students with respect to placing students on Academic Probation, dismissing students from the university for unsatisfactory academic progress, and reinstating student who have been Academically Dismissed.

Changing colleges: A student on Academic Probation may transfer to another program in the university before period 3 begins (before the last day to drop a course.) For students on Academic Probation, transfer during period 3 (after the last day to drop a course) can only occur under exceptional circumstances and with the approval of the chair of the new program and the dean of the new college.

Withdrawal: A student on Academic Probation who withdraws during period 3 will be Academically Dismissed at the end of the term the student withdraws, except under extenuating circumstances as judged by the college academic standards committee.

Reinstated students: Reinstated students should also see the section on Reinstatement.

Veterinary Medicine: Additional rules for minimum satisfactory progress are in effect.

Special (nondegree) students: Students matriculated in this classification category are governed by the regular academic progress regulations. Furthermore, by special action of their college academic standards committee, additional standards may be required.

Academic Progress

For questions concerning interpretation and application of the rules governing academic progress, students should contact the chair or secretary of their college academic standards committee in their college office.

The university's academic standards rules are presented below. In addition to taking action based on these rules, a college academic standards committee may also place a student on academic probation or dismiss a student from enrollment in the university when, in the college committee's judgment, the student's academic performance or progress toward a degree is exceptionally deficient. Likewise, a college committee may, under exceptional circumstances, exempt individual students from the application of these rules. Students who participate in the Regent Universities Student Exchange Program, or in a similar program where the credit taken at the other school will be considered as resident credit and the grades included in the student's ISU cumulative grade point average, are subject to Iowa State University's academic standards.

Maintaining Satisfactory Progress

Continued enrollment at Iowa State University depends upon an undergraduate student maintaining satisfactory academic progress toward attaining a degree. To assist students in maintaining satisfactory progress, Iowa State University has adopted academic standards designed to provide early identification of students who are experiencing academic difficulty, and to provide timely intervention through academic advising and academic support programs.

Academic standing at Iowa State University is dependent upon the total number of credits a student has attempted or earned, the student's semester grade point average (GPA), and the student's cumulative ISU GPA.

Academic Warning

While Academic Warning is the least severe of the negative academic standings, it serves as a reminder that future academic performance below 2.00 could result in more serious consequences. In fact, a student on Academic Warning whose subsequent term GPA is below a 2.00 will be placed on Academic Probation the following term.

Students who receive an Academic Warning are required to develop a plan for academic improvement in consultation with their academic advisor or the Academic Success Center. A student who is subject to both Academic Warning and Academic Probation will be placed on Academic Probation. The Academic Warning is not a part of the student's permanent academic record.

Students will receive an Academic Warning at the end of any fall or spring semester when they earn a GPA of 1.00 – 1.99 for that semester. At the end of the next fall or spring semester of enrollment, one of the following actions will be taken for students on Academic Warning:

- Students will be placed on Academic Probation if they earn less than a 2.00 GPA for the next fall or spring semester, or
- They will be removed from Academic Warning if they earn at least a 2.00 semester GPA for the next fall or spring semester, and they are not subject to Academic Probation based on cumulative GPA (over 75 credits).

See Summer Academic Standards Regulations section for how summer grades affect Academic Warning, Academic Probation, and Academic Dismissal.

Academic Probation

Students are placed on Academic Probation as a warning that their academic progress is not satisfactory and that they should take steps to improve their academic performance to avoid Academic Dismissal from the university. Academic Probation is an indication of very serious academic difficulty. Students may be placed on Academic Probation as a result of either semester GPA, cumulative GPA, or both. Academic

Probation status is not a part of the student's permanent academic record.

Students on Academic Probation and Academic Warning are required to meet with their advisor and to complete the Academic Intervention Self-Assessment form, which can be accessed here: <https://www.provost.iastate.edu/academic-programs/policies/academic-standing> (<https://www.provost.iastate.edu/academic-programs/policies/academic-standing>). (<http://www.dso.iastate.edu/asc/ai/students/>)

Students will be placed on Academic Probation at the end of a semester/term for either of the following two reasons:

1. Semester GPA: Students who earn less than a 1.00 at the end of any fall or spring semester, or less than 2.00 two consecutive semesters, will be placed on Academic Probation. Students will not be placed on Academic Probation at the end of the summer term due to summer term GPA only.
2. Cumulative GPA: Students with 75 or more credits attempted or earned, whichever is greater, will be placed on Academic Probation at the end of any fall or spring semester or summer term when their cumulative GPA is less than 2.00.

At the end of the next fall or spring semester of enrollment, one of the following actions will be taken for students on Academic Probation:

- Students will be academically dismissed if they fail to earn at least a 2.00 semester GPA.
- Students will continue on Academic Probation if they earn at least a 2.00 semester GPA but are subject to continued Academic Probation based on their cumulative GPA (over 75 credits).
- Students will be removed from Academic Probation if they earn at least a 2.00 semester GPA and are not subject to continued Academic Probation based on their cumulative GPA (over 75 credits).

See Academic Dismissal for dismissal policy.

See Summer Academic Standards Regulations section for how summer grades affect warning, probation, or dismissal status.

Academic Dismissal

Students who do not meet the requirements of their Academic Probation are Academically Dismissed from the university. Each College Academic Standards Committee is responsible for final decisions regarding the academic status of students in that college, and any appeals to Academic Dismissal are considered by the college committee. Once a student has been Academically Dismissed, they are not allowed to re-enroll at Iowa State University until they have been Academically Reinstated. (See section on Reinstatement.) Academic Dismissal is placed on the student's academic record as a permanent notation. The

official transcript of a student who has been Academically Dismissed includes a "Not Permitted to Register" notation.

Summer Academic Standards Regulations

Students who are newly placed or continued on Academic Probation at the end of the previous semester may enroll for the summer term without being in jeopardy of Academic Dismissal from the university at the end of that summer term.

Summer Combined Term GPA:

All students who attend summer session will have their academic status reassessed at the end of the summer based on the combined (not averaged) grade summaries of their previous graded term of attendance and summer term. Academic status (warning or probation) after summer session will be based on the resulting combined term GPA. The academic status resulting from the summer combined term GPA supersedes the academic status at the end of the previous term.

For students who have remaining designated repeat credits, courses taken in the previous semester and repeated in summer will be calculated as designated repeats in the combined term GPA.

The combined term GPA (summer plus preceding term) will not appear on the student's grade report or permanent record.

Summer term GPA alone cannot determine academic status. Students who initiate enrollment at Iowa State during the summer will not be placed on Academic Warning or Academic Probation regardless of their academic performance.

Summer Cumulative GPA:

A student who was on Academic Probation at the beginning of summer term based only on cumulative GPA, who raises his or her cumulative GPA to over a 2.0 at the end of the summer term shall be removed from Academic Probation status at the end of the summer term.

A student with 75 or more credits attempted or earned, whichever is greater, will be placed on Academic Probation at the end of the summer term if his or her cumulative GPA is less than 2.00.

A student with 75 or more credits attempted or earned who has a transfer GPA less than 2.00 will be placed on Academic Probation at the end of any summer term if his or her combined transfer/ISU cumulative GPA is less than 2.00.

REGISTRATION

Registration/Enrollment

In order to register for classes students must first accept their offer of admission by the university. Registration and the payment of assessed fees are required of all who attend classes. Enrollment is not complete until fees are paid, including room and board fees for those living in residence halls.

Registration is a process by which students become officially enrolled in classes for a given term. The process involves consultation between the student and the student's academic advisor. All undergraduate students are assigned an academic advisor based on their program of study. A new advisor assignment is made when a student changes their program of study.

Students with disabilities who need assistance with any phase of registration should contact Student Accessibility Services.

Validating Enrollment

To validate their enrollment in each course at the beginning of the semester, students must attend the first or second meeting (first meeting if the class meets only once a week). Students who add a course after the term begins must attend the next class meeting. The instructor has the option to offer a registered place in the course to another student when a registered student fails to attend and has not obtained prior approval of the instructor. Students who do not validate their enrollment must drop or withdraw from the course or they will receive an F grade.

Enrollment Status

Enrollment status is defined for certification purposes as either full-time, three-quarter, half-time, or less than half-time.

Full-time status, fall or spring semester

Undergraduates: 12 credits

Graduates: 9 credits

Professional: 12 credits

Three-quarter status, fall or spring semester

Undergraduates: 9 credits

Graduates: 7 credits

Professional: 9 credits

Half-time status, fall or spring semester

Undergraduates: 6 credits

Graduates: 5 credits

Professional: 6 credits

Full-time status, summer semester

Undergraduates: Summer status depends on the number of weeks a student is enrolled.

Graduates: Summer status depends on the number of weeks a student is enrolled.

Professional: 8 credits

Always contact the Office of the Registrar to verify a student's status for a summer session. Additional enrollment status information is available on the Office of the Registrar webpage (<https://www.registrar.iastate.edu/students/verification-proof-of-enrollment/fulltimestatus/>).

Registration Responsibilities

The registration process includes advising, enrollment in courses, and schedule changes. In addition to the student, this process may involve the student's advisor; the student services staff of the student's college; and the dean of the college. Each is responsible for knowing and following the academic policies and procedures.

Student

- Knowing and adhering to university policies and procedures that apply to registration and schedule changes.
- Checking the accuracy of his/her current classes in Workday, including schedule adjustments (i.e., adds, drops, withdrawals, section changes).
- Knowing the degree requirements of his or her program of study.
- Planning course schedules to meet those requirements; and monitoring the accuracy of the academic progress report.

Advisor

- Consulting with advisees during the advising/registration period
- Providing information about student's program of study requirements
- Providing guidance in the student's course selection
- Assisting in monitoring the academic progress report for accuracy
- Notifying the college student services office with corrections to the academic progress report.

College Student Services Staff

- Assisting new and reentering students with the registration process
- Resolving unusual scheduling problems
- Updating the academic progress report or solving problems concerning the academic progress report.

Dean

- Making decisions with respect to requests for deviations from university policies, deadlines, etc.

Students and staff should check with the college office to find out who is authorized to grant approvals or exceptions on behalf of the dean.

Using AccessPlus Registration (Summer semester only)

Students enter the system via AccessPlus by using university ID and password. A registration access number (RAN) is also needed, if required by their college.

The registration system provides messages after each entry indicating whether each request has been processed. Students may review their current schedules at any time during registration. Students are held accountable for all changes made to their schedules.

Using Workday Student (beginning Fall 2024 semester)

Students enter the registration system via Workday. All eligible students will be assigned a registration appointment, which is the first date and time a student may register for the applicable term.

Students may review their current schedules at any time during registration. Students are held accountable for all changes made to their schedules.

Course Waitlist

A course waitlist is an electronic list of students who are waiting to register for class/section that is at capacity. Students may add themselves to a course/section waitlist while registering for courses for the upcoming academic period.

- Students are added to a course/section waitlist on a first come, first served basis provided they are eligible to take the course.
- If a seat becomes available in the course/section, the first student on the waitlist will be notified. The open seat will be available to that student for a 24-hour period, which includes weekends and holidays, should the student wish to register. An additional notification will be sent to the student six hours prior to the end of the 24-hour period if the student has not already taken action. After the 24-hour period, if the seat remains open, the next student on the waitlist will be notified. The previous student will be moved to the bottom of the waitlist, provided they have not removed themselves from the waitlist.
- A student can accept or decline the seat within the student information system. For official enrollment to take place via the waitlist, the notified student must first accept the seat, review their adjusted schedule, and then accept the offer. It is at the point of accepting the offer, the student is officially enrolled in the course.
- Students can place themselves on the waitlist for one or more desired sections of a course while being enrolled in a different section of the course. If they accept a seat in their desired section, they will automatically be withdrawn from their initially enrolled section.
- Students no longer interested in being added to the course after being placed on the waitlist should remove themselves from the waitlist to optimize the effectiveness of the waitlist system.

Nearly all courses/sections will have a course waitlist, with the exception of those courses that require approval at all times (e.g., 5990, 6990, etc.).

The opportunity for a student to join a waitlist, and accept or decline a seat, is available through Period 1 for the course. For full semester courses, Period 1 ends on the fifth business day of fall and spring semester.

Registration System Abuse

Using the registration system is a privilege, which may be revoked if abuse is detected. Abuse includes, but is not limited to, creating and using an automated program to search for course openings and/or enrolling in a section with the intent of reserving space in that particular section for another student. The Office of the Registrar, college office, and/or advisors have the right to determine abuse and revoke privileges for any type of registration system abuse.

Registration Process

To register for classes, students need the following:

- A registration appointment.
- Course section information.
- Other departmental information applicable to their curriculum, available from their advisor.

Students are expected to do the following in the advising and registration process:

1. Meet with their advisor in advance of their registration start date, who will provide the following:

- a. Academic Progress Report
- b. Guidance in course selection

2. Choose specific sections of each course. Students are responsible for choosing their course sections. In most cases advisors will not be involved in selecting meeting times.

3. Review their registration start date/time information and any registration holds.

4. Register for courses.

Schedule Changes

Summer 2024 semester: Students may make most schedule changes through the first five days of class using the AccessPlus (<https://accessplus.iastate.edu/frontdoor/login.jsp>) registration system. For courses with permission requirements and/or after the first week of classes, a Schedule Change form will be needed. The Schedule Change form can be found in AccessPlus, under the Student tab, within Registrar Forms located in the menu on the left column.

Beginning Fall 2024: Students will register and make schedule changes using Workday. Course adds will be completed using the task 'Find or Register for ISU Course Sections'. Up through the fifth day of the semester, students may drop or swap courses/sections directly from their Current Classes. Students may also modify credits or request grading basis changes utilizing Edit Registration options. For courses with restrictions, prerequisites, permission requirements and/or after the first week of classes, students may request registration approvals through available Workday tasks.

Procedures for schedule changes vary by the time period of the semester. The effective date of a schedule change is the date when the change is entered into the registration system.

Schedule change periods for full term courses are as follows:

Period 1 ends on the fifth day of classes in the fall and spring semesters.

Schedule changes during period 1 do not require advisor approval. Instructor or departmental approval may be required for adds or section changes for some courses during period 1. Course drops during this period will not appear on a student's permanent academic record.

Period 2 ends the Friday of week 10 in the fall and spring semesters. It is important for students to make well-informed decisions when adjusting their course schedules, particularly because such decisions often have financial and/or academic implications. To best support students' decision-making process, period 2 schedule changes should be made in collaboration with their advisor and instructor as appropriate and necessary.

For students who wish to add or change sections of a course, or adjust course credit hours, the approvals grant permission for a student to make the requested change.

The decision to drop a course rests with the student; as such, the advisor's signature is not one of permission, but rather to indicate a conversation about the implications of dropping has occurred. Course drops after period 1 appear on the permanent academic record. A section change does not require a drop.

Drops and other schedule changes that are judged to be beyond the student's control may be processed as administrative actions if approved by the college dean. Administrative drops do not appear on the permanent academic record. The effective date of an administrative action is the date it is approved by the college dean or authorized representative.

Period 3 is any time after period 2. Schedule changes during this period are permitted only for extenuating circumstances, may require a written statement of support from the instructor and the advisor, and

must be approved by the dean of the student's college or authorized representative.

Half-Semester and Partial Term Courses

Specific deadlines for adding and dropping half-semester courses are published in the university calendar. Prorated adjustments to add and drop deadlines are made for other partial term courses. To find out specific deadlines for partial term courses, contact the Registrar's Registration Office at isuregistration@iastate.edu or 515-294-2331.

R-Credit Courses (required courses)

Processing a scheduling change for a required course is usually considered administrative. Administrative drops do not appear on the permanent academic record. To make a Period 3 R-credit drop administrative requires approval of the college dean.

Dates and Deadlines

Dates for registration are published in the university calendar (<http://www.event.iastate.edu/>) (choose the Academic calendar link), and at www.registrar.iastate.edu/calendar/ (<http://www.registrar.iastate.edu/calendar/>).

Students are assigned a registration appointment, which is the first date and time they can use the registration system. Registration start dates are assigned based on projected year in school classification (computed by combining total credits, current term credits, and current term test out credits). Then specific start dates within projected year in school are established by using the sum of total credits and current term test out credits.

Students may choose to delay their registration until a later date; however, courses will begin to fill on the first day of registration. Any delay in registration may reduce course selection options. A list of start dates by classification is available at <http://www.registrar.iastate.edu/calendar/registration-start-dates> (<http://www.registrar.iastate.edu/calendar/registration-start-dates/>).

Continuing students register for the following term during the middle of the current term. For example, registration for spring term begins the middle of fall term; registration for summer session is completed during the previous spring at the same time as registration for fall semester.

A late registration fee is assessed for registration initiated on or after the first day of classes for fall and spring terms. This fee is not charged for the summer term. If registration is not initiated by the end of the fifth day of classes, students must obtain permission from the instructors for the courses they plan to take, their advisor, and in some cases, approval from the dean of the college in which they are registered.

Students may not enroll in courses with time conflicts without the approval of the instructors concerned.

Students who participate in off-campus experiences for which they receive Iowa State University credit must register for that credit during the term when the experience is taking place, whether or not they are taking courses on campus during that time.

Withdrawal of Admission to the University

New undergraduate students who wish to withdraw their admission to the university prior to the first day of classes must initiate their withdrawal by completing the Admissions Office's Application Change Form: https://www.admissions.iastate.edu/forms/change_application.php.

Cancellation/Withdrawal - Currently Enrolled Students

Students who decide not to attend classes before the date class work begins must cancel their registration (<http://www.registrar.iastate.edu/students/cancel-withdraw/>) to avoid tuition and fees assessment. Students who decide not to attend classes beginning the first day of class or later must institutionally withdraw or take a Leave of Absence from the university (<http://www.registrar.iastate.edu/students/withdrawal/>).

Course Information

Prerequisite. A prerequisite indicates the specific academic background or general academic maturity considered necessary by the faculty for the student to be ready for maximum success in the course. For more information, see Information About Courses (<http://catalog.iastate.edu/informationaboutcourses/>), Course Prerequisite.

Permission Required courses/sections. To register for these sections, students must obtain authorization.

Restricted courses/sections. Some courses or sections are restricted to students who meet specified criteria including curriculum/major, college, and/or year in school. In addition, some sections may be restricted to new students to ensure that sufficient spaces are available when new students register during summer orientation. A department may waive a restriction for a student who has extenuating circumstances. To request an override of the eligibility requirement, the student must obtain authorization from the department.

Classrooms are listed for each course in Workday, beginning approximately 3 weeks prior to the start of the term.

Cancelled courses/sections. In some cases, courses or sections may be cancelled due to low enrollment or departmental staffing considerations. Students who are registered for a cancelled course or section will be notified by the Office of the Registrar, the department, and/or on their schedule.

Textbook information. A link to textbook information, including the ISBN and retail price for assigned textbooks, is available from the ISU Bookstore. Textbook information for Iowa State University courses is posted as close to the start of registration as possible. Students may purchase textbooks from any source they choose.

Credit Limits

For fall and spring semesters, the credit limit is 18 credits for undergraduates and 15 credits for graduate students. For summer session, the limits are 12 credits for undergraduates and 10 credits for graduate students. A student may be required to drop credits before adding another course. In some cases, the college dean may approve a higher or lower credit limit for individual students. Students may request a Credit Limit Increase through their advisor. Advisors should notify the student's college student services office if the credit limit needs to be changed.

Registration Holds

Students with holds on their registration will not have access to register until the initiating offices have released the holds. Those who attempt to register before the holds have been released will be restricted from doing so. Students may check for holds within their Student profile.

Drop Limit

Undergraduate students are not limited in the number of courses they may drop during their academic career. Drops (course withdrawals) processed after the fifth day of classes of each semester will appear on the permanent record.

Auditing

To audit a course means to enroll in the course without receiving credit for the course. The instructor of the course approves the audit request.

Students are assessed tuition and fees as though they are taking the course for credit, but the audited course does not count in determining full-time student status. However, an audited course does count towards the maximum allowable credits per semester. Audited courses do not apply toward V.A. benefits.

Graduate students: See Graduate College, Registration for audit policies.

Changing status to audit: Changing a course from credit to audit requires a request to Edit Registration, Grading Basis. See Making Schedule Changes.

Rights and privileges: Once enrolled in an audited course, auditors have the same rights and privileges as any student taking the course for credit. Their names appear on the class list with a notation that they are auditing the course. Audited courses do not appear on the student's permanent record except by special request from the student. A request form can be downloaded from the Office of the Registrar website at

www.registrar.iastate.edu/forms (<http://www.registrar.iastate.edu/forms/>).

Audit Deadlines and Required Signatures

In addition to the deadlines provided below, note that instructors must approve all audits.

Full semester courses:

Adding an audit—day 10 deadline:

- Through day 5 of classes: instructor approval required.
- Day 6-10: instructor, advisor approval required.
- After day 10: only with extenuating circumstances, instructor, advisor, college approval required.

Changing status, from credit to audit—day 10 deadline:

- Through day 5 of classes: instructor approval required.
- Day 6-10: instructor, advisor, college approval required.
- After day 10: only with extenuating circumstances, instructor, advisor, college approval required.

Changing status from audit to credit—day 5 deadline:

- Through day 5 of classes: instructor approval required.
- After day 5: instructor, advisor, college approval required.

Partial semester or summer courses:

Deadlines are determined based on the length of the course. For deadlines concerning partial term or summer courses, contact the Registration Office, isuregistration@iastate.edu or 515-294-2331.

Reinstatement

The procedures delineated in this section apply to students who were dismissed from Iowa State for academic reasons. Students who left Iowa State in good academic standing and who are seeking reentry should see Index, Reentry for more information.

1. Reinstatement is not automatic. Students who have been dismissed for academic reasons should contact the dean's office in the college they wish to enter for instructions specific to that college. The college Academic Standards Committee reviews each petition and other relevant information, and reinstatement is based upon that review. As part of the petition process, students must submit a plan for academic success that identifies the causes of their poor academic performance and demonstrates that they have taken actions to avoid or eliminate these causes.
2. Students can only be reinstated after at least one academic semester (fall or spring) has elapsed since they were academically dismissed. Winter session and summer session are not considered semesters.
3. Students who have been dismissed from enrollment two or more times are not eligible for reinstatement until at least two academic semesters (fall and spring) have elapsed since their last academic

dismissal. Winter session and summer session are not considered semesters.

4. Students who were dismissed by one college and subsequently reinstated by another college cannot transfer back to the original college unless permission is granted by the Academic Standards Committee of the original college. This procedure applies regardless of the student's academic standing when the transfer is requested.
5. To be considered for reinstatement to the university, students must submit a petition to the Academic Standards Committee of the college in which they desire to enroll at least 45 days before the beginning of the semester. Students who have not been enrolled for a period of 2 years or more must also apply for reentry. For more information see the Reentry web site at <http://www.registrar.iastate.edu/info/reentry.html> (<http://www.registrar.iastate.edu/students/reentry/>). (Students dismissed for the second time and requesting reinstatement in the College of Liberal Arts and Sciences must submit their petition 70 days before the beginning of the semester.)
6. Juniors and seniors with extenuating circumstances may request a waiver of their required semesters of absence as identified in number 2 and 3 above. The petition requesting early reinstatement must be submitted through procedures specified by their college's Academic Standards Committee.
7. As a condition of reinstatement, students will reenter on academic probation and must accept whatever additional requirements are stipulated by the college Academic Standards Committee. Examples include full- or part-time status, specified credit hours, specific courses, specific GPAs, restriction on choice of major, and required counseling.

Student Appeal

Students may appeal a decision regarding their academic status if they believe that new information can be provided, or extenuating circumstances exist that would alter the application of any rule in this section. The appeal should be made in writing to the Academic Standards Committee of the college in which the student is enrolled. The written appeal must include the reasons for the appeal and the evidence to substantiate these reasons.

The student should initiate the appeal process by contacting the secretary of the college Academic Standards Committee in the administrative office of her or his college immediately upon receipt of notification of the committee's action, and at least ten calendar days before the beginning of the semester. The secretary will then inform the student of the deadline for submission of the written appeal.

If the student is dissatisfied with the committee's action, he or she may submit an appeal in writing to the dean of her or his college within seven calendar days after they are notified of the committee's action. The dean

must respond in writing within seven calendar days of receipt of the appeal.

If the issue is not resolved within the college, further appeals may be made in writing to the provost and subsequently to the president of the university. Appeals beyond the college level will, however, be considered only if based on one or both of the following contentions: (a) appropriate procedures were not followed at the college level; (b) academic rules were not applied correctly at the college level.

Academic Renewal

Students who are returning to Iowa State University to pursue an undergraduate degree after an extended absence may request permission to remove one or more of their complete academic terms from future degree and GPA considerations.

1. Eligibility. To be eligible for academic renewal consideration, students must meet these requirements:
 - a. Students must not have enrolled at Iowa State University for four or more consecutive calendar years.
 - b. Students must not have graduated from Iowa State University.
 - c. Students must have demonstrated satisfactory academic performance as evidenced by earning a GPA of at least 2.00 over a minimum of 12.00 credit hours taken after returning to the university. If more than one semester is taken to reach 12.00 credit hours, the combined GPA of all semesters/terms of enrollment after returning to the university must be 2.00 or greater.
2. Conditions. Academic renewal is based on the following conditions:
 - a. All courses and credits that were taken during the chosen terms will be removed from consideration for GPA and degree requirements. Students may not combine courses from multiple terms to comprise the semester(s) or quarter(s) dropped. Degree requirements met during the dropped terms will ordinarily have to be repeated.
 - b. Renewal may be applied only to academic terms completed prior to the students' extended absence.
 - c. All courses and grades for the chosen terms will remain on the students' academic record.
 - d. Designated repeats and P/NP options will be reinstated for the terms dropped.
 - e. Students may be granted only one academic renewal.
3. Procedures.
 - a. Students should discuss their desire to pursue academic renewal with an advisor in the college they wish to enter.
 - b. The student must submit a request for Academic Renewal in Workday.

- c. After the request is initiated by the student it will route for approval to the academic advisor and college student services offices and then to the Records area in the Office of the Registrar, 010 Enrollment Services Center.

RETURN / REENTRY TO THE UNIVERSITY

Returning Students

Students planning to return to Iowa State University after an absence of less than 24 months do not complete reentry, and should be assigned registration appointments along with continuing students, unless previous programs of study have been completed or discontinued.

Students who were dropped from enrollment at Iowa State University must obtain reinstatement by the Academic Standards Committee of the college that they wish to reenter. (See Reinstatement/Renewal for policies that apply to requests for reinstatement).

Undergraduate and Graduate students may contact the Office of the Registrar at isuregistration@iastate.edu (%20isuregistration@iastate.edu) or 515-294-2331 with any questions about updating their status and generating registration access. Students should contact their advisor/major professor to select courses and begin the registration process.

International undergraduate and international non-degree undergraduate students planning to return to Iowa State University after an absence of a semester or more must also complete the Returning to ISU electronic form for the International Students and Scholars Office in order to receive their new I-20 or DS-2019. The form can be found under the F-1 or J-1 Student Services tab in Cystart at <https://cystart.its.iastate.edu> (<https://cystart.its.iastate.edu/>). If you have questions or concerns in regard to your documents, please contact the International Students and Scholars Office at 515-294-1120 or isso@iastate.edu.

Reentry Students

Students who have been absent from Iowa State University for more than 24 months since last enrolled must apply for reentry to the university through the Admissions Office.

Students with a bachelor's degree who plan to take supporting graduate level coursework prior to applying for graduate degree admission should request a nondegree graduate admission application.

Students who have previously attended Iowa State University only as nondegree (special) students and who now seek to earn an undergraduate degree should request an undergraduate admission application.

International Students must also complete the Returning to ISU electronic form for the International Students and Scholars Office in order

to receive their new I-20 or DS-2019. The form can be found under the F-1 or J-1 Student Services tab in Cystart at <https://cystart.its.iastate.edu> (<https://cystart.its.iastate.edu/>). If you have questions or concerns in regard to your documents, please contact the International Students and Scholars Office at 515-294-1120 or isso@iastate.edu.

The reentry application should be completed well in advance of the term of reentry. Students who have attended another college or university since enrollment at Iowa State University must have an official transcript(s) of all course work attempted sent to the Office of Admissions, 100 Enrollment Services Center.

Iowa State University requests the information on the reentry application for the purpose of making a reentry decision. The university reserves the right not to approve reentry if the student fails to provide the required information.

Reentering Graduate students that have not been enrolled in the last 24 months or are looking to come back in a different program than previously enrolled, please go to the Returning Graduate Students (<https://www.grad-college.iastate.edu/common/forms/inactive-to-active/>) website and follow the instructions for your specific situation. Please contact the Graduate College at 515-294-4531 if you have questions on returning to the Graduate College.

Reentry Approval Process

The reentry application will be referred to the college for review and decision if the student: (a) desires to change curriculum; (b) has a previous Iowa State University cumulative grade point average below 2.00; (c) was dropped from the university for unsatisfactory academic progress or was not otherwise in good standing; or (d) since leaving Iowa State University, has completed additional college study with less than a 2.00 grade point average.

Reentering students must also contact their departmental office/advisor to prepare a class schedule. Reentry must be approved prior to registration.

Information About Courses

Find the full listing of courses at A-Z Courses

Course Numbers

The courses in each department are numbered from 0001-7999, according to the following groups:

- 0001-0999 Courses not carrying credit toward a degree (zero credit).
- 1000-2999 Courses primarily for freshman and sophomore students.
- 3000-4999 Courses primarily for junior and senior students.
- 5000-5999 Courses primarily for graduate students, but open to qualified undergraduates.

- 6000-6999 Courses for graduate students.
- 7000-7999 Professional courses

Off-campus courses-Residential Credit

Iowa State University faculty teach distance learning courses online by video conferencing and streaming media. Courses are the same as those offered on campus, carry residential credit, and are taught by Iowa State faculty. Credit earned becomes a part of the academic record at Iowa State University and may be used to meet degree requirements the same as credit earned on campus.

Priority Enrollment

High demand for courses in certain areas has necessitated enrollment management for some courses. When enrollment priority is established for a course, first consideration is given to students whose curriculum/major explicitly requires the course.

Course Fees

Courses for which course fees are assessed are designated in the Schedule of Classes. Course fees may be assessed for such extraordinary costs as materials fees (which may include consumable materials or equipment replacement), field trip expenses, developmental course fees, and camp fees. In some cases, course fee amounts vary from term to term. Additional information on camp fees and developmental course fees may be found in the fees webpage at <https://www.registrar.iastate.edu/fees/othfee> (<https://www.registrar.iastate.edu/fees/othfee/>).

Independent Study

Most departments offer opportunities for independent study through a 4900 course listing. Usually a minimum of 6 to 10 credits of coursework in the department is required before independent study is permitted. Students who are interested in this kind of experience in a particular department should check the catalog to determine the department's prerequisites to register for 4900. 4900H sections are reserved for students in the University Honors Program.

Students should check with the department about procedures, in addition to meeting the prerequisites, for registering for 4900. A written plan of study is prepared in advance with a faculty member who has agreed to supervise the student's work, to evaluate progress and the final product, and to assign a grade. Initiation of the plan of study should occur prior to the semester in which enrollment is desired. Both the student and the instructor should agree on the number of credits for which the student will enroll, the amount and kind of work the student do for that credit, and the system by which the student will be graded (A-F or S/F). Students should not expect to register for or add 4900 credit without an instructor's permission. Some colleges and/or departments have limits on the number of credits of 4900 that may be applied toward graduation.

Credits and Contact Hours

The academic value of each course is stated in semester credits. Each credit is normally earned by attending one (50-minute) hour of lecture per week for the entire 16-week semester, or by attending a laboratory or studio period of two or three hours per week. As a guideline, undergraduate students typically will be expected to spend two hours in preparation outside of class for each lecture hour; additional outside work may be required for laboratory or studio classes. The Office of the Registrar will maintain a table of faculty-approved credit-contact hour equivalencies for the types of instruction (e.g. lecture, studio, internships, research courses) offered by the institution: <https://www.registrar.iastate.edu/faculty-staff/offeringinfo/define> (<https://www.registrar.iastate.edu/faculty-staff/offeringinfo/define/>).

Courses offered for less than a full semester (e.g. summer terms or compressed formats) will fulfill the same contact hour requirements as full-semester courses having the same credit hours. For example, a student enrolled in a one-credit course offered in an 8-week (half-semester) format should expect two hours of lecture and four hours of out of class preparation per week. Similarly, a course offered in hybrid or online format is expected to meet the same contact hour requirement, and offer equivalent student-faculty/student-student interaction and class preparation time, as the same course taught in a traditional format.

Each course states the number of semester credits assigned to the course, preceded in parentheses by the number of hours in class (contact hours) expected of the student. The first of the two contact-hour numbers indicates the number of lecture class hours per week for the semester.

The second is the number of laboratory or studio hours required per week. Laboratory and studio hours may include some time devoted to lectures. For example, COMS 2270 Object-oriented Programming is listed as (3-2) Cr. 4. In that case, the course is 4 semester credits, 3 hours of lecture and two hours of laboratory each week.

The term “Cr. arr.” means that the amount of credit is arranged in advance between the student and the instructor. The credit to be earned depends on the amount of work expected of the student, in accordance with the policy that some combination of teacher-student contact and outside work by the student involving at least three hours per week for the semester is required for each credit.

The term “Cr. R.” means that the course is required in a certain curriculum or as cognate to one or more other courses. It is also used for cooperative education courses and for some optional inspection trips, study tours, and professional development courses for which numerical credit is not granted. An R credit course does not carry numerical credit toward a student’s degree, but it does apply toward the degree. The R credit course is generally listed on the degree program as a requirement for a specific curriculum/major that must be completed prior to graduation. R credit courses may be graded using the A-F grading

scale or the satisfactory/fail grading scale. All R credit courses are assigned a numerical value for purposes of enrollment certification. Requests by students to drop an R credit course will be processed as an administrative drop during period 2 and will not appear on the student’s transcript. (See Schedule Changes.)

Credit Involving a Paid Activity

Students may obtain credit for an activity, either on- or off-campus, for which they are also paid, provided the activity is academically relevant. This policy does not apply to registrations for R credit.

In order for an activity to be defined as academically relevant, prior arrangements for receiving credit must be made with a faculty member in an appropriate department.

The arrangements must include agreement on (1) the academic objectives which the activity is expected to achieve, and (2) the procedure by which the student’s learning will be assessed.

Semester of Offering

Within each course description may be found one or more of the following letters: F. S. SS., indicating which term—fall, spring, summer session—of the academic year the course is offered. “Alt.” is the abbreviation for alternate. If there is sufficient demand, courses may be offered more frequently than announced. Insufficient demand or unforeseen staffing problems may result in the cancellation of announced offerings. Students are advised to refer to the Schedule of Classes or consult with departments for up-to-date course schedule information.

Course Prerequisite

A prerequisite indicates the specific academic background or general academic preparedness considered necessary for the student to be ready to undertake the course. Prerequisites are usually stated in terms of specific courses, but equivalent preparation is usually acceptable. An instructor may, however, direct a student whose background does not meet the stated prerequisite, or its equivalent, to drop the course. Conversely, an instructor may waive the prerequisite (or approval may be given following the appropriate departmental process) for a course for which they are responsible. Thus, permission of the instructor (or departmental process) is understood to be an alternate to the stated prerequisites.

It is university policy that the department or instructor informs enrolled students who have not met the prerequisite requirements that they must drop the course. Instructors have the right to neither accept, nor grade the work of a student who does not meet the stated prerequisite, or its equivalent (as determined by the process established in the department offering the course). Notification should be done as soon as possible and

prior to the first day of class whenever possible. For students enrolled after the first day of class, notification must be given as soon as possible.

Some courses have been approved by their colleges to use administrative drops to enforce prerequisites. In such cases, the department shall inform the enrolled students who have not met the prerequisite requirements that they must drop the course or provide evidence of equivalent preparation to be reviewed by the department. Notification should be done prior to the first day of class for students enrolled prior to the first day of class. For students enrolled after the first day of class, notification must be given as soon as possible. After such notification (via email or Canvas announcement), the student must drop the course within 3 business days, or initiate a review of their equivalent preparation. This timeframe should be indicated to the student during the notification process. If a student does not drop the course or have a successful review of an equivalent, the department or instructor may contact their college student services office to initiate an administrative drop to remove the student from the course. Additionally, students whose request to waive the prerequisite is denied, will be administratively dropped from the course. Administrative drops will be completed by the 10th day of the semester in most cases. Course prerequisites are listed in the Schedule of Classes as well as in the Courses and Programs section of this publication.

Cross-listed Courses

A course, including its complete description, may be listed in two or more departments. The participating department or departments are noted in parentheses. Credit for the course may be obtained through any of the cross-listed departments.

Dual-listed Courses

Dual-listed courses permit undergraduate and graduate students to be in the same class while receiving credit for either undergraduate or graduate level work.

Credit in the graduate course is not available to students who have received credit in the corresponding undergraduate course. Both graduates and undergraduates receive the same amount of credit for the course, but additional work is required of all graduate students taking the course under the graduate-level course number. This extra work may take the form of additional reading, projects, examinations, or other assignments as determined by the instructor. The instructor must be a member of the Graduate Faculty or a Graduate Lecturer. Each dual-listed course is designated in the catalog with the phrase "Dual-listed with," although the student's official transcript of credits, both graduate and undergraduate, does not identify dual-listed courses as such. There is a limit to the number of dual-listed course credits that may be used to meet the requirement for an advanced degree. (For information about

procedures for requesting permission to offer dual-listed courses, faculty should consult the Graduate Faculty Handbook.)

Entry Level Courses

Resources for Course Information

<http://catalog.iastate.edu/azcourses/>

<http://classes.iastate.edu>

Experimental course listings: courses not published in the catalog. (<https://www.registrar.iastate.edu/faculty-staff/courses/explisting/>)

The following courses are suitable for first year students. Course numbers that begin with 0 (e.g., CHEM 050) may incur an additional "developmental course" fee. See the Tuition and Fees web site for more information about other fees (<http://www.registrar.iastate.edu/fees/othfee/>).

ABE 1600: Systematic Problem Solving and Computer Programming

Credits: 3.

Prereq: Credit or enrollment in MATH 1430 or MATH 1650

Systematic problem-solving using principles of dynamics, statics, mass/energy conservation, and algorithmic thinking. Use of spreadsheet programs and computer programming language(s) to solve engineering problems. Graduation Restriction: Only one of ENGR 1600, ABE 1600, AERE 1600, CE 1600, CHE 1600, CPRE 1850, EE 1850, IE 1480, ME 1600, and SE 1850 may count towards graduation. (Typically Offered: Fall, Spring)

ABE 1700: Engineering Graphics and Introductory Design

Credits: 3.

Applications of multi-view drawings and dimensioning. Techniques for visualizing, analyzing, and communicating 3-D geometries. Application of the design process including written and oral reports.

ADVRT 2300: Advertising Principles

Credits: 3. Contact Hours: Lecture 3.

Historical, social, economic and legal aspects of advertising. Evaluations of advertising research, media, strategy and appeals. Study of the creation of advertising.

AERE 1600: Aerospace Engineering Problems With Computer Applications Laboratory

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Credit or enrollment in MATH 1650 or satisfactory (76+) score on mathematics placement exam

Introduction to aerospace engineering and systems thinking through engineering design team projects such as flight control of Lighter Than Air (LTA) vehicles. Introduction to programming using python. Solving aerospace engineering problems while learning about significant figures, estimation, units of measure, graphing, curve fitting, and presenting solutions through technical reports. Brief history of aerospace engineering. Satisfactory placement scores can be found at: <https://math.iastate.edu/academics/undergraduate/aleks/placement/>. Graduation Restriction: Only one of ENGR 1600, ABE 1600, AERE 1600, BME 1600, CE 1600, CHE 1600, CPRE 1850, EE 1850, IE 1480, ME 1600, and SE 1850 may count towards graduation. (Typically Offered: Fall, Spring)

AFAM 2010: Introduction to African American Studies

Credits: 3. Contact Hours: Lecture 3.

An interdisciplinary introduction to the study of African American culture. Includes history, the social sciences, literature, religion, and the arts, as well as conceptual frameworks for investigation and analysis of the African American experience. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall, Spring)

AFAS 1410: Foundations of the United States Air Force

Credits: 1. Contact Hours: Lecture 1.

Explore the core values of the Department of the Air Force through hands-on activities designed to foster personal growth. This course develops practical skills in followership, accountability, initiative, resilience, and problem-solving. Students will cultivate essential leadership traits and a growth mindset, preparing them to excel in both military and professional environments. (Typically Offered: Fall)

AGRON 1200: Introduction to Renewable Resources

(Cross-listed with NREM 1200/ ENVS 1200).

Credits: 3. Contact Hours: Lecture 3.

Overview of soil, water, plants, and animals as renewable natural resources in an ecosystem context. History and organization of resource management. Concepts of integrated resource management. (Typically Offered: Fall, Spring)

AGRON 1800: Global Agriculture in a Changing World

Credits: 3. Contact Hours: Lecture 3.

A scientific investigation of the global distribution of climate, soils and agricultural production and consumption. Physical processes that connect natural resources to agriculture and the environment. How global change drives increasing demand for agricultural production. Meets International Perspectives Requirement. (Typically Offered: Fall)

AGRON 2060: Introduction to Weather and Climate

(Cross-listed with MTEOR 2060).

Credits: 3. Contact Hours: Lecture 3.

Basic concepts in weather and climate, including atmospheric measurements, radiation, stability, precipitation, winds, fronts, forecasting, and severe weather. Applied topics include global warming, ozone depletion, world climates and weather safety. (Typically Offered: Fall, Spring)

AMIN 2010: Native People in American Culture

Credits: 3. Contact Hours: Lecture 3.

Perceptions and realities of Native people living in and responding to American society and culture. Topics include representations, contemporary Native identity, literature, the arts, history, film, and issues of diversity. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall, Spring, Summer)

AMIN 2100: Introduction to American Indian Studies

Credits: 3. Contact Hours: Lecture 3.

Introduction to the multidisciplinary aspects of American Indian Studies. Topics include the relevant events and ideas defining the contemporary American Indian experience, on and off reservation, in the United States. Sovereignty, identity, jurisdiction, taxes, economic development, education, and other issues are addressed. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall, Spring, Summer)

ANS 1010: Working with Animals

Credits: 2. Contact Hours: Lecture 1, Laboratory 2.

An introductory course in skills for proper care, handling, and management of domestic animals. Terminology and skills in working with animals, identification, life-cycle management practices, and animal health management are introduced and examined. (Typically Offered: Fall, Spring)

ANS 1140: Survey of the Animal Industry

Credits: 2. Contact Hours: Lecture 2.

Principles of management and care of domestic animals, including genetics, nutrition, and reproduction. Service of domestic animals to society in terms of food, shelter, protection, fuel and emotional well-being. Basic biology, industry structure, management practices and production systems. (Typically Offered: Fall, Spring)

ANTHR 2010: Introduction to Cultural Anthropology

Credits: 3. Contact Hours: Discussion 1, Lecture 2.

Introduction to the core concepts, theories, and methods of cultural anthropology with an emphasis on understanding human cultural diversity in global society from an anthropological perspective. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

ANTHR 2020: Human Origins

Credits: 3. Contact Hours: Discussion 1, Lecture 2.

Human biological and cultural evolution; survey of the evidence from fossil primates, the human fossil record and the archaeological record, as well as living primates; introduction to research methods in archaeology and biological anthropology. (Typically Offered: Fall, Spring)

ANTHR 2300: Globalization and the Human Condition

Credits: 3. Contact Hours: Lecture 3.

An introduction to understanding key global issues in the contemporary world. Focuses on social relations, cultural practices and political-economic linkages among Africa, the Americas, Asia, Europe and the Pacific. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

ARCH 2210: Histories and Theories of Architecture to 1750

Credits: 3. Contact Hours: Lecture 3.

Survey of architectural ideas, theories, and practices before 1750. Emphasis on the mutually formative relationship between architecture and the social, cultural, economic, and political forces, nationally and globally, in which it is produced. (Typically Offered: Fall)

ARTH 2800: History of Art I

Credits: 3. Contact Hours: Lecture 3.

Development of the visual arts including painting, sculpture, architecture, and crafts, from the prehistoric through Gothic periods. Meets International Perspectives Requirement. (Typically Offered: Fall)

ARTH 2920: Introduction to Visual Culture Studies

Credits: 3. Contact Hours: Lecture 2, Discussion 1.

An introduction to various topics in visual culture studies, including significant trends in the visual arts, mass media, scientific imagery, visual communications, and other areas related to visual literacy and visual representation in local and global contexts. Cross cultural viewpoints and issues of diversity will be presented in relation to visual culture.

ASTRO 1030: Evening Star

Credits: 1. Contact Hours: Lecture 1.

An entirely web-based course covering topics in celestial mechanics ("Rocket science!") for students with little or no previous experience. It combines the geography of the solar system with discussion of methods of traveling to the other planets. The course "lectures" are on-line, interactive units with built-in exercises, hands-on (offline) activities, and layers of help. Graded homework and quizzes are administered via Canvas. Graduation Restriction: Students who take ASTRO 1200 may count credit in only one of ASTRO 1020 or 1030 toward graduation. (Typically Offered: Fall, Spring, Summer)

ASTRO 1200: The Sky and the Solar System

Credits: 3. Contact Hours: Lecture 2, Discussion 1.

For the nonscientist. A survey of our view of the universe, and the exploration of the solar system and beyond. The sky: constellations; motions of the Sun, Moon, and planets; seasons and the calendar; eclipses. The solar system: origin and evolution; characteristics of the Sun, planets, satellites, comets, meteorites, and asteroids. The detection and characterization of other solar systems, and the search for life in the universe. Extensive use of the planetarium is included. (Typically Offered: Fall, Spring, Summer)

ASTRO 1500: Stars, Galaxies, and Cosmology

Credits: 3.

For the nonscientist. A survey of astronomy with a focus on the universe beyond our solar system. Basic observational astronomy and the history of astronomy. Stellar astronomy: motions, distances, sizes, spectra; types of stars; variability; binary systems. Stellar evolution: the birth, life, and death of stars, including supernovae, neutron stars, and black holes. The structure and evolution of the Milky Way Galaxy. Other galaxies, clusters of galaxies, quasars. Theories of the origin of the universe. (Typically Offered: Fall, Spring)

BBMB 1010: Introduction to Biochemistry

Credits: 2. Contact Hours: Lecture 2.

Foundational principles of the molecules and chemistry of life, including structure and function of biological molecules: protein, lipids, nucleic acids, and carbohydrates. Survey of modern biotechnology frontiers. (Typically Offered: Fall)

BIOL 1010: Introductory Biology

Credits: 3. Contact Hours: Lecture 3.

Life considered at cellular, organism, and population levels. Function and diversity of the living world. Presentation of basic biological principles as well as topics and issues of current human interest. Graduation Restriction: BIOL 1010 does not satisfy biology major requirements. (Typically Offered: Fall, Spring, Summer)

BIOL 1550: Human Biology

Credits: 3. Contact Hours: Lecture 3.

A survey course of human biology, including principal structures and functions of the body systems and the diseases and disorders associated with them. Designed to meet general education requirements in natural science. Not recommended for those seeking a career in the allied health professions or for students majoring in life science. Does not satisfy biology major requirements. (Typically Offered: Fall, Spring)

BIOL 1730: Environmental Biology

(Cross-listed with ENVS 1730).

Credits: 3. Contact Hours: Lecture 3.

An introduction to the structure and function of natural systems at scales from the individual to the biosphere and the complex interactions between humans and their environment. Discussions of human population growth, biodiversity, sustainability, resource use, and pollution. Does not satisfy biology major requirements. (Typically Offered: Fall, Spring)

BIOL 2110: Principles of Biology I

Credits: 3. Contact Hours: Lecture 3.

Introduction to the nature of life, including the diversity of microbial, plant, and animal life; the nature of heredity; evolution; and principles of ecology. Intended for life science majors. (Typically Offered: Fall, Spring)

BIOL 2110L: Principles of Biology Laboratory I

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Credit or enrollment in BIOL 2110

Laboratory to accompany 2110. (Typically Offered: Fall, Spring)

BIOL 2120: Principles of Biology II

Credits: 3. Contact Hours: Lecture 3.

Introduction to the chemical, molecular, and cellular basis of life; form and function of microbial, plant, and animal life. Intended for life science majors. HS courses in biology and chemistry necessary. Credit or enrollment in CHEM 1630 or CHEM 1770 recommended. (Typically Offered: Fall, Spring)

BIOL 2120L: Principles of Biology Laboratory II

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Credit or enrollment in BIOL 2120

Laboratory to accompany 2120. (Typically Offered: Fall, Spring)

BIOL 2550: Fundamentals of Human Anatomy

Credits: 3. Contact Hours: Lecture 3.

An introduction to human anatomy, beginning with cells and tissues, surveying all body systems, relating form to function. Systems covered include: integumentary, bones and joints, muscles, nervous, sensory, endocrine, circulatory, lymphatic, respiratory, digestive, urinary, and reproductive. Pre-Medical students should consider BIOL 3510 for their anatomy background. Does not satisfy biology major requirements. HS courses in biology and chemistry necessary. Credit or enrollment in BIOL 1010 recommended. (Typically Offered: Fall)

BIOL 2550L: Fundamentals of Human Anatomy Laboratory

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Credit or enrollment in BIOL 2550

Investigation of human anatomy using models and dissections of preserved organs and model mammals. Pre-Medical students should consider 3510 for their anatomy background. Does not satisfy biology major requirements. (Typically Offered: Fall)

BUSAD 1020: Business Learning Team Orientation

Credits: 1. Contact Hours: Lecture 1.

A required orientation for all College of Business Students involved with a Business Learning Team. Review of college and university requirements, transfer credits, academic planning, university policies and deadlines and registration procedures. Includes a consideration of various business majors and careers, tools for success in college including writing skills and presentations from employers, alumni and current students. (Typically Offered: Fall, Spring)

BUSAD 1030: Orientation

Credits: 1. Contact Hours: Lecture 1.

A required orientation for all College of Business students. Review of college and university requirements, transfer credits, academic planning, university policies and deadlines, and registration procedures. Includes group advising for course selection and registration. (Typically Offered: Fall, Spring)

CE 1600: Engineering Problems with Computational Laboratory

Credits: 3. Contact Hours: Laboratory 2, Lecture 2.

Prereq: Credit or Enrollment in MATH 1650

Engineering approach to solving problems and presenting results with applications to examples in civil, construction, and environmental engineering, such as problems in statics. Dimensions and units. Data processing, graphing, and curve fitting. Formulating and solving fundamental and practical engineering problems with spreadsheets and a structured programming language. Graduation Restriction: Only one of ENGR 1600, ABE 1600, AERE 1600, CE 1600, CHE 1600, CPRE 1850, EE 1850, IE 1480, ME 1600, and SE 1850 may count towards graduation. (Typically Offered: Fall, Spring)

CE 1700: Graphics for Civil Engineering

Credits: 2. Contact Hours: Laboratory 4.

Prereq: Credit or concurrent enrollment in MATH 1430 or MATH 1450 (or satisfactory scores on mathematics placement assessments)

Integration of fundamental graphics, computer modeling, and engineering design. Applications of multi-view drawings and dimensioning. Techniques for visualizing, analyzing, and communicating 3-D geometries. Application of the design process. Freehand and computer methods. Satisfactory placement scores can be found at: <https://math.iastate.edu/academics/undergraduate/aleks/placement/>. (Typically Offered: Fall, Spring)

CRP 2010: The North American Metropolis

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Examination of the evolution of American urban centers from the colonial era to the present. Considers the demographic changes and social movements underway in urban America and explores how an understanding of the history of cities provides us with knowledge that we can use to improve our cities today. (Typically Offered: Fall, Spring)

CRP 2510: Fundamentals of Geographic Information Systems

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Fundamentals of the concepts, models, functions and operations of Geographic Information Systems (GIS). Principles of spatial problems, spatial questions and hypotheses and their solutions based on spatial data, GIS tools and techniques. Integration of concepts and applications through lectures and facilitated labs. Applications from a variety of areas including design; physical, social, and human science; engineering; agriculture; business and medicine, landscape architecture, architecture, urban planning, geology, forestry, biology, and ecology. (Typically Offered: Fall)

CHE 1600: Chemical Engineering Problems with Computer Applications Laboratory

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: (MATH 1430 or satisfactory scores on mathematics placement examinations) AND (MATH 1650 or satisfactory scores on mathematics placement examinations)

Formulation and solution of engineering problems. Significant figures. Use of SI units. Graphing and curve-fitting. Flowcharting. Introduction to material balances, engineering economics, and design. Use of spreadsheet programs to solve and present engineering problems. Solution of engineering problems using computer programming languages. Chemical Engineering examples. Satisfactory placement scores can be found at: <https://math.iastate.edu/academics/undergraduate/aleks/placement/>. Graduation Restriction: Only one of ENGR 1600, ABE 1600, AERE 1600, CHE 1600, CE 1600, CPRE 1850, EE 1850, IE 1480, ME 1600, and SE 1850 may count towards graduation. (Typically Offered: Fall, Spring)

CHEM 1600: Chemistry in Modern Society

Credits: 3. Contact Hours: Lecture 3.

Aspects of chemistry visible to a non-scientist in our society. A survey of selected areas of chemistry with emphasis on the interface between chemistry and other fields of human activity. (Typically Offered: Fall, Spring)

CHEM 1630: College Chemistry

Credits: 4. Contact Hours: Lecture 3, Discussion 1.

Prereq: Credit or concurrent enrollment in CHEM 1630L

A general survey of chemistry with an emphasis on conceptual problems for those who are not physical and biological science or engineering majors. Nomenclature, chemical reactions, stoichiometry, atomic structure, periodic properties, chemical bonding, states of matter, solutions, thermochemistry, acid-base theory, oxidation-reduction reactions, basic chemical kinetics, and chemical equilibrium. 1 year of high school algebra and geometry and CHEM 0500 or 1 year of high school chemistry necessary. Graduation Restriction: Only one of CHEM 1630, 1670, 1770, or 2010 may count toward graduation. (Typically Offered: Fall, Spring, Summer)

CHEM 1630L: Laboratory in College Chemistry

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Credit or enrollment for credit in CHEM 1630

Laboratory to accompany CHEM 1630. Must be taken with CHEM 1630. Graduation Restriction: Only one of CHEM 1630L, 1670L, and 1770L may count toward graduation. (Typically Offered: Fall, Spring, Summer)

CHEM 1670: General Chemistry for Engineering Students

Credits: 4. Contact Hours: Lecture 3, Discussion 1.

Principles of chemistry and properties of matter explained in terms of modern chemical theory with emphasis on topics of general interest to the engineer. MATH 1400 or 2 years of high school algebra and 1 year of high school geometry and CHEM 0500 or 1 year of high school chemistry necessary. Graduation Restriction: Only one of CHEM 1630, 1670, 1770, or 2010 may count toward graduation. (Typically Offered: Fall, Spring)

CHEM 1770: General Chemistry I

Credits: 4. Contact Hours: Lecture 3, Discussion 1.

Prereq: Credit or enrollment in CHEM 1770L

The first semester of a two-semester sequence which explores chemistry at a greater depth and with more emphasis on concepts, problems, and calculations than 1630. Recommended for physical and biological science majors, chemical engineering majors, and all others intending to take 3000-level chemistry courses. Principles and quantitative relationships, stoichiometry, chemical equilibrium, acid-base chemistry, thermochemistry, rates and mechanism of reactions, changes of state, solution behavior, atomic structure, periodic relationships, chemical bonding. Chemistry and Biochemistry majors may consider taking CHEM 2010. MATH 1400 or 2 years of high school algebra and 1 year of high school geometry and CHEM 0500 or 1 year of high school chemistry necessary. Graduation Restriction: Only one of CHEM 1630, 1670, 1770, or 2010 may count toward graduation. (Typically Offered: Fall, Spring, Summer)

CHEM 1770L: Laboratory in General Chemistry I

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Credit or concurrent enrollment in CHEM 1770

Laboratory to accompany 1770. 1770L must be taken with 1770.

Graduation Restriction: Only one of CHEM 1630L, 1670L, and 1770L may count toward graduation. (Typically Offered: Fall, Spring, Summer)

CHEM 1770N: Laboratory in General Chemistry I

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Credit or concurrent enrollment in CHEM 1770

Laboratory to accompany CHEM 1770. CHEM 1770N must be taken with CHEM 1770. For Chemistry and Biochemistry majors. Laboratory to accompany CHEM 1770. CHEM 1770N must be taken with CHEM 1770. Graduation Restriction: Only one of CHEM 1630, 1670, 1770, or 2010 may count toward graduation. (Typically Offered: Fall)

CHEM 1780: General Chemistry II

Credits: 3. Contact Hours: Lecture 2, Discussion 1.

Prereq: CHEM 1630 or CHEM 1670 or (CHEM 1770; CHEM 1770L)

Continuation of 1770. Recommended for physical or biological science majors, chemical engineering majors, and all others intending to take 3000-level chemistry courses. (Typically Offered: Fall, Spring, Summer)

CHEM 1780L: Laboratory in College Chemistry II

Credits: 1. Contact Hours: Laboratory 3.

Prereq: CHEM 1770L and (Credit or concurrent enrollment in CHEM 1780)

Laboratory to accompany 1780. 1780L is not a necessary co-requisite with 1780. (Typically Offered: Fall, Spring, Summer)

CHEM 2010: Advanced General Chemistry

Credits: 5. Contact Hours: Lecture 4, Discussion 1.

Prereq: Credit or concurrent enrollment in MATH 1650 or MATH 1660 or MATH 2650; concurrent enrollment in CHEM 2010L

A one-semester course in general chemistry designed to give students an in-depth, broad-based view of modern chemistry, and, in part, to facilitate participation in independent undergraduate research. Topics include stoichiometry, atomic and molecular structure, chemical bonding, kinetics, chemical equilibria, and thermodynamics. Discussion of current trends in various chemical disciplines, which may be given by guest experts in chemistry, biochemistry, and chemical engineering, will help the student appreciate the scope of the chemical sciences and how research is carried out. One year HS chemistry and one year HS physics, or advanced chemistry necessary. Graduation Restriction: Only one of CHEM 1630L, 1670L, and 1770L may count toward graduation. (Typically Offered: Fall)

CHIN 1010: Elementary Mandarin Chinese I

Credits: 4. Contact Hours: Lecture 4.

Introduction to spoken and written colloquial Mandarin through pinyin and simplified characters. For students whose native language is not Chinese. (Typically Offered: Fall)

CHIN 2010: Intermediate Mandarin Chinese I

Credits: 4. Contact Hours: Lecture 4.

Prereq: CHIN 1020

Development of speaking, writing, reading, and listening skills. Review and expansion of grammar skills, intensification of character acquisition. For students whose native language is not Chinese. Meets International Perspectives Requirement. (Typically Offered: Fall)

CJ 2400: Introduction to the U.S. Criminal Justice System

Credits: 3. Contact Hours: Lecture 3.

Provides systematic overview of law, police organization and behavior, prosecution and defense, sentencing, the judiciary, community corrections, penology, and capital punishment. The course demonstrates the role of discretion in all of these agencies as well as the sociological influences of age, race, gender, and social class on criminal justice system processes. (Typically Offered: Fall)

CLST 2730: Greek and Roman Mythology

Credits: 3. Contact Hours: Lecture 3.

Survey of the legends, myths of the classical world with emphasis on the principal gods, and heroes, and their relation to ancient social, psychological, and religious practices; some attention may be given to important modern theories. Meets International Perspectives Requirement.

COMS 1010: Orientation

Credits: Required. Contact Hours: Discussion 1, Lecture 1.

Required orientation class for all incoming students in the Computer Science major. Topics include academic planning and policies, campus resources, and supports. Opportunity to connect with other computer science peers, faculty, alumni, and employers. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

COMS 1030: Computer Literacy and Applications

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Introduction to computer literacy and applications. Literacy: Impact of computer technology in today's societies, hardware, software, software programming, database and information systems, communication and networks, digital media technology, computer security and safety, ethics and privacy. Applications: In-depth hands-on experience with the operating systems, Microsoft word processing, spreadsheets, database management and presentation software. No prior computer experience necessary. Offered online only. (Typically Offered: Fall, Spring, Summer)

COMS 1040: Brief Introduction to Computer Programming for Non-Majors

Credits: 2. Contact Hours: Lecture 1.5, Discussion 0.5.

Offered first 8 weeks and last 8 weeks. Use of personal computer and workstation and beginning programming. Project-oriented approach to computer operation and programming, including use of tools to aid in programming. Topics from computer history, using basic Windows and MacOS tools, program structure, expression, variables, decision and logic, and iteration. No prior computer experience necessary. (Typically Offered: Fall, Spring)

COMS 1070: Windows Application Programming

Credits: 3. Contact Hours: Lecture 3.

Introduction to computer programming for non-majors using a language such as the Visual Basic language. Basics of good programming and algorithm development. Graphical user interfaces. (Typically Offered: Fall, Spring)

COMS 1130: Introduction to Spreadsheets and Databases

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Using Microsoft Excel spreadsheets and Microsoft Access databases to input, store, process, manipulate, query, and analyze data for business and industrial applications. Graduation Restriction: Credit in COMS 1130 may not be applied toward graduation in the SE and CPRE majors. (Typically Offered: Fall, Spring, Summer)

COMS 2070: Fundamentals of Computer Programming

Credits: 3. Contact Hours: Lecture 3, Discussion 1.

Prereq: MATH 1500 or credit or enrollment in MATH 1400 or higher

An introduction to computer programming using an object-oriented programming language. Emphasis on the basics of good programming techniques and style. Extensive practice in designing, implementing, and debugging small programs. Use of variable, if-statement, looping, method, and class. Interactive and file I/O. This course is not designed for computer science, software engineering, and computer engineering majors. Graduation Restriction: Credit may not be applied toward graduation for both COMS 2070 and COMS 2270. (Typically Offered: Fall, Spring, Summer)

COMS 2270: Object-oriented Programming

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: Credit or concurrent enrollment in MATH 1430 or higher; (COMS 1270 or CPRE 1850 or SE 1850 or EE 2850)

Computer programming using objects as the mechanism for modularity, abstraction, and code reuse. Instance variables, methods, and encapsulation. Review of control structures for conditionals and iteration. Developing algorithms on strings, arrays, and lists. Recursion, searching, and sorting. Text parsing and file I/O. Interfaces, inheritance, polymorphism, and abstract classes. Exception handling. Tools for unit testing and debugging. Emphasis on a disciplined approach to specification, code development, and testing. Course intended for majors in computer science and related fields. Graduation Restriction: Credit may not be applied toward graduation for both COMS 2070 and 2270. (Typically Offered: Fall, Spring, Summer)

COMS 2280: Introduction to Data Structures

Credits: 3. Contact Hours: Lecture 3, Discussion 1.

Prereq: Minimum of C- in COMS 2270; credit or concurrent enrollment in MATH 1650

An object-oriented approach to data structures and algorithms. Object-oriented analysis, design, and programming, with emphasis on data abstraction, inheritance and subtype polymorphism, and generics. Abstract data type specification and correctness. Collections including lists, stacks, queues, trees, heaps, maps, hash tables, and graphs. Big-O notation and algorithm analysis. Searching and sorting. Graph search and shortest path algorithms. Emphasis on object-oriented design, writing and documenting medium-sized programs. This course is designed for majors. (Typically Offered: Fall, Spring, Summer)

COMST 1010: Introduction to Communication Studies

Credits: 3. Contact Hours: Lecture 3.

An introduction to communication theory, the development and functions of communication, and a survey of verbal, nonverbal, interpersonal, small group, organizational, and intercultural communication.

COMST 2110: Interpersonal Communication

Credits: 3. Contact Hours: Lecture 3.

Apply interpersonal communication theory and concepts to daily interactions. Develop knowledge and skills such as listening and responding, conversation management, using and interpreting nonverbals, conflict resolution, among others. Build skills leading to effective interactions in friendships, romances, families, and the workplace. .

CPRE 1850: Introduction to Computer Engineering and Problem Solving I

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: (MATH 1430 or satisfactory scores on mathematics placement examinations) OR (MATH 1650 or satisfactory scores on mathematics placement examinations)

Introduction to Computer Engineering. Project based examples from computer engineering. Individual interactive skills for small and large groups. Computer-based projects. Solving engineering problems and presenting solutions through technical reports. Solution of engineering problems using a programming language. Satisfactory placement scores can be found at: <https://math.iastate.edu/academics/undergraduate/aleks/placement/>. Graduation Restriction: Only one of ENGR 1600, ABE 1600, AERE 1600, BME 1600, CE 1600, CHE 1600, CPRE 1850, EE 1850, IE 1480, ME 1600, and SE 1850 may count towards graduation.

DANCE 2700: Dance Appreciation

Credits: 3. Contact Hours: Lecture 3.

Introduction to the many forms and functions of dance in world cultures. Develop abilities to distinguish and analyze various dance styles. No dance experience required. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

DES 2300: Design Thinking

Credits: 3. Contact Hours: Lecture 3.

Introduction to design thinking processes, toolkits, and mindsets, and its interaction with art, design, and technology. Emphasis on interdisciplinary practices.

DS 2010: Introduction to Data Science

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Satisfactory math placement test score (ALEKS, 51+)

Data Science concepts and their applications; domain case studies with applications in various fields; overview of data analysis; major components of data analysis pipelines; computing concepts for data science; descriptive data analysis; hands-on data analysis experience; communicating findings to stakeholders, and ethical issues in data science. Placement scores can be found at: <https://math.iastate.edu/academics/undergraduate/aleks/placement/>. (Typically Offered: Fall, Spring)

DSNS 1020: Design Studio I

Credits: 4. Contact Hours: Lecture 1, Studio 6.

A foundation design studio exploring two and three-dimensional design. Emphasis on fundamental skills and ideas shared across design disciplines. Creative processes, visual order, materials, and critical thinking are investigated through studio projects. Lectures and discussions cover the topics introduced in studios.

DSNS 1150: Design Collaborative Seminar

Credits: 1. Contact Hours: Lecture 1.

Orientation to the College of Design. Introduction to the design disciplines and studio pedagogy.

DSNS 1310: Drawing I

Credits: 4. Contact Hours: Lecture 1, Studio 6.

An introduction to methods of visual thinking and drawing through studio experiences and lectures. All design fields utilize visual communication and drawing. Focus on the use of drawing as a method for creative problem solving, design development and visual communication. Explore, from observation and imagination, the use of fast sketching and in-depth drawing, using various scales, mediums and processes.

DSNS 1830: Design in Context

Credits: 3. Contact Hours: Discussion 1, Lecture 2.

Explores designed media, objects, places, spaces, structures, and systems as products of varied and often intersecting contexts. Using historical and contemporary case studies, investigates how cultural, economic, environmental, spatial, social, and temporal contexts, among others, affect design. Explores in particular how design addresses complex and multifaceted problems.

DSNS 2320: Digital Design Communications

Credits: 3. Contact Hours: Lecture 3.

Introductory investigations of various digital design media to develop multi-dimensional problem solving, digital communication skills and perceptual sensitivity. Open to all university majors.

EE 1850: Introduction to Electrical Engineering and Problem-Solving I

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: (MATH 1430 or satisfactory scores on mathematics placement examinations) OR (MATH 1650 or satisfactory scores on mathematics placement examinations)

Project based examples from electrical engineering. Systematic thinking process for engineering problem solving. Group problem solving. Mathematical, conceptual and computer-based projects. Solving engineering problems and presenting solutions through technical reports and oral presentations. Solutions of engineering problems using computation tools and basic programming. Satisfactory placement scores can be found at: <https://math.iastate.edu/academics/undergraduate/aleks/placement/>. Graduation Restriction: Only one of ENGR 1600, ABE 1600, AERE 1600, BME 1600, CE 1600, CHE 1600, CPRE 1850, EE 1850, IE 1480, ME 1600, and SE 1850 may count towards graduation. (Typically Offered: Fall, Spring)

ECON 1010: Principles of Microeconomics

Credits: 3. Contact Hours: Lecture 3.

Resource allocation, opportunity cost, comparative and absolute advantage. Supply and demand. Marginal analysis. Theories of production and consumption, pricing, and the market system. Perfect and imperfect competition and strategic behavior. Factor markets. Present discounted value. (Typically Offered: Fall, Spring, Summer)

ECON 1010L: Laboratory in Principles of Microeconomics

Credits: 1. Contact Hours: Laboratory 2.

Discussion of material typically covered in ECON 1010. Application of economic principles to real world problems. Economic principles and basic business management concepts applied to decision-making in agribusiness operations. (Typically Offered: Fall)

ECON 1020: Principles of Macroeconomics

Credits: 3. Contact Hours: Lecture 3.

Measurement of macro variables and general macro identities. Classical models of full employment. Production and growth. Savings and investment. Employment and unemployment. Money, inflation, and price levels. Operation of the U.S. banking system. Fiscal and monetary policy. Elements of international finance. ECON 1010 recommended. (Typically Offered: Fall, Spring, Summer)

ECON 2350: Introduction to Agricultural Markets

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 1010

Basic concepts and economics principles related to markets for agricultural inputs and products. Overview of current marketing problems faced by farms and agribusinesses, farm and retail price behavior, structure of markets, food marketing channels, food quality and food safety, and the role of agriculture in the general economy. The implications of consumer preferences at the farm level. Introduction to hedging, futures, and other risk management tools. (Typically Offered: Fall, Spring)

EDUC 2040: Social Foundations of Education in the United States: Secondary

Credits: 3. Contact Hours: Lecture 3.

Introduction to the historical and contemporary landscape of schooling in the United States. Emphasis is placed on topics and tensions in the relationship between school and society (e.g. equity of access to education and competing purposes of education) and the implications of these topics and tensions for teaching and learning at the secondary level in public schools. For prospective teachers in an ISU Secondary Educator Preparation program; open to students who are considering teaching and/or work in education as a career path. (Typically Offered: Fall, Spring, Summer)

EDUC 2050: Social Foundations of Education in the United States: Early Childhood and Elementary Education

Credits: 3. Contact Hours: Lecture 3.

Introduction to the historical and contemporary landscape of schooling in the United States. Emphasis on topics and tensions in the relationship between school and society (e.g., equity of access to education and competing purposes of education) and the implications of these topics and tensions for teaching and learning in public schools. Student in K-12 education, or a non-education major should take EDUC 2040. (Typically Offered: Fall, Spring)

EDUC 2190: Orientation to Teacher Education: English, FCS, History, Math, Science and World Language Majors

Credits: 1. Contact Hours: Lecture 1.

Overview of English, mathematics, science, family and consumer sciences and history, and world language and cultures secondary education (grades 5-12), teacher licensure requirements in Iowa and other states. Program and career planning. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

ENGL 1010B: English for Native Speakers of Other Languages: Academic English

Credits: 3. Contact Hours: Lecture 3.

For undergraduates: Completion of ENGL 1010 requirement prepares students for ENGL 1500. For graduates: Completion of ENGL 1010 satisfies the English requirement of the Graduate College. ENGL 1010 courses are limited to students who are nonnative speakers of English. See English Requirement for International Students in Index for additional information about placement exam. Graduation Restriction: Credit from ENGL 1010 does not count toward graduation. (Typically Offered: Fall, Spring)

ENGL 1010C: English for Native Speakers of Other Languages: Academic English II--Undergraduates

Credits: 3. Contact Hours: Lecture 3.

Prereq: (Score of 2+ on EPT for ENGL 1010B OR Credit in ENGL 1010B) AND Undergraduate Student

For undergraduates: Completion of ENGL 1010 requirement prepares students for ENGL 1500. For graduates: Completion of ENGL 1010 satisfies the English requirement of the Graduate College. ENGL 1010 courses are limited to students who are nonnative speakers of English. See English Requirement for International Students in Index for additional information about placement exam. Graduation Restriction: Credit from ENGL 1010 does not count toward graduation. (Typically Offered: Fall, Spring)

ENGL 1500: Critical Thinking and Communication

Credits: 3. Contact Hours: Lecture 3.

Prereq: [(Overall EPT Score 2+ OR Passing ESL Course Grade) AND (Membership in EPT Advisory Group)] OR (Not Member of EPT Advisory Group)

Application of critical reading and thinking abilities to topics of civic and cultural importance. Introduction of basic oral, visual, and electronic communication principles to support writing development. Initiation of communication portfolio. Concurrent enrollment in LIB 1600 is recommended. (Typically Offered: Fall, Spring, Summer)

ENGL 2010: Introduction to Literature

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or concurrent enrollment in ENGL 1500

Introduction to the diversity of literary texts. Students will explore work across different genres (drama, poetry, short fiction, the novel) and traditions (Indigenous, postcolonial, global, British, American). Recommended for nonmajors.

ENGL 2140: Introduction to Technical Communication

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 1500.

A broad introduction to the culture of professional work as a technical communicator, with particular emphasis on principles and best practices for developing and managing technical information and digital media. Examination of user-centered design, the history of the discipline, cross-cultural communication, and the ethics of communicating complex information to lay audiences. Study and practice of team-based collaboration, project management, and technical editing. (Typically Offered: Fall)

ENGL 2250: Survey of British Literature to 1800

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500

Survey of British Literature from its beginnings to 1800. Representative works studied in their historical, cultural, and literary contexts that span nearly 900 years of shifts in religious, political, ethnic, and philosophical cultures.

ENGL 2260: Survey of British Literature since 1800

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500

Representative works studied in their historical, cultural, and literary contexts, including attention to the impact and legacy of the British empire on its former colonies, i.e., postcolonial literature.

ENGL 2370: Survey of Film History

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit in or enrollment in ENGL 1500 or 2500

Survey of U.S. and international film history from its beginnings in the late nineteenth century to the present.

ENGL 2400: Introduction to American Indian Literature

(Cross-listed with AMIN 2400).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit in or enrollment in ENGL 1500 or 2500

Survey of American Indian Literature of varying genres, including fiction, non-fiction, poetry, film, drama, and media. Focuses on interdisciplinary approaches to American Indian cultural, social, and environmental issues. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall)

ENGL 2500: Written, Oral, Visual, and Electronic Composition

Credits: 3. Contact Hours: Lecture 3.

Prereq: [(Overall EPT Score 2+ OR Passing ESL Course Grade) AND (Membership in EPT Advisory Group) AND (credit or enrollment in LIB 1600) AND (credit or exemption from ENGL 1500)] OR [(Credit or exemption from ENGL 1500) AND (Credit or enrollment in LIB 1600)]

Analyzing, composing, and reflecting on written, oral, visual, and electronic (WOVE) discourse within academic, civic, and cultural contexts. Emphasis on supporting a claim and using primary and secondary sources. Continued development of communication portfolio. Graduation Restriction: The University requires a minimum grade of C in ENGL 2500 to meet the Communication Proficiency graduation requirement; some majors/degree programs may set higher standards. (Typically Offered: Fall, Spring, Summer)

ENGL 2750: Analysis of Popular Culture Texts

(Cross-listed with SPCM 2750).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or concurrent enrollment in ENGL 2500

Analysis of how information and entertainment forms persuade and manipulate audiences. Study of several forms that may include newspapers, speeches, television, film, advertising, fiction, and magazines. Special attention to verbal and visual devices. (Typically Offered: Fall, Spring)

ENGR 1600: Engineering Problems with Computer Applications**Laboratory**

Credits: 3.

Prereq: MATH 1430 or satisfactory score of 76 on mathematics placement exam

Solving engineering problems and presenting solutions through technical reports. Significant figures. Use of SI units. Graphing and curve-fitting. Flowcharting. Introduction to mechanics, statistics and engineering economics. Use of spreadsheet programs to solve and present engineering problems. Solution of engineering problems using computer programming languages. (The honors section includes application of programming to mobile robotics). Satisfactory placement scores can be found at: <https://math.iastate.edu/academics/undergraduate/aleks/placement/>. Graduation Restriction: Only one of ENGR 1600, ABE 1600, AERE 1600, CE 1600, CHE 1600, CPRE 1850, EE 1850, IE 1480, ME 1600, and SE 1850 may count towards graduation. (Typically Offered: Fall, Spring, Summer)

ENT 2010: Introduction to Insects

Credits: 1. Contact Hours: Lecture 2.7.

Biological and ecological aspects of insects. Offered online only. 5 weeks. (Typically Offered: Fall, Spring)

ENT 2110: Insects and Society

Credits: 2. Contact Hours: Lecture 2.7.

The importance of insects in human well-being. Insect-human interactions. Primarily for non-science and non-agriculture majors. Offered online only. 11 weeks. (Typically Offered: Fall, Spring)

ENT 2140: Insects in Forensic Science

Credits: 3. Contact Hours: Lecture 3.

Introduction to the use of insects as evidence in court and how they can assist in solving crimes. Topics covered include basic insect biology, systematics, behavior, with emphasis on applications of forensic entomology. Offered even-numbered years. (Typically Offered: Fall)

ENVS 1010: Environmental Geology: Earth in Crisis

(Cross-listed with GEOL 1010).

Credits: 3. Contact Hours: Lecture 3.

Exploration of the interactions between humans and the geologic environment, and the consequences of those interactions, on local to global scales. Discussion of water, soil, mineral, and energy resources, pollution, climate change, and natural hazards such as earthquakes, volcanism, mass wasting, and flooding. (Typically Offered: Fall, Spring, Summer)

ENVS 1200: Introduction to Renewable Resources

(Cross-listed with AGRON 1200/ NREM 1200).

Credits: 3. Contact Hours: Lecture 3.

Overview of soil, water, plants, and animals as renewable natural resources in an ecosystem context. History and organization of resource management. Concepts of integrated resource management. (Typically Offered: Fall, Spring)

ENVS 1730: Environmental Biology

(Cross-listed with BIOL 1730).

Credits: 3. Contact Hours: Lecture 3.

An introduction to the structure and function of natural systems at scales from the individual to the biosphere and the complex interactions between humans and their environment. Discussions of human population growth, biodiversity, sustainability, resource use, and pollution. Does not satisfy biology major requirements. (Typically Offered: Fall, Spring)

ENVS 2010: Introduction to Environmental Issues

(Cross-listed with BIOL 2010/ ENSCI 2010).

Credits: 2. Contact Hours: Lecture 2.

Discussion of current and emerging environmental issues such as human population growth, energy use, loss of biodiversity, water resources, and climate change. (Typically Offered: Fall)

EVENT 1710: Introduction to Event Management

Credits: 3. Contact Hours: Lecture 3.

Overview of the event management industries. Techniques and procedures required for designing and implementing successful events. (Typically Offered: Fall, Spring, Summer)

FRNCH 1010: Elementary French I

Credits: 4. Contact Hours: Lecture 4.

Beginning level development of reading, writing, listening comprehension, and speaking in French, within the context of French culture. (Typically Offered: Fall, Summer)

FRNCH 2010: Intermediate French I

Credits: 4. Contact Hours: Lecture 4.

Prereq: FRNCH 1020

Intermediate level development of reading, writing, listening comprehension, and speaking in French within the context of French culture. Meets International Perspectives Requirement. (Typically Offered: Fall)

FSHN 1010: Food and the Consumer

Credits: 3. Contact Hours: Lecture 3.

The food system from point of harvest to the consumption of the food by the consumer. Properties of food constituents. Protection of food against deterioration and microbial contamination. Introduction of foods into the marketplace. Processes for making various foods. Government regulations. Use of food additives. Current and controversial topics. High school biology and chemistry or 3 credits of college level biology and chemistry recommended. (Typically Offered: Fall, Spring, Summer)

FSHN 1670: Introductory Human Nutrition and Health

Credits: 3. Contact Hours: Lecture 3.

Understanding and implementing present day knowledge of nutrition. The role of nutrition in the health and well being of the individual and family. High school biology or 3 credits of biology recommended. (Typically Offered: Fall, Spring, Summer)

FSHN 2200: American Food and Culture

Credits: 3. Contact Hours: Lecture 3.

American cuisine reflects the history of the U.S. It is the unique blend of diverse groups of people from around the world, including indigenous Native American Indians, Africans, Asians, Europeans, Pacific Islanders, and South Americans. Explore factors that impact the American Cuisine of today including diverse ethnic and cultural group influences, historical events related to food diversity in the U.S., and agriculture and industrial impacts on food production. Practical knowledge and basic food preparation techniques related to the U.S. food system and trends. Class sessions will include lectures, class discussions and Tasting Immersion activities. (Typically Offered: Fall, Spring)

GEOL 1000: How the Earth Works

Credits: 3. Contact Hours: Lecture 3.

How does the earth work, what is it made of, and how does it change through time? Plate tectonics, Earth materials, landforms, structures, climate, and natural resources. Emphasis on the observations and hypotheses used to interpret earth system processes. Students may also enroll in GEOL 1000L. (Typically Offered: Fall, Spring, Summer)

GEOL 1000L: How the Earth Works: Laboratory

Credits: 1. Contact Hours: Laboratory 2.

Students will gain understanding of how Earth processes affect their lives and how they affect the Earth, and of the complex nature of the Earth and its processes. They will gain a deep knowledge of the methods used to understand the time scales and rates of Earth processes also through an applied research experience on groundwater and surface water. (Typically Offered: Fall, Spring)

GEOL 1010: Environmental Geology: Earth in Crisis

(Cross-listed with ENVS 1010).

Credits: 3. Contact Hours: Lecture 3.

Exploration of the interactions between humans and the geologic environment, and the consequences of those interactions, on local to global scales. Discussion of water, soil, mineral, and energy resources, pollution, climate change, and natural hazards such as earthquakes, volcanism, mass wasting, and flooding. (Typically Offered: Fall, Spring, Summer)

GEOL 1050: Gems and Gemstones

Credits: 1. Contact Hours: Lecture 1.

Offered in second half of the semester. Introduction to gems and gemstones, physical and optical properties of gems and gemstones, explanation of where gems come from and how they are found, how to distinguish between synthetic and naturally occurring gems, how the value of gems are determined, and the history of famous gems. (Typically Offered: Fall)

GEOL 1110: Geological Disasters

(Cross-listed with ENVS 1110).

Credits: 1. Contact Hours: Lecture 1.

Introduction to the catastrophic geologic processes with the potential to devastate human populations that continue to expand into regions at greatest risk from geologic hazards. Selected case studies and discussion of plate tectonics, climate, and earth processes explain the driving forces behind natural hazards such as earthquakes, tsunamis, volcanic eruptions, landslides, and floods. (Typically Offered: Fall, Spring, Summer)

GEOL 2010: Geology for Engineers and Environmental Scientists

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Introduction to Earth materials and processes with emphasis on engineering and environmental applications. (Typically Offered: Fall)

GER 1010: Elementary German I

Credits: 4. Contact Hours: Lecture 4.

Beginning level development of reading, writing, listening comprehension, and speaking in German within the context of German culture. For beginning-level learners who have little or no prior exposure to German. (Typically Offered: Fall, Summer)

GER 2010: Intermediate German I

Credits: 4. Contact Hours: Lecture 4.

Prereq: GER 1020

Intermediate level development of reading, writing, listening comprehension, and speaking in German within the context of German culture. Intensive review of basic grammar covered in the first-year German class (or equivalent high school courses) while exploring cultural topics and themes. Meets International Perspectives Requirement. (Typically Offered: Fall)

GLOBE 2010: Introduction to Global Resource Systems

Credits: 3. Contact Hours: Lecture 3.

A systematic analysis of natural, physical, and socio-economic resources. Examine ways communities prioritize, save, use, and invest in community resources to address their needs and wants in a sustainable way, and the global implications of resource systems decisions. Assessed service-learning component. (Typically Offered: Fall, Spring)

HS 1050: First Aid and Emergency Care

Credits: 2.

Discussion and application of the basic techniques of utilizing bloodborne pathogen safety measures, administering first aid and cardiopulmonary resuscitation. ARC layperson certification available. (Typically Offered: Fall, Spring, Summer)

HS 1100: Personal and Consumer Health

Credits: 3. Contact Hours: Lecture 3.

Physical, mental, emotional and social aspects of health as a basis for understanding and promoting health, and preventing poor health conditions. Study of personal responsibility on the long-term benefits of maintaining a high level of wellness and health. Identification and mitigation of negative lifestyle habits. (Typically Offered: Fall, Spring)

HDFS 1020: Human Development

Credits: 3. Contact Hours: Lecture 3.

Overview of life-span developmental tasks (physical, cognitive, language, social, emotional) examined from various theoretical perspectives. Discussion of topics related to family diversity, individual/family health and well-being and reciprocal relationships as affected by external factors. (Typically Offered: Fall, Spring, Summer)

HDFS 1830: Financial Literacy for Life

Credits: 1. Contact Hours: Lecture 1.

Introduction to basic concepts and budgeting practices for management of resources and prevention of financial problems commonly associated with college, including credit and student loans. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

HDFS 2230: Child Development and Health

Credits: 3. Contact Hours: Lecture 3.

Typical and atypical development of children prenatal through middle childhood. Examination of healthy development and potential impact of health issues in children. Discussion of influence of the family and society on development. Graduation Restriction: Either HDFS 2230 or HDFS 2240, but not both, may be applied toward graduation. (Typically Offered: Spring)

HDFS 2390: Consumer Issues

Credits: 3. Contact Hours: Lecture 3.

Introduction to factors affecting consumer decisions of individuals and families, including housing, healthcare, and personal finances. Emphasis on accessibility and affordability, community contexts for families; and consumer protection, legislation and regulation, and consumer fraud. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall, Spring)

HDFS 2400: Children's Literature

Credits: 3. Contact Hours: Lecture 3.

Evaluation of literature for children with emphasis on diversity and inclusion. Role of literature in the development of children across contexts. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall, Spring)

HDFS 2760: Human Sexuality

Credits: 3. Contact Hours: Lecture 3.

Behavioral, biological, and psychological aspects of human sexuality within the social context of family, culture, and society. Role of sexuality in human development. Critical analysis of media and research. Communication and decision-making skills relating to sexuality issues and relationships. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall, Spring, Summer)

HIST 2010: Introduction to Western Civilization I

Credits: 3. Contact Hours: Lecture 3.

Western civilization from ancient Mediterranean world to 1500. Social and cultural developments; economic and political ideas and institutions; problems of historical change and continuity. Meets International Perspectives Requirement. (Typically Offered: Fall)

HIST 2070: Chinese Civilization

Credits: 3. Contact Hours: Lecture 3.

Origins, development, decline and transformation of China from earliest times to 1911. Meets International Perspectives Requirement.

HIST 2110: Ancient Empires: From Sargon to Caesar

Credits: 3. Contact Hours: Lecture 2, Discussion 1.

Development of empires in the Near East and Mediterranean from the Akkadians to the fall of Rome. Discussion of the Hittites, Assyrians, Persians, Athenians, Macedonians (including the conquests of Alexander the Great), Carthaginians, and Romans; examination of imperialism as well as the social, cultural, and economic consequences of empire. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

HIST 2210: Survey of United States History I

Credits: 3. Contact Hours: Lecture 3.

Colonial foundations: revolution, confederation, and constitution; nationalism and democracy; sectional disunity, Civil War, and reunion. (Typically Offered: Fall)

HIST 2800: Introduction to History of Science I

Credits: 3. Contact Hours: Lecture 3.

Ideas of nature from ancient Greece to the seventeenth-century scientific revolution. Meets International Perspectives Requirement.

HORT 1210: Home Horticulture

Credits: 3. Contact Hours: Discussion 1, Lecture 2.

Growing plants in and around the home including requirements for growing indoor plants, plant propagation, landscape design, and maintaining trees, lawns, flower, fruit, and vegetable gardens. Recitation includes demonstrations and hands-on activities that illustrate principles of designing, growing and maintaining plants for both indoor and outdoor gardens. (Typically Offered: Fall, Spring)

HSPM 1010: Introduction to the Hospitality Industry

Credits: 3. Contact Hours: Lecture 3.

Introduction to the foodservice, lodging, and tourism components of the hospitality industry. Background information, current issues, and future challenges in various segments of the industry. (Typically Offered: Fall, Spring)

INTST 2350: Introduction to International Studies

Credits: 3. Contact Hours: Lecture 3.

Overview of international studies, emphasizing cultural, geographic, economic, and political characteristics of major world areas and nations. Meets International Perspectives Requirement. (Typically Offered: Fall, Summer)

ITAL 1070: Intensive Beginning Italian

Credits: 4. Contact Hours: Lecture 4.

A communicative approach to grammar and vocabulary within the context of Italian culture for students whose native language is not Italian. Taught in Italian. (Typically Offered: Fall, Spring)

JLMC 1010: Mass Media and Society

Credits: 3. Contact Hours: Lecture 3.

Communication theory models and their application to the mass media; the mass communication process; organization, characteristics and responsibilities of the mass media; media literacy process. (Typically Offered: Fall, Spring, Summer)

JLMC 1100: Orientation to Journalism and Communication

Credits: 1. Contact Hours: Lecture 1.

Orientation to curriculum requirements in the Greenlee School and introduction to careers related to Greenlee majors. Introduction to professional and preprofessional opportunities. Offered on a satisfactory/fail basis only. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

JLMC 2400: Principles of Journalism

Credits: 3. Contact Hours: Lecture 3.

Analysis of the journalism industry and specific audiences served by traditional media, including print and broadcast, as well as digital and emerging media. Introduction to core values of journalism in a democratic society and guiding principles that encompass a free press, media literacy, ethics, law, history, the economy and cultural and societal implications. (Typically Offered: Fall, Spring)

JLMC 2420: Visual Principles for Mass Communicators

Credits: 3. Contact Hours: Lecture 3.

Understanding and analysis of the visual message. Visual perception, visual communication theory, design syntax, design elements and how they are applied in mass communication. (Typically Offered: Fall, Spring)

KIN 2520: Introduction to the Discipline of Kinesiology

Credits: 1. Contact Hours: Lecture 1.

Relevant societal issues and research within the discipline of Kinesiology (the study of movement) are addressed. (Typically Offered: Fall, Spring)

KIN 2530: Orientation and Learning Community in Kinesiology and Health

Credits: 1. Contact Hours: Lecture 1.

Overview of ISU policies and procedures, academic advising operations, degree requirements, program of study planning, and campus resources. Students will have out-of-class activities and work with faculty, staff and mentors to explore careers in Kinesiology and complete assignments related to identification & development of their skills and interests. Department of Kinesiology students only. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

LLS 1120: Foundations of Learning and Productive Team Membership

Credits: 2. Contact Hours: Lecture 2.

Introduction to developing intentional learners and worthy team members. Learning as the foundation of human enterprise; intellectual curiosity; ethics as a personal responsibility; everyday leadership; effective team and community interactions including team learning and the effects on individuals; and growth through understanding self, demonstrating ownership of own learning, and internalizing commitment to helping others. Intentional mental processing as a means of enhancing learning. Interconnectedness of the individual, the community, and the world. (Typically Offered: Fall)

LAS 1010: Orientation

Credits: 1. Contact Hours: Lecture 1.

Prereq: Major in the College of Liberal Arts and Sciences (LAS)

For first-year LAS students. Introduction to university policies and deadlines, campus resources and services, academic success strategies, degree planning, and registration procedures. Assists with a successful academic transition to the university. Introduction to career resources. . Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

LATIN 1010: Elementary Latin I

Credits: 3. Contact Hours: Lecture 3.

Grammar and vocabulary of classical Latin, within the context of Roman culture; reading knowledge through texts adapted from classical authors. (Typically Offered: Fall)

LDST 1220: Leading with Purpose

Credits: 1. Contact Hours: Lecture 1.

Designed for emerging student leaders. Basic leadership skills covering personal skills development, goal achievement, values-based behaviors and mission statement development. (Typically Offered: Fall, Spring)

LDST 2700: Campus Leadership Development

Credits: 3. Contact Hours: Lecture 3.

Introduce effective leadership practices for emerging leaders. Engage in experiential campus leadership opportunities. (Typically Offered: Fall, Spring, Summer)

LIB 1600: Introduction to College Level Research

Credits: 1. Contact Hours: Lecture 1.

Eight-week course required for undergraduate degree. Provides a foundation for college level research. Students will develop the critical thinking skills necessary to successfully navigate the research process: developing a research question, searching strategically, evaluating sources, and using information ethically. To be taken as early as possible in the student's undergraduate career. See course descriptions of ENGL 1500 and ENGL 2500 for requirements related to LIB 1600. (Typically Offered: Fall, Spring, Summer)

LING 1190: Introduction to World Languages

(Cross-listed with WLC 1190).

Credits: 3. Contact Hours: Lecture 3.

Study of language diversity and the personal, social and political effects of diversity. Language families, attitudes toward language and language use, language and culture, multilingualism, foreign language learning, written codes, official languages, and language policy. Meets International Perspectives Requirement.

LING 1200: Computers and Language

(Cross-listed with ENGL 1200).

Credits: 3. Contact Hours: Lecture 3.

Introduction to the use of linguistic knowledge in computer applications today and the basic computational techniques used in such applications. The development of these techniques throughout the history of computational linguistics. How the study of language has contributed to the advancement of technology and how certain computational problems have influenced the way linguists study language.

ME 1600: Mechanical Engineering Problem Solving with Computer Applications

Credits: 3.

Prereq: ME majors only. MATH 1430 or MATH 1450; credit or enrollment in MATH 1650.

Introduction to the field of Mechanical Engineering through problem-solving in a range of topics including statics, mechanics of materials and thermo-fluids. Techniques to professionally present and communicate solutions. Use of Python computer programming to aid problem solving, including curve fitting and graphing. Graduation Restriction: Only one of ENGR 1600, ABE 1600, AERE 1600, CE 1600, CHE 1600, CPRE 1850, EE 1850, IE 1480, ME 1600, and SE 1850 may count toward graduation. (Typically Offered: Fall, Spring)

ME 1700: Engineering Graphics and Introductory Design

Credits: 3.

Prereq: Credit or concurrent enrollment in MATH 1430 or MATH 1450 (or satisfactory scores on mathematics placement assessments)

Integration of fundamental graphics, computer modeling, and engineering design. Applications of multiview drawings and dimensioning. Techniques for visualizing, analyzing, and communicating 3-D geometries. Application of the design process including written and oral reports. Freehand and computer methods. Satisfactory placement scores can be found at: <https://math.iastate.edu/academics/undergraduate/aleks/placement/>. (Typically Offered: Fall, Spring)

MS 1010: Introduction to Military Science

Credits: 1. Contact Hours: Lecture 1.

Prereq: Concurrent enrollment in MS 1010L required

Examines the role of a Cadet in the Army Reserve Officer Training Corps and a Lieutenant in the United States Army. The course explores a military culture whose ultimate success is determined by the character and proficiency of its' leaders. Instruction introduces students to the cultural heritage and history of the U.S. Army. Students will begin to understand the structure of the U.S. Army and how it functions as an organization and institution. The curriculum promotes the development of students' communication skills to enhance their ability to transmit ideas. The class examines how the Army's cultural values drive the development of leadership in the Officer Corps. Hands-on activities enable students to gain insight on the skills and abilities required of cadets and officers interacting with civilians and soldiers. (Typically Offered: Fall)

MS 1010L: Basic Leadership Laboratory I

Credits: 1. Contact Hours: Laboratory 2.

Prereq: Concurrent enrollment in MS 1010 required

Uses basic military training, missions and scenarios to provide a hands-on method of developing confidence and leadership skills. Students observe and participate in the rotation through various levels of leadership positions at the platoon and squad level within the Army command structure. This concept provides a constant learning environment as they learn to communicate effectively and work as a team while assigned to positions at various levels within the organization. Marching, rifle firing, and tactical patrolling; students gain confidence through rappelling and construction/use of rope bridges; and increase professional knowledge in areas such as first aid, water survival, personal physical fitness, and land navigation. Teaching locations include the ISU Armory, Camp Dodge (National Guard Facility), Pammel Woods (ISU campus), and ISU fitness centers. Full participation in all events will be determined based on students' physical and medical eligibility. (Typically Offered: Fall)

MS 1500: Army Physical Readiness

Credits: 1. Contact Hours: Laboratory 3.

Repeatable.

This lab is designed to use basic military skills and instruction to develop confidence, leadership, and physical fitness. The team approach is utilized in the instruction and application of Army physical fitness requirements. Students will learn various Army physical fitness techniques as well as how to conduct physical fitness sessions. Teaching locations include Lied Recreation Center, Beyer Hall, State Gym as well as around campus. Full participation in all events will be determined based on students' physical and medical eligibility. (Typically Offered: Fall, Spring)

MATH 1010: Orientation in Mathematics

Credits: 1. Contact Hours: Lecture 1.

A required orientation for all first-year and transfer students in mathematics. Provides information about campus resources and opportunities available to students, assists with transition to the University, and academic planning. Offered on a satisfactory/fail basis only. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

MATH 1040: Introduction to Probability

Credits: 3. Contact Hours: Lecture 3.

Prereq: Satisfactory math placement test score (ALEKS 15+)

Permutations, combinations, probability, expected value, and applications. Satisfactory placement scores can be found at <https://math.iastate.edu/academics/undergraduate/aleks/placement/>. (Typically Offered: Fall, Spring, Summer)

MATH 1050: Introduction to Mathematical Ideas

Credits: 3. Contact Hours: Lecture 3.

Prereq: Satisfactory math placement test score (ALEKS 15+)

Introduction to the use of basic mathematics to solve real-world problems in the areas of voting issues, measuring power in situations where people have different numbers of votes, apportionment, fair division, and elementary game theory. No prior background in politics or history is necessary for this course. Satisfactory placement scores can be found at <https://math.iastate.edu/academics/undergraduate/aleks/placement/>. (Typically Offered: Fall, Spring, Summer)

MATH 1400: College Algebra

Credits: 3. Contact Hours: Lecture 2, Discussion 1.

Prereq: Satisfactory math placement test score (ALEKS, 39+) or (concurrent enrollment in MATH 1390 and ALEKS 15+)

Coordinate geometry, quadratic and polynomial equations, functions, graphing, rational functions, exponential and logarithmic functions, inverse functions, quadratic inequalities, systems of linear equations. Satisfactory placement scores can be found at <https://math.iastate.edu/academics/undergraduate/aleks/placement/>. Credits earned in MATH 1400 cannot be applied toward graduation by Math majors. (Typically Offered: Fall, Spring, Summer)

MATH 1430: Preparation for Calculus

Credits: 4. Contact Hours: Lecture 2, Discussion 2.

Prereq: Satisfactory performance on placement assessment or MATH 1400

Preparation for MATH 1600 or MATH 1650. Functions, graphing, basic trigonometry, logarithms, exponentials. Emphasis on co-variational reasoning. Satisfactory placement scores can be found at <https://math.iastate.edu/academics/undergraduate/aleks/placement/>. Graduation Restriction: Only one of MATH 1430 and MATH 1450 may count toward graduation. (Typically Offered: Fall, Spring)

MATH 1450: Applied Trigonometry

Credits: 3. Contact Hours: Lecture 2, Discussion 1.

Prereq: Satisfactory performance on placement assessment or MATH 1400

Mathematical ideas regarding the conception of space. General trigonometry, with an emphasis on the calculation of lengths, areas, and angles. The Law of Sines and the Law of Cosines. Polar, cylindrical, and spherical coordinate systems. Conic sections and quadric surfaces. Satisfactory placement scores can be found at <https://math.iastate.edu/academics/undergraduate/aleks/placement/>. Graduation Restriction: Only one of MATH 1430 and MATH 1450 may count toward graduation. (Typically Offered: Fall, Spring)

MATH 1500: Discrete Mathematics for Business and Social Sciences

Credits: 3. Contact Hours: Lecture 3.

Prereq: ALEKS 39+ OR (Concurrent enrollment in MATH 1490 AND ALEKS 15+)

Linear equations and inequalities, matrix algebra, linear programming, discrete probability. Satisfactory placement scores can be found at <https://math.iastate.edu/academics/undergraduate/aleks/placement/>. (Typically Offered: Fall, Spring, Summer)

MATH 1600: Survey of Calculus

Credits: 4. Contact Hours: Lecture 4.

Prereq: Satisfactory performance on placement assessment or minimum of C- in (MATH 1400 or MATH 1430)

Analytic geometry, derivatives and integrals of elementary functions, simple differential equations, and applications. Will not serve as a prerequisite for MATH 2650 or MATH 2660. Satisfactory placement scores can be found at <https://math.iastate.edu/academics/undergraduate/aleks/placement/>. Graduation Restriction: Only one of MATH 1510, MATH 1600, or the sequence MATH 1650-MATH 1660 may be counted towards graduation. (Typically Offered: Fall, Spring)

MATH 1650: Calculus I

Credits: 4. Contact Hours: Lecture 3, Discussion 1.

Prereq: Minimum C- in MATH 1430 or satisfactory score on placement exam

Differential calculus, applications of the derivative, introduction to integral calculus. Satisfactory placement scores can be found at <https://math.iastate.edu/academics/undergraduate/aleks/placement/>. Graduation Restriction: Only one of MATH 1510, MATH 1600, or the sequence MATH 1650-MATH 1660 may be counted towards graduation. (Typically Offered: Fall, Spring, Summer)

MATH 1660: Calculus II

Credits: 4. Contact Hours: Lecture 3, Discussion 1.

Prereq: Minimum C- in MATH 1650 or satisfactory placement on ALEKS (80+) and Canvas Calculus placement exam (by advisor permission)

Integral calculus, applications of the integral, parametric curves and polar coordinates, power series and Taylor series. Satisfactory placement scores can be found at <https://math.iastate.edu/academics/undergraduate/aleks/placement/>. Graduation Restriction: Only one of MATH 1510, MATH 1600, or the sequence MATH 1650-MATH 1660 may be counted towards graduation. (Typically Offered: Fall, Spring, Summer)

MATH 1950: Mathematics for Elementary Education I

Credits: 3.

Prereq: Satisfactory performance on placement assessment; Early or Elementary Education major

Whole number operations through analysis of properties, theoretical and hands-on models, mathematical analysis of elementary students' thinking; standard and non-standard algorithms; structure of the decimal system; linear measurement; two- and three-dimensional measurement, shapes and spatial sense; number theory; algebra as it relates to elementary curricula/teaching profession. Satisfactory placement scores can be found at <https://math.iastate.edu/academics/undergraduate/aleks/placement/>. Graduation Restriction: Students in the College of Liberal Arts and Sciences may not count MATH 1950 toward General Education Requirements. (Typically Offered: Fall, Spring)

MATH 2650: Calculus III

Credits: 4. Contact Hours: Lecture 3, Discussion 1.

Prereq: Minimum of C- in MATH 1660 or MATH 1660H

Geometry of space and vectors, multivariable differential calculus, multivariable integral calculus, vector calculus. (Typically Offered: Fall, Spring, Summer)

MATH 2670: Elementary Differential Equations and Laplace Transforms

Credits: 4. Contact Hours: Lecture 3, Discussion 1.

Prereq: Minimum of C- in MATH 1660 or MATH 1660H

Same as MATH 2660 but also including Laplace transforms and power series solutions to ordinary differential equations. Graduation Restriction: Credit for either MATH 2670 or the MATH 2660, 2680 pair of courses, but not both, may be applied toward graduation. Credit for only one of the following courses may be applied toward graduation: MATH 2670, MATH 2660, MATH 2690. (Typically Offered: Fall, Spring, Summer)

MICRO 1010: Microbial World

Credits: 3. Contact Hours: Lecture 3.

Introduction to the importance of viruses, bacteria, fungi, archaea and parasites both to humans and to the biosphere. Topics include past and present microbial impact on humans and society, ecology and diversity of microbes, biotechnology and microbial impact on the biosphere. Recommended: High School Biology. (Typically Offered: Fall)

MICRO 2010: Introduction to Microbiology

Credits: 2. Contact Hours: Lecture 2.

Prereq: One BIOL course except BIOL 1100, BIOL 1110, BIOL 1120, BIOL 1730, BIOL 2010, BIOL 3070

Selected topics in microbiology with emphasis on the relationship of microorganisms to human and animal health, agricultural technology, and the environment. With written petition to the chair of the supervisory committee, students who obtain a grade of B or better may substitute 2010 for MICRO 3020 in advanced courses. (Typically Offered: Fall, Spring)

MICRO 2010L: Introductory Microbiology Laboratory

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Credit or concurrent enrollment in MICRO 2010 or MICRO 3020

Basic microbiology laboratory techniques for non-microbiology majors. Graduation Restriction: Credit for either MICRO 2010L or 3020L, but not both, may be applied toward graduation. (Typically Offered: Fall, Spring)

MTEOR 1070: Severe and Hazardous Weather

Credits: 1. Contact Hours: Lecture 1.

Understanding of atmospheric processes that play a role in creating severe and hazardous weather. Focus on thunderstorms, tornadoes, hurricanes, floods, blizzards, ice storms, and temperature extremes. Impacts on lives and property. (Typically Offered: Fall)

MTEOR 1400: Climate and Society

(Cross-listed with AGRON 1400/ ENVS 1400/ GEOL 1400/ CLSCI 1400).

Credits: 3. Contact Hours: Lecture 3.

The climate system of our planet. How nature and our actions alter the existing energy balance leading to climate change. Past climates on our planet. The influence of climate on society and resource availability during the Holocene (~ 11,000 years ago to present) with focus on changes post industrial revolution. Significant climate events that have altered our way of life in the past. Projected changes in future climate and potential impacts on society, environment and resources. Adaption to and mitigation of climate change. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

MTEOR 2060: Introduction to Weather and Climate

(Cross-listed with AGRON 2060).

Credits: 3. Contact Hours: Lecture 3.

Basic concepts in weather and climate, including atmospheric measurements, radiation, stability, precipitation, winds, fronts, forecasting, and severe weather. Applied topics include global warming, ozone depletion, world climates and weather safety. (Typically Offered: Fall, Spring)

MUSIC 1010: Fundamentals of Music

Credits: 2.

Notation, recognition, execution and analysis of scales, intervals, triads, and rhythm; key signatures; time signatures; transposition. Open to non-majors only. Ability to read elementary musical notation required. (Typically Offered: Fall, Spring)

MUSIC 1020: Introduction to Music Listening

Credits: 3. Contact Hours: Lecture 3.

Expansion of the music listening experiences for the general student through greater awareness of differences in techniques of listening, performance media, and materials of the art. The course focuses on the elements of music: rhythm, melody, harmony, form, and style, and how these elements are used in musics of different cultures and time periods. Ability to read or perform music not required. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

MUSIC 1110: Wind Ensemble

Credits: 1. Contact Hours: Laboratory 3.

Repeatable.

Emphasis on significant extended compositions for wind and percussion instruments. Performances include formal concerts on campus and the annual tour. Open to all students by audition. (Typically Offered: Fall, Spring)

MUSIC 1120: Concert Band

Credits: 1. Contact Hours: Laboratory 2.

Repeatable.

Repertoire includes the broad spectrum of band music. Two concerts are presented each semester. Open to students who have performed on a wind or percussion instrument in high school band or orchestra. (Typically Offered: Fall, Spring)

MUSIC 1130: Jazz Ensemble

Credits: 1. Contact Hours: Laboratory 2.

Repeatable.

Designed to explore various styles and trends in contemporary jazz. Open to all students by audition. (Typically Offered: Fall, Spring)

MUSIC 1140A: Marching and Pep Bands: Marching Band

Credits: 1. Contact Hours: Laboratory 5.

Repeatable.

Membership determined by audition and band application. Auditions held for woodwind, brass, percussion, flag, and twirler positions. Presentation of pre-game and half time shows at each home football game; additional performances are also scheduled on and off campus. Audition information is listed on the band website (www.cyclonemarchingband.iastate.edu). Students may not be concurrently enrolled in MUSIC 1140A and 1140C. (Typically Offered: Fall)

MUSIC 1150: Symphonic Band

Credits: 1. Contact Hours: Laboratory 3.

Repeatable.

Stresses high quality wind literature. Performances include formal concerts on campus. Open to all students by audition. (Typically Offered: Fall, Spring)

MUSIC 1410: Lyrica Ensemble

Credits: 1. Contact Hours: Laboratory 2.

Repeatable.

Large chorus; emphasis on wide variety of literature and singing sounds from around the world. Includes fundamental voice and choral skills. Campus concerts each semester. Open to all treble voice students by audition. (Typically Offered: Fall, Spring)

MUSIC 1510A: University Chorus: Cantamus Women's Choir

Credits: 1. Contact Hours: Laboratory 3.

Repeatable.

Large chorus; emphasis on adventurous, contemporary programming. Advanced skills required. Campus concerts each semester, some in conjunction with orchestra. Open to all treble voice students by audition. (Typically Offered: Fall, Spring)

MUSIC 1510B: University Chorus: Statesmen Men's Choir

Credits: 1. Contact Hours: Laboratory 3.

Repeatable.

Advanced skills required, high quality literature. Campus concerts each semester, some concerts in conjunction with orchestras. Men's and women's choirs separately and in combination. Open to all students by audition. (Typically Offered: Fall, Spring)

MUSIC 1610: Iowa State Singers

Credits: 1. Contact Hours: Laboratory 5.

Repeatable.

Concert choir specializing in performance of advanced music literature, Renaissance through contemporary. Campus concerts, annual spring tour. Open to all students by audition. (Typically Offered: Fall, Spring)

MUSIC 1810: Symphony Orchestra

Credits: 1. Contact Hours: Laboratory 4.

Repeatable.

Reading, preparation, and performance of standard repertoire. Five or six concerts annually plus occasional off-campus appearances. Open to all students by audition. (Typically Offered: Fall, Spring)

NS 1110: Introduction to Naval Science

Credits: 3. Contact Hours: Lecture 3, Laboratory 3.

Introduction to the organization, regulations, and capabilities of the US Navy, with emphasis on mission and principal warfare components. (Typically Offered: Fall)

NREM 1200: Introduction to Renewable Resources

(Cross-listed with AGRON 1200/ ENVS 1200).

Credits: 3. Contact Hours: Lecture 3.

Overview of soil, water, plants, and animals as renewable natural resources in an ecosystem context. History and organization of resource management. Concepts of integrated resource management. (Typically Offered: Fall, Spring)

PR 2200: Principles of Public Relations

Credits: 3. Contact Hours: Lecture 3.

Introduction to public relations in business, government and non-profit organizations; functions, processes, and management; ethics, public opinion and theory.

PHIL 2010: Introduction to Philosophy

Credits: 3. Contact Hours: Lecture 3.

It has been rumored that the unexamined life is not worth living. Philosophy is an attempt to begin examining life by considering such questions as: What makes us human? What is the world ultimately like? How should we relate to other people? Is there a god? How can we know anything about these questions? Understanding questions of this kind and proposed answers to them is what this course is all about. (Typically Offered: Fall, Spring, Summer)

PHIL 2060: Introduction to Logic and Scientific Reasoning

Credits: 3. Contact Hours: Lecture 3.

Basic principles of critical reasoning and argument evaluation. A consideration of basic forms of argumentation in science and everyday life. Application to contemporary issues and controversies. (Typically Offered: Fall)

PHIL 2070: Introduction to Symbolic Logic

(Cross-listed with LING 2070).

Credits: 3. Contact Hours: Lecture 3.

Introduction to fundamental logical concepts and logical symbolism. Development of natural deduction through first order predicate logic with identity. Applications to arguments in ordinary English and to philosophical issues. Linguistics majors should take LING/PHIL 2070 as early as possible. (Typically Offered: Fall, Spring)

PHIL 2300: Moral Theory and Practice

Credits: 3. Contact Hours: Lecture 3.

Investigation of moral issues in the context of major ethical theories of value and obligation; e.g., punishment, abortion, economic justice, job discrimination, world hunger, and sexual morality. Emphasis on critical reasoning and argument analysis. (Typically Offered: Fall, Spring, Summer)

PHIL 2350: Ethical Issues in a Diverse Society

Credits: 3. Contact Hours: Lecture 3.

This course will examine a range of arguments on diversity issues. Topics will include: the social status of women, the moral status of sexuality and homosexuality, the nature and role of racism in contemporary society, the relationship between biology, gender roles and social status, and various proposals for change from a variety of political perspectives. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall, Spring)

PHYS 1010: Physics for the Nonscientist

Credits: 3. Contact Hours: Lecture 3.

Survey of the principal areas of both classical and modern physics. Emphasis on the nature of the physical universe and the application of physical principles to life in the modern world. (Typically Offered: Fall, Spring, Summer)

PHYS 1150: Physics for the Life Sciences

Credits: 4. Contact Hours: Lecture 3, Discussion 1.

Emphasis on basic physics principles applied to biological problems. Topics include mechanics, fluids, thermodynamics, heat, light, sound, electricity and magnetism. A coordinated laboratory, PHYS 1150L laboratory is available. 1.5 yr. HS algebra, 1 yr. HS geometry, 1 semester HS trigonometry recommended. (Typically Offered: Fall, Spring)

PHYS 1310: General Physics I

Credits: 4. Contact Hours: Lecture 3, Discussion 1.

General background in physical concepts, principles, and methods for those who do not plan advanced study in physics or engineering. Mechanics, fluids, heat and thermodynamics, vibrations, waves, sound. 1.5 yr. HS algebra, 1 yr. HS geometry, 1 semester HS trigonometry recommended. (Typically Offered: Fall, Spring, Summer)

PHYS 1310L: General Physics I Laboratory

Credits: 1. Contact Hours: Laboratory 2.

Laboratory experiments in elementary kinematics, work and energy, conservation laws, rotational motion, waves and fluids. 1.5 yr. HS algebra, 1 yr. HS geometry, 1 semester HS trigonometry recommended. (Typically Offered: Fall, Spring, Summer)

PHYS 1320: General Physics II

Credits: 4. Contact Hours: Lecture 3, Discussion 1.

Prereq: PHYS 1310 or PHYS 2310

General background in physical concepts, principles, and methods for those who do not plan advanced study in physics or engineering. Electricity and magnetism, ray and wave optics, topics in modern physics. (Typically Offered: Fall, Spring, Summer)

PHYS 1320L: General Physics II Laboratory

Credits: 1. Contact Hours: Laboratory 2.

Prereq: Credit or enrollment in PHYS 1320

Laboratory experiments in Electricity and Magnetism, Wave and Optics. (Typically Offered: Fall, Spring, Summer)

PHYS 2310: Introduction to Classical Physics I

Credits: 4. Contact Hours: Discussion 1, Lecture 3.

Prereq: [MATH 1650 OR (MATH 1630X AND 1640X)] AND Credit or concurrent enrollment in MATH 1660

Tailored toward engineering majors (For a broader set of physics topics consider PHYS 2410). 3 hours of lecture each week plus 1 recitation each week. Review of basic vector manipulation, elementary mechanics including kinematics and dynamics of particles, work and energy, linear and angular momentum, conservation laws, rotational motion, oscillations, gravitation. (Typically Offered: Fall, Spring, Summer)

PHYS 2310L: Introduction to Classical Physics I Laboratory

Credits: 1. Contact Hours: Laboratory 2.

Prereq: MATH 1650 AND (credit or enrollment in MATH 1660) AND (credit or concurrent enrollment in PHYS 2310 or PHYS 2410)

Laboratory experiments in elementary kinematics, work and energy, conservation laws, and rotational motion. Proficiency in algebra, trigonometry, vector manipulation required. (Typically Offered: Fall, Spring, Summer)

PHYS 2320: Introduction to Classical Physics II

Credits: 4. Contact Hours: Discussion 1, Lecture 3.

Prereq: MATH 1660; PHYS 2310 or PHYS 2410

3 hours of lecture each week plus 1 recitation each week. Electric forces and fields; Electrical currents; DC circuits; Magnetic forces and fields; LR, LC, LCR circuits; AC circuits. (Typically Offered: Fall, Spring, Summer)

PHYS 2320L: Introduction to Classical Physics II Laboratory

Credits: 1. Contact Hours: Laboratory 2.

Prereq: MATH 1660 AND (Credit or concurrent enrollment in PHYS 2320 or PHYS 2420)

Laboratory experiments in fluid dynamics, electric forces and fields, electrical currents, DC circuits, magnetic forces and fields, and wave optics. (Typically Offered: Fall, Spring, Summer)

PHYS 2410: Principles and Symmetries in Classical Physics I

Credits: 5. Contact Hours: Lecture 3, Discussion 1.5, Laboratory 1.

Prereq: MATH 1650; credit or concurrent enrollment in MATH 1660

Covers all of mechanics; kinematics and dynamics of particles, work and energy, linear and angular momentum, conservation laws, rotational motion, oscillations, gravitation, and extremum principles. Topics in kinetic theory, thermodynamics, waves and sound. Proficiency in algebra, trigonometry, vector manipulation required. (Typically Offered: Fall)

POLS 1110: Introduction to American Government

Credits: 3. Contact Hours: Lecture 3.

Fundamentals of American democracy; constitutionalism; federalism; rights and duties of citizens; executive, legislative, and judicial branches of government; elections, public opinion, interest groups, and political parties. (Typically Offered: Fall, Spring)

POLS 1210: Introduction to International Politics

Credits: 3. Contact Hours: Lecture 3.

Dynamics of interstate relations pertaining to nationalism, the nation state; peace and war; foreign policy making; the national interest; military capability and strategy; case studies of transnational issues, such as population, food, energy, and terrorism. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

POLS 1250: Democracy and Dictatorship: Introduction to Comparative Politics

Credits: 3. Contact Hours: Lecture 3.

Interactions between governments and citizens in countries outside the US. Causes of democracy, dictatorship, and economic and social development. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

PSYCH 1010: Introduction to Psychology

Credits: 3. Contact Hours: Lecture 2, Discussion 1.

Fundamental psychological concepts derived from the application of the scientific method to the study of behavior and mental processes. Applications of psychology. (Typically Offered: Fall, Spring, Summer)

PSYCH 1020: Laboratory in Introductory Psychology

Credits: 1. Contact Hours: Laboratory 2.

Prereq: Credit or concurrent enrollment in PSYCH 1010

Laboratory to accompany 1010. (Typically Offered: Fall, Spring)

PSYCH 1110: Orientation to Psychology

Credits: 1. Contact Hours: Lecture 1.

Program requirements and degree/career options. Required of psychology majors. (Typically Offered: Fall, Spring)

PSYCH 1310: Academic Learning Skills

Credits: 1. Contact Hours: Lecture 1.

Evidence-based approach to learning and applying academic skills such as time management, note-taking, reading, test preparation, goal setting and motivation, and well-being. Hybrid course structured in a team-based learning format. (Typically Offered: Fall, Spring)

PSYCH 2300: Developmental Psychology

Credits: 3. Contact Hours: Lecture 3.

Life-span development of physical traits, cognition, intelligence, language, social and emotional behavior, personality, and adjustment. (Typically Offered: Fall, Spring, Summer)

PSYCH 2500: Psychology of the Workplace

Credits: 3. Contact Hours: Lecture 3.

Survey of theories and research methods of psychology applied to the workplace. Consideration of employee selection, training, performance evaluation, leadership, work groups, employee motivation, job attitudes and behaviors, organizational culture, organizational development, human factors, and job design from the scientist-practitioner approach.

PSYCH 2800: Social Psychology

Credits: 3. Contact Hours: Lecture 3.

Individual human behavior in social contexts. Emphasis on social judgments and decisions, attitudes, perceptions of others, social influence, aggression, stereotypes, and helping. (Typically Offered: Fall, Spring, Summer)

RELIG 2050: World Religions

(Cross-listed with WLC 2050).

Credits: 3. Contact Hours: Lecture 3.

An introduction to religious studies - the academic study of religion. Religions from around the world will be discussed, including their myths, rituals, beliefs, values, and social forms. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

RELIG 2100: Religion in America

Credits: 3. Contact Hours: Lecture 3.

Introductory study of the major beliefs, practices, and institutions of American Judaism, Catholicism, Protestantism, and Islam with emphasis on the diversity of religion in America, and attention to issues of gender, race, and class. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall, Spring, Summer)

RELIG 3320: Catholicism

Credits: 3. Contact Hours: Lecture 3.

Examination of the history and theology of Catholicism from an academic perspective. Attention to Catholic doctrine, diverse experiences of lay Catholics, and Catholicism's influence on politics, culture, and art. (Typically Offered: Fall)

RUS 1010: Introduction to Russian Language and Culture I

Credits: 4. Contact Hours: Lecture 4.

Introduction to the Russian language (focusing on the development of speaking, listening, reading and writing skills) and Russian culture. (Typically Offered: Fall)

RUS 2010: Intermediate Russian I

Credits: 4. Contact Hours: Lecture 4.

Prereq: RUS 1020

Thorough review of grammar and growth of vocabulary. Selected readings. Continued use of the four basic skills. Meets International Perspectives Requirement. (Typically Offered: Fall)

SE 1010: Software Engineering Orientation

Credits: Required. Contact Hours: Lecture 1.

Introduction to the procedures, policies, and resources of Iowa State University and the Software Engineering Program. Offered on a satisfactory-fail basis only.

SE 1850: Problem Solving in Software Engineering

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Credit or concurrent enrollment in MATH 1430 (or satisfactory scores on mathematics placement examinations)

Introduction to software engineering and computer programming. Systematic thinking process for problem solving in the context of software engineering. Group problem solving. Solving software engineering problems and presenting solutions through computer programs, written documents and oral presentations. Introduction to principles of programming, software design, and extensive practice in design, writing, running, debugging, and reasoning about programs. Satisfactory placement scores can be found at: <https://math.iastate.edu/academics/undergraduate/aleks/placement/>. Graduation Restriction: Only one of ENGR 1600, ABE 1600, AERE 1600, BME 1600, CE 1600, CHE 1600, CPRE 1850, EE 1850, IE 1480, ME 1600, and SE 1850 may count towards graduation.

SOC 1150: Orientation to Sociology

Credits: 1. Contact Hours: Lecture 1.

Orientation to sociology. A familiarization with University and LAS College requirements and procedures. Occupational tracks and career options open to sociology; introduction to career planning. Recommended during first semester of freshman year, or as soon as possible after transfer into the department. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

SOC 1340: Introduction to Sociology

Credits: 3. Contact Hours: Lecture 3.

Overview of sociological thought and research on the sociological imagination, socialization, social control, stratification, institutions, and the forces of social change. Individual lives are placed in social and historical context to better understand our place in the world and our time in history. (Typically Offered: Fall, Spring, Summer)

SOC 2190: Families and Intimate Relationships

Credits: 3. Contact Hours: Lecture 3.

Exploration of families and intimate relationships using a sociological perspective, with the goal to help students make informed and intentional choices in their relationships across the life course. Topics covered include family definitions and theories, sexuality, singlehood, dating, cohabitation, marriage, parenting, divorce, stepfamilies, and aging. Relationship quality, communication, conflict, and work-life balance will also be examined, as well as differences in family dynamics by gender, race and ethnicity, and class. (Typically Offered: Fall, Spring)

SOC 2350: Social Problems and American Values

Credits: 3. Contact Hours: Lecture 3.

Explores relationship between contemporary social problems and American values. Explores how contradictory values impede political consensus while complicating our ability to define and solve social problems. Discussion may focus upon: working conditions, income and wealth, poverty and welfare, impacts of technology on society, criminal justice and victimization, reproductive rights and gender, child rearing and education, immigration and race, guns and violence, and environment and climate change. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall, Spring)

SPCM 1100: Listening

Credits: 3. Contact Hours: Lecture 3.

Theory, principles, and competency development in comprehensive, therapeutic, critical, consumer, and appreciative listening. The impact of listening in relationships and partnerships. (Typically Offered: Fall, Spring)

SPCM 2120: Fundamentals of Public Speaking

Credits: 3. Contact Hours: Lecture 3.

Prereq: [(Score of 2+ on EPT for ENGL 0990S OR Credit in ENGL 0990S) AND (Membership in EPT Advisory Group)] OR [No Membership in EPT Advisory Group]

Theory and practice of basic speech communication principles applied to public speaking. Practice in the preparation and delivery of extemporaneous speeches. (Typically Offered: Fall, Spring, Summer)

SPCM 2160: America Speaks: Great Speakers and Speeches in US History

Credits: 3. Contact Hours: Lecture 3.

Survey of great speeches examined within their political and cultural contexts. Analysis of the rhetorical strategies of diverse speakers with an emphasis on texts from social movements in the United States. Meets U.S. Cultures and Communities Requirement.

SPCM 2750: Analysis of Popular Culture Texts

(Cross-listed with ENGL 2750).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or concurrent enrollment in ENGL 2500

Analysis of how information and entertainment forms persuade and manipulate audiences. Study of several forms that may include newspapers, speeches, television, film, advertising, fiction, and magazines. Special attention to verbal and visual devices. (Typically Offered: Fall, Spring)

SPED 2500: Education of the Exceptional Learner

Credits: 3. Contact Hours: Lecture 3.

An overview of students with diverse learning needs, including students with disabilities, English Learners, students who are at risk, and gifted learners. Emphasis is on early identification; educational programming and implications; and legal foundations. Includes Individual Education Programs, Least Restrictive Environment, Functional Behavioral Assessment, and Behavior Intervention Plans. (Typically Offered: Fall, Spring)

SPAN 1010: Elementary Spanish I

Credits: 4. Contact Hours: Lecture 4.

A communicative approach to grammar and vocabulary within the context of Hispanic culture. For students whose native language is not Spanish. Students Who Have Completed One Or More Years Of High School Spanish May Not Enroll In 101. Testout Not Available If Also Registered. (Typically Offered: Fall, Summer)

SPAN 1020: Elementary Spanish II

Credits: 4. Contact Hours: Lecture 4.

Prereq: SPAN 1010 or SPAN 0970 or placement by departmental exam

Continuation of Spanish 1010. A communicative approach to grammar and vocabulary within the context of Hispanic culture. For students whose native language is not Spanish. Meets International Perspectives Requirement. (Typically Offered: Spring, Summer)

SPAN 2010: Intermediate Spanish I

Credits: 4. Contact Hours: Lecture 4.

Prereq: SPAN 1020 or placement by departmental exam

Intensive review of basic grammar and conversation. For students whose native language is not Spanish. Practice in oral and written communication. Development of fluency with idiomatic expressions. Selected readings on culture and literature. Meets International Perspectives Requirement. (Typically Offered: Fall)

SPAN 2970: Intensive Intermediate Spanish

Credits: 4. Contact Hours: Lecture 4.

Prereq: SPAN 2010 or placement by departmental exam

Bridge course between 2000- and 3000-level Spanish courses that focuses on application of advanced grammatical concepts within the context of Hispanic culture. Accelerated review of SPAN 2010 and SPAN 2020 designed for students who want to continue at the 3000 level. Taught in Spanish for students whose native language is not Spanish. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

STAT 1010: Principles of Statistics

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Statistical concepts in modern society; descriptive statistics and graphical displays of data; the normal distribution; data collection (sampling and designing experiments); elementary probability; elements of statistical inference; confidence intervals and hypothesis testing; linear regression and correlation; contingency tables. 1 1/2 years of high school algebra required. Graduation Restriction: Credit for only one of the following courses may be applied toward graduation: STAT 1010, STAT 1040, STAT 2010, or STAT 2260. (Typically Offered: Fall, Spring, Summer)

STAT 1040: Introduction to Statistics

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Statistical concepts and their use in science; collecting, organizing and drawing conclusions from data; elementary probability; binomial and normal distributions; regression; confidence intervals and hypothesis testing. For students in the agricultural and biological sciences. 1 1/2 years of high school algebra required. Graduation Restriction: Credit for only one of the following courses may be applied toward graduation: STAT 1010, STAT 1040, STAT 2010, or STAT 2260. (Typically Offered: Fall, Spring, Summer)

THTRE 1060: Introduction to the Performing Arts

Credits: 3. Contact Hours: Lecture 3.

An audience oriented, broad-based, survey of the performing arts which emphasizes theatre and includes segments on television, radio and podcasts, film, dance, music, and video games. (Typically Offered: Fall, Spring)

THTRE 1100: Theatre and Society

Credits: 3. Contact Hours: Lecture 3.

An introduction to Theatre focusing on its relationship with society throughout history. (Typically Offered: Fall, Spring)

THTRE 2510: Acting Foundations

Credits: 3. Contact Hours: Lecture 3.

Theory and practice in fundamentals of acting. (Typically Offered: Fall, Spring)

TSM 1150: Solving Technology Problems

Credits: 3.

Prereq: Credit or enrollment for credit in MATH 1400 or higher

Solving technology problems using modern hardware and software tools for data-driven solutions. Problem solving cycle, unit conversion, unit factor method, SI and engineering units, significant figures, data collecting and cleaning, error analysis, data visualization, curve fitting, and computer coding fundamentals (data types, flow control, I/O handling, visualization, debugging). Strong emphasis on critical thinking, systematic problem solving, and effective communication. (Typically Offered: Fall, Spring)

TSM 1160: Introduction to Design in Technology

Credits: 3.

Use of parametric solid modeling software to create three dimensional solid models and document parts and assemblies. Includes national and international standards for documentation, design projects, and teamwork. Rapid prototyping design creation, 3D printing, assemblies, rendering, and detailing technical drawings. (Typically Offered: Fall, Spring)

USLS 2110: Introduction to U.S. Latino/a Studies

Credits: 3. Contact Hours: Lecture 3.

History and current lives of the Latino/a peoples in the United States, including Mexican, Cuban, Puerto Rican, Dominican, and South and Central Americans, as well as information specific to Iowa Latino/as, will be covered. Through readings, class discussions, writing assignments, and guest speakers, students will acquire accurate information and a solid understanding of the US Latino/a population and cultural perspectives. Elements of Latino/a culture to be covered include historical, sociological, educational, psychological, economic, and political facets. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall, Spring)

WGS 1600: Gender Justice

Credits: 1. Contact Hours: Lecture 0.5, Discussion 0.5.

Half semester course. Examines the socialization process in the United States and how our perspectives are formed. An introduction to patriarchy, sexism, and ally development are explored. Skills to enhance communication and understanding among women and men will be developed. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

WGS 2010: Introduction to Women's and Gender Studies

Credits: 3. Contact Hours: Lecture 3.

Introduction to the interdisciplinary field of Women's and Gender Studies. Contemporary status of women in the U.S. and worldwide from social, economic, historical, political, philosophical and literary perspectives. Analysis of intersection of gender, race, class, and sexuality. Subject matter includes work, health, sexuality, and violence. Foundation for the other courses in the program. Meets U.S. Cultures and Communities Requirement.

WFS 2780: Introduction to Global Film

Credits: 3. Contact Hours: Lecture 3.

Introduction to the cinema of non-English speaking regions and cultures of the world through representative subtitled films, lectures, and readings. Topics vary according to faculty interest. Emphasis on selected national cinemas and film as a mode of cultural expression as well as on diverse cultural contexts of cinema. Meets International Perspectives Requirement. (Typically Offered: Fall)

Credits

The academic value of each course is stated in semester credits.

Each credit is normally earned by attending one (50-minute) hour of lecture or recitation per week for the entire semester, or by attending a laboratory or studio period of two or three hours per week. As a guideline, undergraduate students typically will be expected to spend two hours in preparation outside of class for each lecture or recitation hour; additional outside work may be required for laboratory or studio classes.

Contact Hours

Each course states the number of semester credits assigned to the course, preceded in parentheses by the number of hours in class (contact hours) expected of the student. The first of the two contact-hour numbers indicates the number of lecture or recitation class hours per week for the semester. The second is the number of laboratory or studio hours required per week. Laboratory and studio hours may include some time devoted to lectures and recitations. For example, COMS 2270 Introduction to Object-oriented Programming is listed as (3-2) Cr. 4. In that case, the course is 4 semester credits, 3 hours of lecture and two hours of laboratory each week.

Semester Offering

The expected term a course is to be offered is indicated by the abbreviations F (Fall) S (Spring) SS (Summer). The notations are for planning purposes and *do not* guarantee a course will be offered in a particular term. Always check the Schedule of Classes (<http://classes.iastate.edu>) for availability and specific offering times.

PLAN OF STUDY - SOAR IN 4

Four Year Graduation Guarantee

Iowa State University's Soar in 4: Four-Year Graduation Guarantee provides the opportunity for students to take a proactive approach towards completing their undergraduate degree in four years (or eight semesters). Through careful planning with their academic advisors, students can complement their undergraduate degree with experiences such as study abroad, internship, and service learning. By graduating in four years, students can reduce their tuition costs and accelerate their entry into the job market or advanced education compared to students who take more than eight semesters to graduate. The program encourages students to work collaboratively with their academic advisor to make strategic academic decisions about which courses to take each semester.

Students wanting to graduate in four years under the Soar in 4: Four-Year Graduation Guarantee are expected to:

- Keep in close contact with their Iowa State academic advisor, who will guide students' academic decisions and keep students up-to-date with university policies and procedures.
- Take required courses at the times they are available.
- Maintain student registration at ISU during off-campus experiences.
- Register for classes promptly and monitor academic progress on a regular basis by reviewing the degree audit with their advisor.

Iowa State University will provide the academic advising services and degree-audit mechanisms to assist students in accurately monitoring progress toward graduation. ISU is also responsible for providing class space in the courses required for the student's respective major in order to complete a bachelor's degree within eight consecutive semesters.

Additional information about the Four-Year Graduation Guarantee can be found at:

<http://www.provost.iastate.edu/academic-programs/soarin4> (<http://www.provost.iastate.edu/academic-programs/soarin4/>)

Four-year (eight-semester) templates for ISU programs of study

Iowa State University offers over 100 majors in six undergraduate colleges. All but two programs, architecture and landscape architecture, may be completed in four years. ISU's bachelor degree programs require from 120 to 144 credits; therefore, students must average between 15 and 18 credits per semester. To assist students in creating their own personal four-year academic plans, eight-semester templates are provided for all programs of studies covered by the Soar in 4 program.

- Agricultural and Life Sciences Education, B.S. - communications option
- Agricultural and Life Sciences Education, B.S. - teacher certification option
- Agricultural and Rural Policy Studies, B.S.
- Agricultural Business, B.S.
- Agricultural Studies, B.S.
- Agricultural Systems Technology, B.S. - Agricultural and Biosystems Management option
- Agricultural Systems Technology, B.S. - Machine Systems option
- Agronomy, B.S.
- Animal Ecology, B.S. - fisheries and aquatic sciences
- Animal Ecology, B.S. - interpretation of natural resources option
- Animal Ecology, B.S. - Pre-vet & wildlife care option
- Animal Ecology, B.S. - wildlife option
- Animal Science, B.S.
- Animal Science, B.S. - pre-veterinary medicine
- Biochemistry, B.S. - option 1
- Biochemistry, B.S. - option 2
- Biology, B.S.
- Culinary Food Science, B.S.
- Dairy Science, B.S. - general
- Dairy Science, B.S. - pre-veterinary medicine option
- Diet and Exercise, B.S./M.S.
- Dietetics, B.S.
- Environmental Science, B.S.
- Food Science, B.S.
- Forestry, B.S. - Forest Ecosystem Management option
- Genetics, B.S.
- Global Resource Systems, B.S.
- Horticulture, B.S. - Greenhouse Plant Production option
- Horticulture, B.S. - Horticulture Food Crop Production and Management option
- Horticulture, B.S. - Landscape Design, Installation, and Management
- Horticulture, B.S. - Public Horticulture option
- Horticulture, B.S. - Horticulture Research option
- Horticulture, B.S. - Turfgrass Management option
- Industrial Technology, B.S. - manufacturing option
- Industrial Technology, B.S. - occupational safety option
- Microbiology, B.S.
- Nutritional Science, B.S. - nutritional and wellness option
- Nutritional Science, B.S. - pre-health professional & research option

- Accounting, B.S.
- Actuarial Science, B.S.
- Business Analytics, B.S.
- Business Economics, B.S.
- Entrepreneurship, B.S.
- Finance, B.S.
- Healthcare Management, B.S.
- Human Resource Management, B.S.
- Management, B.S.
- Management Information Systems, B.S.
- Marketing, B.S.
- Supply Chain Management, B.S.
- Architecture, B.Arch.
- Art and Design, B.A., Art and Culture Concentration
- Art and Design, B.A., Visual Culture Studies Concentration
- Community and Regional Planning, B.S.
- Graphic Design, B.F.A.
- Industrial Design
- Integrated Studio Arts, B.F.A.
- Interior Design, B.F.A.
- Landscape Architecture, B.L.A.
- Aerospace Engineering, B.S.
- Agricultural Engineering, B.S. - ag power and machinery option
- Agricultural Engineering, B.S. - animal production systems engineering option
- Agricultural Engineering, B.S. - land and water resources engineering option
- Biological Systems Engineering, B.S. - ecological engr option
- Biological Systems Engineering, B.S. - food & bioprocess engr option
- Biological Systems Engineering, B.S. - open option
- Chemical Engineering, B.S.
- Civil Engineering, B.S. - environmental specialization
- Civil Engineering, B.S. -GENERAL Program
- Computer Engineering, B.S.
- Construction Engineering, B.S. building emphasis
- Construction Engineering, B.S. electrical emphasis
- Construction Engineering, B.S. heavy/highway emphasis
- Construction Engineering, B.S. mechanical emphasis
- Cyber Security Engineering, B.S.
- Electrical Engineering, B.S.
- Environmental Engineering, B.S.
- Industrial Engineering, B.S.
- Materials Engineering, B.S.
- Mechanical Engineering, B.S.
- Software Engineering, B.S.
- Apparel, Merchandising, and Design, B.S. - creative and technical design option
- Apparel, Merchandising, and Design, B.S. - merchandising retail analytics option
- Apparel, Merchandising, and Design, B.S. - product development for apparel and soft goods option
- Apparel, Merchandising, and Design, B.S. - fashion communications
- Culinary Food Science, B.S.
- Diet and Exercise, B.S./M.S.
- Dietetics, B.S.
- Early Childhood Education, B.S.
- Elementary Education, B.S.
- Event Management, B.S.
- Family and Consumer Sciences Education and Studies, B.S. - communications option
- Family and Consumer Sciences Education and Studies, B.S. - professional studies option
- Financial Counseling and Planning, B.S.
- Food Science, B.S.
- Hospitality Management, B.S.
- Human Development and Family Studies, B.S.-Advocacy, Administration, & Policy option
- Human Development and Family Studies, B.S.-Child Development & Guidance option
- Human Development and Family Studies, B.S.-Health, Well-being, & Prevention option
- Kinesiology and Health, B.S. - Community/Public Health
- Kinesiology and Health, B.S. - Exercise Science
- Kinesiology and Health, B.S. - Physical Activity and Health Promotion
- Kinesiology and Health, B.S. - Physical Education Teacher Education
- Kinesiology and Health, B.S. - Pre-Health Professions - Chiropractic
- Kinesiology and Health, B.S. - Pre-Health Professions - Dentistry
- Kinesiology and Health, B.S. - Pre-Health Professions - Human Medicine (Pharmacy)
- Kinesiology and Health, B.S. - Pre-Health Professions - Occupational Therapy
- Kinesiology and Health, B.S. - Pre-Health Professions - Optometry
- Kinesiology and Health, B.S. - Pre-Health Professions - Physical Therapy

- Kinesiology and Health, B.S. - Pre-Health Professions - Physician Assistant
- Nutritional Science, B.S. - Nutrition & wellness option
- Nutritional Science, B.S. - Pre-health professional & research option
- Advertising, B.A.
- Anthropology, B.A., B.S.
- Biochemistry, B.S.
- Bioinformatics and Computational Biology B.S.
- Biology, B.S.
- Biophysics, B.S.
- Chemistry, B.A.
- Chemistry, B.S.
- Climate Science, B.S.
- Communication Studies, B.A.
- Computer Science, B.A., B.S.
- Criminal Justice, B.A.
- Data Science, B.S.
- Earth Science, B.A., B.S.
- Economics, B.S.
- English, B.A. - English Education
- English, B.A., B.S.
- Environmental Science, B.S.
- Genetics, B.S.
- Geology, B.S.
- History, B.S.
- History, B.A.
- Journalism and Mass Communication, B.A., B.S.
- Linguistics, B.A.
- Mathematics, B.S.
- Meteorology, B.S.
- Music, B.A.
- Music, B.Mus. - Instrumental: K-12 Certification
- Music, B.Mus. - organ
- Music, B.Mus. - piano
- Music, B.Mus. - strings
- Music, B.Mus. - vocal: K-12 certification
- Music, B.Mus. - voice
- Music, B.Mus. - wind or percussion instrument
- Music, B.Mus.-composition
- Performing Arts, B.A.
- Philosophy, B.A.
- Physics, B.S.
- Political Science, B.A.
- Psychology, B.A.
- Psychology, B.S.
- Public Relations, B.S.
- Religious Studies, B.A.
- Scientific Illustration and Visualization (<http://catalog.iastate.edu/planofstudy/collegeofliberalartsandsciences/scientificillustrationandvisualization/>), B.A. (<http://catalog.iastate.edu/planofstudy/collegeofliberalartsandsciences/scientificillustrationandvisualization/>)
- Sociology, B.A., B.S.
- Software Engineering, B.S.
- Speech Communication, B.A.
- Statistics, B.S.
- Technical Communication, B.S.
- Theatre, B.A. - See Performing Arts
- Women's and Gender Studies, B.A., B.S.
- World Languages and Cultures B.A-French/German/Spanish

UNDERGRADUATE MAJORS, CERTIFICATES, MINORS, PRE-PROFESSIONAL STUDY

ACADEMIC PROGRAM DEFINITIONS

- **Program** - Administrative infrastructure supporting the curriculum.
- **Curriculum** - The requirements for a major, certificate, or minor.
- **Major** - Subject area of study that results in a named baccalaureate, masters, or doctoral degree upon completion of a set of requirements. A major appears on the academic transcript.
- **Secondary major** - A major that can only be earned concurrent with a primary major. A secondary major appears on the academic transcript.
- **Option** - Credits within an undergraduate major in which students choose coursework focused on a subset of the subject area of study. The remainder of the degree requirements are common to all students in the major. Options have also been called specializations, tracks, emphasis areas, focus areas, etc. An option does not appear on the academic transcript.
- **Certificate** - An academic credential in a focused area of study. A certificate appears on the academic transcript and may be earned concurrent with a degree or on its own.
- **Minor** - An academic area of emphasis that is in addition to a major. A minor appears on the academic transcript and must be earned concurrent with a degree.

UNIVERSITY REQUIREMENTS

Undergraduate Degree Requirements

Iowa State University offers a wide variety of undergraduate majors housed in six colleges. The requirements for all majors include the following university-wide requirements for graduation:

- Communication Proficiency
- U.S. Cultures & Communities
- International Perspectives
- LIB 1600 Introduction to College Level Research
- Minimum of 120-semester credits
- Cumulative grade point average of at least 2.00 in all coursework taken at ISU

See Degree Planning for university-wide requirements for the bachelor's degree.

COLLEGES

- College of Agriculture and Life Sciences
- Ivy College of Business

- College of Design
- College of Engineering
- College of Health and Human Sciences
- College of Liberal Arts and Sciences

The College of Veterinary Medicine offers the Doctor of Veterinary Medicine degree.

For a listing of the majors offered by the Graduate College, see the Graduate Programs list in this catalog.

UNDERGRADUATE MAJORS

See Degree Planning for university-wide requirements for the bachelor's degree.

Major - Subject area of study that results in a named baccalaureate, masters, or doctoral degree upon completion of a set of requirements. A major appears on the academic transcript.

Secondary major - A major that can only be earned in conjunction with a primary major. A secondary major appears on the academic transcript.

Option - Credits within an undergraduate major in which students choose coursework focused on a subset of the subject area of study. The remainder of the degree requirements are common to all students in the major. Options have also been called specializations, tracks, emphasis areas, focus areas, etc. An option does not appear on the academic transcript.

- Accounting, B.S.
- Actuarial Science, B.S.
- Advertising, B.A.
- Aerospace Engineering, B.S.
- Agricultural and Life Sciences Education, B.S.
- Agricultural and Rural Policy Studies, B.S.
- Agricultural Business, B.S.
- Agricultural Communication, B.S.
- Agricultural Engineering, B.S.
- Agricultural Studies, B.S.
- Agricultural Systems Technology, B.S.
- Agronomy, B.S.
- Animal Ecology, B.S.
- Animal Science, B.S.
- Anthropology, B.A., B.S.
- Architecture, B.Arch.
- Art, B.A.
- Art, B.F.A.
- Art History, B.A.

- Athletic Training
- Biochemistry, B.S. (College of Agriculture and Life Sciences)
- Biochemistry, B.S. (College of Liberal Arts and Sciences)
- Bioinformatics and Computational Biology, B.S.
- Biological Systems Engineering, B.S.
- Biology, B.S. (College of Agriculture and Life Sciences)
- Biology, B.S. (College of Liberal Arts and Sciences)
- Biomedical Engineering, B.S.
- Business Administration, B.B.A.
- Business Analytics, B.S.
- Business Economics, B.S.
- Chemical Engineering, B.S.
- Chemistry, B.A., B.S.
- Civil Engineering, B.S.
- Classical Studies - *See Interdisciplinary Studies, B.A., B.S.*
- Climate Science, B.S.
- Communication Studies, B.A.
- Community and Regional Planning, B.S.
- Computer Engineering, B.S.
- Computer Science, B.A., B.S.
- Construction Engineering, B.S.
- Criminal Justice, B.A.
- Culinary Food Science, B.S. (College of Agriculture and Life Sciences)
- Culinary Food Science, B.S. (College of Health and Human Sciences)
- Cyber Security Engineering, B.S.
- Dairy Science, B.S.
- Data Science, B.S.
- Diet and Exercise, B.S./M.S. (College of Agriculture and Life Sciences)
- Diet and Exercise, B.S./M.S. (College of Health and Human Sciences)
- Dietetics, B.S. (College of Agriculture and Life Sciences)
- Dietetics, B.S. (College of Health and Human Sciences)
- Early Childcare Education and Programming, B.S.
- Early Childhood Education, B.S.
- Earth Science, B.A., B.S.
- Economics, B.S.
- Education Secondary - *See Undergraduate Secondary Majors*
- Electrical Engineering, B.S.
- Elementary Education, B.S.
- English, B.A., B.S.
- Entrepreneurship, B.S.
- Environmental Engineering, B.S.
- Environmental Science, B.S. (College of Agriculture and Life Sciences)
- Environmental Science, B.S. (College of Liberal Arts and Sciences)
- Environmental Studies - *See Undergraduate Secondary Majors*
- Event Management, B.S.
- Family and Consumer Sciences Education and Studies, B.S.
- Fashion Design and Merchandising, B.S.
- Finance, B.S.
- Financial Counseling and Planning, B.S.
- Food Science, B.S. (College of Agriculture and Life Sciences)
- Food Science, B.S. (College of Health and Human Sciences)
- Forestry, B.S.
- French - *See World Languages and Cultures, B.A.*
- Game Design, B.S.
- Genetics, B.S. (College of Agriculture and Life Sciences)
- Genetics, B.S. (College of Liberal Arts and Sciences)
- Geology, B.S.
- German - *See World Languages and Cultures, B.A.*
- Global Resource Systems, B.S.
- Graphic Design, B.F.A.
- Healthcare Management, B.S.
- History, B.A., B.S.
- Horticulture, B.S.
- Hospitality Management, B.S.
- Human Development and Family Studies, B.S.
- Human Resource Management, B.S.
- Industrial Design, B.I.D.
- Industrial Engineering, B.S.
- Industrial Technology, B.S.
- Interdisciplinary Design - *See Undergraduate Secondary Majors*
- Interdisciplinary Studies, B.A., B.S.
 - Classical Studies
 - U.S. Latino/a Studies
- Interior Design, B.F.A.
- International Agriculture - *See Undergraduate Secondary Majors*
- International Business - *See Undergraduate Secondary Majors*
- International Studies - *See Undergraduate Secondary Majors*
- Journalism and Mass Communication, B.S.
- Kinesiology and Health, B.S.
- Landscape Architecture, B.L.A.
- Liberal Studies, B.L.S. (a general studies degree)
- Linguistics, B.A.

- Management, B.S.
- Management Information Systems, B.S.
- Marketing, B.S.
- Materials Engineering, B.S.
- Mathematics, B.S.
- Mechanical Engineering, B.S.
- Meteorology, B.S.
- Microbiology, B.S.
- Music, B.A., B.Mus.
- Nursing, B.S.N. (College of Agriculture and Life Sciences)
- Nursing, B.S.N. (College of Health and Human Sciences)
- Nutritional Science, B.S. (College of Agriculture and Life Sciences)
- Nutritional Science, B.S. (College of Health and Human Sciences)
- Performing Arts, B.A.
- Philosophy, B.A.
- Physics, B.S.
- Political Science, B.A.
- Professional Studies, B.L.S. (a general studies degree)
- Psychology, B.A., B.S.
- Public Relations, B.S.
- Religious Studies, B.A.
- Scientific Illustration and Visualization, B.A.
- Seed Science - *See Undergraduate Secondary Majors*
- Sociology, B.A., B.S.
- Software Engineering, B.S. (College of Engineering)
- Software Engineering, B.S. (College of Liberal Arts and Sciences)
- Spanish - *See World Languages and Cultures, B.A.*
- Sports Media and Communication, B.A.
- Statistics, B.S.
- Supply Chain Management, B.S.
- Technical Communication, B.S.
- Theatre - *See Performing Arts, B.A.*
- U.S. Latino/a Studies - *See Interdisciplinary Studies, B.A., B.S.*
- Women's and Gender Studies, B.A., B.S.
- World Languages and Cultures B.A.
 - French
 - German
 - Spanish

Undergraduate Secondary Majors

See Degree Planning for university-wide requirements for the bachelor's degree.

Secondary major - A major that can only be earned in conjunction with a primary major. A secondary major appears on the academic transcript.

- Education Secondary
- Environmental Studies
- Interdisciplinary Design
- International Agriculture
- International Business
- International Studies
- Seed Science

UNDERGRADUATE CERTIFICATES

See Degree Planning for university-wide requirements for an undergraduate certificate.

Certificate - An academic credential in a focused area of study. A certificate appears on the academic transcript and may be earned concurrently with a degree or on its own.

- Actuarial Science
- Beef Cattle Production Management
- Computing Applications
- Cyber Security
- Dairy Cattle Production Management
- Data Science
- Equine Science and Management
- Health Coach
- Healthcare Management
- Integrated Studio Arts
- Latin American Studies
- Leadership Studies
- Merchandising (^)
- Occupational Safety
- Poultry Production Management
- Professional Sales
- Real Estate
- Risk Management and Insurance
- Science Communication
- Soil Science (^)
- Swine Production Management

Certificates may be earned at the same time as an ISU baccalaureate degree or after the completion of a baccalaureate degree from any accredited institution. Those marked with a (^) may also be earned after the completion of an associate of arts (AA) or associate of science (AS) degree from any accredited institution.

Iowa State University also offers certificates from the Graduate College.

UNDERGRADUATE MINORS

See Degree Planning for university-wide requirements for an undergraduate minor.

Minor - An academic area of emphasis that is in addition to a major. A minor appears on the academic transcript and must be earned in conjunction with a degree.

- Accounting
- Advertising
- African and African American Studies
- Agricultural Business
- Agricultural Systems Technology
- Agriculture and Life Sciences Education
- Agronomy
- American Indian Studies
- Animal Ecology
- Animal Science
- Anthropology
- Apparel, Merchandising, and Design
- Applied Artificial Intelligence
- Artificial Intelligence
- Astronomy
- Beverage Management
- Biochemistry
- Bioinformatics and Computational Biology
- Scientific Illustration and Visualization (<http://catalog.iastate.edu/collegescurricula/collegeofliberalartsandsciences/scientificillustrationandvisualization/#minortext>)
- Biology
- Biomedical Engineering
- Business Analytics
- Business and Technology Consulting
- Chemistry
- Chinese Studies
- Classical Studies
- Communication Studies
- Computer Science
- Criminal Justice
- Critical Studies in Design
- Culinary Food Science
- Cyber-Physical Systems
- Cyber Security
- Dance
- Data Science
- Design Studies
- Digital Media
- Economics
- Education Services in Family and Consumer Sciences
- Energy Systems Engineering
- Engineering Sales
- English
- Entrepreneurship
- Environmental Studies
- Ethics
- Event Management
- Exercise Science
- Fashion Culture History and Social Justice
- Feed Technology
- Finance
- Financial Counseling and Planning
- Food and Society
- Food Safety
- Food Science
- Forestry
- French
- General Business
- Genetics (AGLS)
- Genetics (LAS)
- Geographic Information Science (GIS)
- Geology
- German
- Gerontology
- Global Health
- Global Human Sciences
- Health Promotion
- History
- Horticulture
- Hospitality Management
- Human Development and Family Studies
- Illustration
- Industrial Technology
- Insect Science
- International Agriculture
- International Business

- International Studies
- Journalism and Mass Communication
- Kinesiology
- Leadership Studies
- Learning and Leadership Sciences
- Learning Technologies
- Landscape Management
- Linguistics
- Management
- Management Information Systems
- Marketing
- Mathematics
- Meat Science
- Meteorology
- Microbiology
- Middle Eastern Studies
- Military Studies
- Music
- Music Technology
- Nondestructive Evaluation
- Nutrition
- Performing Arts (Theatre)
- Pharmacology and Toxicology
- Philosophy
- Physics
- Political Science
- Preservation and Cultural Heritage
- Psychology
- Public Relations
- Religious Studies
- Russian Studies
- Scientific Illustration and Visualization
- Sociology
- Spanish
- Spanish Translation and Interpretation Studies
- Speech Communication
- Statistics
- Supply Chain Management
- Sustainability
- Teaching English as a Second Language
- Technical Communication
- Textile Design

- Textile Science and Product Performance
- Theatre - See Performing Arts
- U.S. Latino/a Studies
- Urban Studies
- Women's and Gender Studies
- World Film Studies

PRE-PROFESSIONAL STUDY

Requirements for admission to most professional academic programs can be met by study at Iowa State University. Pre-professional programs such as pre-law or pre-med are not degree-granting majors, but rather tracks for students who plan to attend professional school (e.g., dental, medical, optometry, physical therapy, law, or veterinary medicine) after their undergraduate studies. Students can major in any field, and they will work with an advisor who helps with course sequencing and academic preparation for application to professional schools.

For more details, explore the pre-professional section of the catalog and explore the links below.

Tracks

- Pre-Health & Pre-Medicine (<https://pre-health.las.iastate.edu/>)
 - Dentistry (<https://pre-health.las.iastate.edu/health-professions/dentistry/>)
 - Human Medicine (<https://pre-health.las.iastate.edu/health-professions/human-medicine/>)
 - Optometry (<https://pre-health.las.iastate.edu/health-professions/optometry/>)
 - Pharmacy (<https://pre-health.las.iastate.edu/health-professions/pharmacy/>)
 - Physical Therapy (<https://pre-health.las.iastate.edu/health-professions/physical-therapy/>)
 - Physician Assistant (<https://pre-health.las.iastate.edu/health-professions/physicians-assistant/>)
- Pre-Law
- Pre-Veterinary Medicine

Pre-professional Study

Pre-professional Study

Iowa State University is a great place to prepare for careers that require professional school training, such as medical school, law school or veterinary school. Requirements for admission to most professional academic programs can be met during your studies at Iowa State University. The specific courses taken in a pre-professional program will depend primarily upon the admission requirements of the professional schools to which a student wants to apply.

In some programs where professional schools require only three years of pre-professional work, a student may, by careful planning, complete requirements for the bachelor's degree upon transferring to Iowa State up to 32 semester credits of professional coursework. Generally, these reverse transfer credits will be counted as electives, but a maximum of 24 may be used to apply to a major in Interdisciplinary Studies and a smaller number may be used to meet requirements in other majors as approved by the faculty.

All students, whether they have selected a major or not, are encouraged to identify their interest in a professional career by designating it on their application to the university. Students who have not decided on a major can enter Iowa State as pre-professional students, selecting pre-medical, pre-law, pre-professional health (PHP), Open Option, or General Undergraduate Studies Pre-Veterinary Medicine (GENPV), until they choose a major or transfer to a professional school.

Information about pre-professional program admissions requirements and career opportunities in human health or law is available in the Liberal Arts and Sciences Advising Center. Information about veterinary medicine admissions requirements and career opportunities is available from the coordinator of the pre-veterinary program in the Office of the Dean of the College of Veterinary Medicine.

Learn More About These and Other Pre-Professional Pathways

- Pre-Health & Pre-Medicine (<https://pre-health.las.iastate.edu/>)
 - Dentistry (<https://pre-health.las.iastate.edu/health-professions/dentistry/>)
 - Human Medicine (<https://pre-health.las.iastate.edu/health-professions/human-medicine/>)
 - Optometry (<https://pre-health.las.iastate.edu/health-professions/optometry/>)
 - Pharmacy (<https://pre-health.las.iastate.edu/health-professions/pharmacy/>)
 - Physical Therapy (<https://pre-health.las.iastate.edu/health-professions/physical-therapy/>)
 - Physician Assistant (<https://pre-health.las.iastate.edu/health-professions/physicians-assistant/>)
- Pre-Law
- Pre-Veterinary Medicine

Pre-Health and Pre-Medical Advising

[Iowa State University is a great place to prepare for careers in health and medicine. As a major research university with an exceptional student experience, we're excited to help you create a competitive application for medical or professional school.](#) Whether you are aiming for a career in human medicine, dentistry, occupational health, physical therapy, pharmacy, optometry, health information management, dietetics, hospital

and health administration, medical technology, clinical lab sciences, or many others, you can find the classes and experiences you need to be prepared for the next steps in your professional training. Learn more on the Pre-health and Pre-medical Professions Advising (<https://pre-health.las.iastate.edu/>) website.

PRE-Law Preparation

A student planning to enter law school may pursue an undergraduate degree in any discipline. The choice of the bachelor's degree should reflect a student's passion and personal interests rather than be limited by a belief that law schools require a specific major. Students should complete courses that will enhance their strengths in critical thinking, analytical writing, research and oral communication. Courses from a broad range of disciplines will provide students with the knowledge base and skills to support their preparation for law school. Courses might include accounting, criminal justice, economics, English literature, history, management, mathematics, political science, psychology, philosophy and statistics. Advanced writing courses and speech communication courses will also serve students well. The American Bar Association (https://www.americanbar.org/groups/legal_education/resources/pre_law/) advises students that "taking a broad range of difficult courses from demanding instructors is excellent preparation for legal education." The College of Liberal Arts and Sciences participates in a 3+3 program with the Law Schools at Drake University and at the University of Iowa. Visit the Liberal Arts and Sciences Student Academic Services office for details about the 3+3 program and pre-law club, and to explore your pathway to law school.

Learn more on the Pre-Law Advising (<https://pre-law.las.iastate.edu/>) website.

Pre-Veterinary Medicine

Deanna Gerber (futuredvm@iastate.edu)

About 75% of all veterinarians are engaged in private practice. In a mixed practice, they diagnose and treat health problems among a variety of animals. Others specialize in one species (e.g., feline, pet bird) and still others specialize in a specific discipline within veterinary medicine (e.g., cardiology, ophthalmology). Veterinarians may also choose public and corporate practice (e.g., public health, education, research, food safety, industry, laboratory animal medicine, aquatic animal medicine, poultry medicine, and military veterinary medicine).

The professional program requires four years at a college of veterinary medicine and leads to the doctor of veterinary medicine degree (D.V.M.). Admission to a veterinary college involves at least two years of preprofessional college education. Candidates must take courses in biology, chemistry, genetics, physics, English, humanities, social sciences, speech, anatomy and physiology, and biochemistry. (For Iowa State University see Pre-Veterinary Medicine Preparation in the Veterinary

Medicine section of the catalog; for the most current information regarding applications and admission to the College of Veterinary Medicine, please refer to the College website at www.vetmed.iastate.edu/ (<http://www.vetmed.iastate.edu/>).

Students may pursue their pre-veterinary preparation in any college at Iowa State University. A major (pre-veterinary medicine is not a major) should be selected that is allied to each student's vocational interests in veterinary medicine or that otherwise offers vocational satisfaction in the event that plans for entry into the College of Veterinary Medicine change. Students are encouraged to pursue a bachelor's degree; the most effective progress toward a bachelor's degree is made when a major is selected upon entry and no change occurs before graduation. However, students who have not even considered a career other than veterinary medicine may need some time to explore possibilities before selection of a major.

To assist students who have indicated interest in the pre-veterinary program for the College of Veterinary Medicine and are undecided about a major, an advising category is available known as GENPV (General Undergraduate Studies Pre Vet). Orientation and advising services for these students are designed to help students fulfill pre-veterinary course requirements, to introduce available majors and careers allied to veterinary medicine, and to introduce career options in veterinary medicine. GENPV students must select a major by the end of their second semester. Some Iowa State University majors allow, by careful planning, the opportunity for a student to earn the bachelor's degree by combining credits from three years of preprofessional study and one year of professional study in the College of Veterinary Medicine.

COLLEGE OF AGRICULTURE AND LIFE SCIENCES

Daniel Robison, Endowed Dean
Carmen Bain, Associate Dean, Academic Innovation
Theresa Cooper, Assistant Dean, Diversity
Jay Harmon, Associate Dean, Extension Programs and Outreach
Kendall Lamkey, Associate Dean for Facilities and Operations
Ruth MacDonald, Associate Dean, Personnel and Finance
Francis Owusu, Associate Dean, Global Engagement
Asheesh (Danny) Singh, Associate Dean, Research and Discovery

www.cals.iastate.edu (<http://www.cals.iastate.edu>)

Students enrolled in the College of Agriculture and Life Sciences receive a broad-based education that includes: communications, biological, physical, and social sciences, humanities, and technical subject matter.

Graduates of the College are prepared for diverse career opportunities because of the well-balanced education they have received. Opportunities for graduates of the College of Agriculture and Life Sciences includes: agribusiness and industry, production agriculture, biological and environmental sciences, value-added processing, natural resource management, rural development, public agencies, education, animal and human health professions, graduate studies and professional schools.

Advising

The College is proud of its quality of advising. Each student in the College of Agriculture and Life Sciences works closely with an academic advisor who is associated with the major in which the student is enrolled.

The advisors assist students in making personal adjustments to university life, offer suggestions on academic and co-curricular choices, and provide information on career choices. Advisors make a special effort to adjust course schedules in accordance with students’ interests and capabilities.

All entering students are strongly encouraged to participate in the summer orientation program in which they will have the opportunity to meet and work with academic advisors in planning their first semester schedule of classes.

A student may wish to prepare for admission to a professional program such as law, medicine, or veterinary medicine while pursuing a Bachelor of Science degree in the College of Agriculture and Life Sciences. This may be accomplished through several majors; however, it is recommended that the student work closely with an academic advisor.

Degree Requirements for all CALS Majors

All undergraduate majors in the College of Agriculture and Life Sciences (CALS) lead to a Bachelor of Science degree.

High School Preparation

Requirements for students entering from high school or transferring with less than 24 college credits into the College of Agriculture and Life Sciences include four years of English; three years of mathematics which must include one year each of algebra, geometry, and advanced algebra; three years of science which must include one year each of Biology and chemistry, or Biology and physics, or chemistry and physics; and two years of social studies. No foreign language is required for admission to the College of Agriculture and Life Sciences.

College Requirements

To graduate with a degree from the College of Agriculture and Life Sciences a student must complete, while at Iowa State University, a minimum of 18 credits from the College’s departmental offerings, program offerings, and cross-listed program offerings. Twelve or more of those 18 credits must be 3000-level or above. Some majors within the College may have more restrictive requirements.

Each major has specific degree requirements for graduation based on the major and college student learning outcomes. College of Agriculture and Life Sciences course requirements for the four areas listed below provide the foundation for successful achievement of both major and college student learning outcomes.

The College of Agriculture and Life Sciences course requirements for all majors are:

Interpersonal and public communication skills	10 credits
6 credits of English composition with grades of C or better	
3 credits of speech fundamentals with grades of C or better	
1 credit of LIB 1600 Introduction to College Level Research	
Mathematical, physical, and life sciences from college-approved lists	17 credits
3 credits of mathematics	
3 credits of statistics	
5 credits of physical science (e.g., chemistry, geological and atmospheric sciences, physics)	
6 credits of life sciences including BIOL 1010 Introductory Biology, or BIOL 2110 Principles of Biology I, or BIOL 2120 Principles of Biology II, or BIOL 2510 Biological Processes in the Environment and 3 additional credits of life sciences	

Personal development from approved lists 15 credits

3 credits of ethics (college list)

3 credits of humanities (college list)

3 credits of social sciences (college list)

3 credits of U.S. cultures & communities (university list)

3 credits of international perspectives (university list)

Students pursuing a primary major in another college and taking a second major in the College of Agriculture and Life Sciences must fulfill the core course requirements of the College of Agriculture and Life Sciences, and all the requirements of the second major.

Student Learning Outcomes

All students graduating with majors within the College of Agriculture and Life Sciences are expected to be able to do the following (college-level outcomes) at the time of graduation:

Communications

- Speak and write clearly and persuasively.
- Prepare effective visual and electronic forms of communication.

Problem-Solving/Critical Thinking

- Apply a holistic approach to identify and solve complex problems.
- Distinguish verifiable facts from value claims.
- Identify assumptions and detect bias.
- Distinguish relevant from irrelevant information.
- Establish priorities and courses of action.
- Summarize, analyze, and interpret research data and/or policy issues.

Leadership and Teamwork

- Organize, facilitate, and participate effectively in a group or team.
- Define a problem or opportunity and implement an action planning process.
- Work towards a goal and justify actions taken.

Creativity, Innovation and Entrepreneurship

- Demonstrate innovativeness and creativity.
- Identify and pursue opportunities that produce value.
- Identify resources to manage risk to facilitate change.

Ethics

- Define and assess their ethical perspective, moral responsibility, and values.
- Identify and critically evaluate contemporary ethical and moral issues in professional and private life.

Environmental Awareness

- Explain physical interactions within ecosystems.
- Explain biological interactions within ecosystems.

- Explain how human activities impact the environment.
- Explain how societies are affected by environmental change.

Cultures, Communities, and Global Citizenship (University Outcomes)

- Through completion of the U.S. Cultures & Communities requirement, should achieve at least three of the following learning outcomes:
 - Identify the experiences and contributions of underrepresented or marginalized groups and how they have shaped the history and culture of the United States.
 - Understand the analytical concepts of culture, ethnicity, race, gender, sexuality and/or religion and be able to apply these concepts to an analysis of the United States.
 - Analyze systemic oppression and personal prejudice and their impact on marginalized communities and the broad U.S. society; and
 - Evaluate important aspects of diversity, equity and inclusion so they can live, work and collaborate with others in the 21st century United States.
- Through completion of the International Perspectives requirements, students should achieve two of the following learning outcomes:
 - Analyze the accuracy and relevancy of their own worldviews and anticipate how people from other nations may perceive that worldview.
 - Describe and analyze how cultures and societies around the world are formed, are sustained, and evolve.
 - Analyze and evaluate the influence of global issues in their own lives.
 - Describe the values and perspectives of cultures other than their own and discuss how they influence individuals' perceptions of global issues and/or events; and
 - Communicate competently in a second language.

Information Literacy

- Demonstrate proficient acquisition and use of information relevant to their fields of study.

In addition to the College level learning outcomes, each major within the college has additional discipline-specific outcomes that apply to graduates of that major.

Electives

Students use electives in addition to degree requirements to broaden their education or to strengthen an area of specialization. Electives may be used to meet the requirements for multiple majors (see statement on multiple majors in this catalog).

Other Requirements

- Those who wish to change their major, or who decide to graduate with multiple majors, must be enrolled for the last two semesters in the major in which they expect to graduate.
- Students in ROTC may apply ROTC credits toward elective requirements. No more than 9 credits of 4900 coursework from any Iowa State University major may be applied toward graduation, although some individual majors may establish a more restrictive use of 4900 credits toward fulfillment of graduation requirements.

Graduate Study

Graduate study in agriculture and life sciences is conducted through the Graduate College. Details are found in the Graduate College section of this catalog.

Various departments in the College of Agriculture and Life Sciences also participate in the following graduate-level interdepartmental offerings:

- Ecology and Evolutionary Biology
- Environmental Science
- Genetics and Genomics
- Immunobiology
- Microbiology
- Molecular, Cellular, and Developmental Biology
- Neuroscience
- Nutritional Sciences
- Plant Biology
- Seed Technology and Business
- Sustainable Agriculture
- Technology and Social Change (interdepartmental minor)
- Toxicology

Departments in the College

Departments are the administrative units that offer undergraduate and graduate majors, minors and certificates in addition to their efforts in research, outreach and service. These are the departments in the College of Agriculture and Life Sciences:

- Agricultural and Biosystems Engineering (joint with the College of Engineering)
- Agricultural Education and Studies
- Agronomy
- Animal Science
- Roy J. Carver Department of Biochemistry, Biophysics, and Molecular Biology (joint with the College of Liberal Arts and Sciences)
- Ecology, Evolution, and Organismal Biology (joint with the College of Liberal Arts and Sciences)

- Economics (joint with the College of Liberal Arts and Sciences)
- Food Science and Human Nutrition (joint with the College of Health and Human Sciences)
- Genetics, Development and Cell Biology (joint with the College of Liberal Arts and Sciences)
- Horticulture
- Natural Resource Ecology and Management
- Plant Pathology, Entomology and Microbiology
- Sociology and Criminal Justice (joint with the College of Liberal Arts and Sciences)
- Statistics (joint with the College of Liberal Arts and Sciences)

Undergraduate Majors, Minors and Certificates

An undergraduate major is a subject area of study that results in a named baccalaureate degree upon completion of a set of requirements. All majors in the College of Agriculture and Life Sciences result in a Bachelor of Science degree.

A student has many majors from which to choose. Each major is unique although some courses are common across majors in the first two years. This is helpful to students in that they may transfer from one major to another before the second year with little loss of credits.

Options within a major further define some majors and specify certain required coursework. All majors are designed to help students achieve the learning outcomes and succeed in their chosen professions.

Primary Majors

Agricultural Business
 Agricultural Communication
 Agricultural and Life Sciences Education
 Agricultural and Rural Policy Studies
 Agricultural Studies
 Agricultural Systems Technology
 Agronomy
 Animal Ecology
 Animal Science
 Biochemistry
 Biology
 Culinary Food Science
 Dairy Science
 Diet and Exercise
 Dietetics
 Environmental Science
 Food Science
 Forestry
 Genetics

Global Resource Systems
Horticulture
Industrial Technology
Microbiology
Nursing
Nutritional Science

Secondary Majors*

Environmental Studies
International Agriculture
Seed Science

*A secondary major must be taken in conjunction with a primary major.

Minors

An undergraduate minor is an academic area of emphasis in addition to a major consisting of at least 15 credits. It must be earned concurrent with a major.

Agricultural Business
Agricultural and Life Sciences Education
Agricultural Systems Technology
Agronomy
Animal Ecology
Animal Science
Biochemistry
Biology
Culinary Food Science
Entrepreneurial Studies*
Environmental Studies
Feed Technology*
Food and Society
Food Safety*
Food Science
Forestry
Genetics
Global Health*
Horticulture
Industrial Technology
Insect Science
International Agriculture
Landscape Management
Learning and Leadership Sciences*
Meat Science
Microbiology
Nutrition
Sustainability*

*The College of Agriculture and Life Sciences participates in these interdepartmental minors.

Certificates

An undergraduate certificate is an academic credential in a focused area of study consisting of at least 20 credits. It may be earned concurrent with a major or on its own.

Beef Cattle Production Management
Dairy Cattle Production Management
Equine Science and Management
Poultry Production Management
Swine Production Management
Occupational Safety

Special Programs

Agriculture Exploration

Agriculture Exploration is a starting place for students who wish to pursue careers in the life sciences, food science, natural resources, production agriculture, business, or communications but who are unsure of which majors to choose. Students entering this program will be advised in the College of Agriculture and Life Sciences Student Services Office until they select their majors.

Pre-Veterinary Medicine

Students in the College of Agriculture and Life Sciences may complete the requirements for admission to the College of Veterinary Medicine by enrolling in any major within the college. Because a solid foundation in the sciences is basic to the program in veterinary medicine, those majors that emphasize the sciences are usually more compatible with veterinary medicine.

New students direct from high school who are undecided about choice of major may enroll as a general pre-veterinary studies (Gen PV) student. These students will also enroll in an orientation course, which describes the various college majors. By the end of their first semester, a Gen PV student must select a major. Transfer students, however, must select a major prior to enrolling in their first semester classes.

Enrollment as a Gen PV student does not guarantee admission into the College of Veterinary Medicine (veterinary school). See the College of Veterinary Medicine section of this catalog for specific admissions requirements.

Students accepted into the College of Veterinary Medicine without a Bachelor of Science degree have an opportunity, with careful planning, to complete the requirements for a Bachelor of Science degree in an individual curriculum within the College of Agriculture and Life Sciences after admission into the College of Veterinary Medicine. This may be done by completing the prescribed course of study established by an

individual major. Students also may meet degree requirements of an individual major through the College of Agriculture and Life Sciences Honors Program. Further details are available from an academic advisor or from members of the College of Agriculture and Life Sciences Honors Committee.

Honors Program

The College of Agriculture and Life Sciences Honors Program provides an opportunity for students of high ability to maximize their educational experience by individualizing their program of study. (See statement on Honors Program in the Colleges and Curricula section of this catalog). For more information, contact the chair of the College of Agriculture and Life Sciences Honors Committee, or a department Honors contact person.

Off-Campus Programs

Online courses, certificates, and graduate programs (<https://www.agonline.iastate.edu>) from the College of Agriculture and Life Sciences are designed for working professionals and recent graduates alike giving students anywhere in the world the opportunity to enhance their careers and advancing in their profession. Students learn from the same faculty and in the same classes as our resident students. Start your adventure with one of our online certificates or programs to advance your career.

Master's Programs: Agricultural Education, Agronomy, Plant Breeding, Seed Technology and Business

Graduate Certificates: Agronomy, Biochemistry, Food Safety and Defense, Meat Science, Seed Science and Technology, Seed Business Management

Undergraduate B.S.: Agricultural Studies (hybrid online/campus)

Undergraduate Certificates: Swine Science, Occupational Safety

Study Abroad and International Travel Opportunities

Agriculture and life sciences are part of a highly interconnected global system; decisions made in one sector have profound impacts worldwide. It is important for students to develop an understanding and appreciation for the global system and the role that U.S. agriculture plays in providing a safe and predictable food supply for a growing world population. The College of Agriculture and Life Sciences provides study abroad and international internship opportunities on all seven continents. Students can enroll in CALS travel courses, spend a semester or more at a partner university abroad or develop an independent academic opportunity like research, service learning or working abroad. Travel ranges from two weeks to a year and students travel to over 30 countries annually. For additional information, contact the Office of Global Programs in the College of Agriculture and Life Sciences (<https://www.agstudyabroad.iastate.edu>).

Internships and Cooperative Education Programs

Practical work experience can provide a unique learning opportunity that complements academic coursework. This experience is provided through internships or cooperative education programs. For additional information, contact a departmental advisor or internship coordinator.

Agricultural and Life Sciences Education OVERVIEW

Administered by the Department of Agricultural Education and Studies

For undergraduate curricula in agricultural and life sciences education, agricultural communications, and agricultural studies, leading to the degree of Bachelor of Science, see College of Agriculture and Life Sciences, Curricula.

The department offers three curricula for students desiring to enter careers in agriculture and related fields. These curricula are agricultural communication, agricultural and life sciences education and agricultural studies. The agricultural communication curriculum prepares graduates to communicate about agricultural science with diverse audiences within and outside the agricultural sector locally, nationally, and globally, using various communication channels and tools. The agricultural and life sciences education curriculum prepares persons for careers as agricultural education instructors, and educational specialists for industry, nonprofit organizations, and governmental agencies. The agricultural studies curriculum has two options, production and management and multidisciplinary. Graduates are prepared for careers in production agriculture and agricultural industry. Graduates of all three curricula accept positions in agricultural business, industry, agencies, and production agriculture.

Student Learning Outcomes

Graduates will have a broad base of agricultural knowledge, and will be skilled in decision-making, planning, organizing, presenting, and evaluating information. Through the successful completion of the required coursework, active participation in clubs and organizations, and the acquisition of technical skills and experiences associated with work experiences, internships, and international travel, graduates of our baccalaureate programs meet the university, college, and departmental outcomes in the following nine areas:

1. Professional, interpersonal, and cross-cultural communications
2. Problem solving and critical thinking
3. Leadership
4. Entrepreneurship
5. Life-long learning
6. Ethics

7. Environmental awareness
8. U.S. diversity
9. International perspectives.

More information regarding the departmental learning outcomes can be found at www.ageds.iastate.edu/. (<http://www.ageds.iastate.edu/>)

Curriculum in Agricultural and Life Sciences Education

Administered by the Department of Agricultural Education and Studies. Students majoring in Agricultural and Life Sciences Education may lead to teacher licensure.

Total Degree Requirement: 128 cr.

Only 65 cr. from a two-year institution may apply which may include up to 16 technical cr.; 9 P-NP cr. of free electives; 2.00 minimum GPA. Teacher certification requires 2.5 GPA at particular points in the program of study, and a minimum grade of C- in selected courses.

University Requirements:

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
International Perspectives		3
LIB 1600	Introduction to College Level Research	1
U.S. Cultures and Communities		3
Total Credits		13

CALS Requirements: Communications Proficiency:

6 cr. of English composition with a C or better and 3 cr. of speech fundamentals with a C or better.

AGEDS 3110	Presentation and Sales Strategies for Agricultural Audiences	3
American History Elective		3
BIOL 2110	Principles of Biology I	3
BIOL 2110L	Principles of Biology Laboratory I	1
BIOL 2120	Principles of Biology II	3
BIOL 2120L	Principles of Biology Laboratory II	1
CHEM 1630	College Chemistry	4
CHEM 1630L	Laboratory in College Chemistry	1
ECON 1010	Principles of Microeconomics	3
Ethics Elective from Approved List		3
MATH 1400	College Algebra	3
STAT 1040	Introduction to Statistics	3

Major Specific Requirements - Agricultural Sciences and Economics (C- or higher required)

ACCT 2840	Financial Accounting	3
Ag Elective From Approved List		3
AGEDS 3150	Personal, Professional, and Entrepreneurial Leadership in Agriculture	3
AGEDS 4880	Methods of Teaching Agricultural Mechanics	3
AGRON 1810	Introduction to Crop Science	3
AGRON 1820	Introduction to Soil Science	3
ANS 1010	Working with Animals	2
ANS 1140	Survey of the Animal Industry	2
HORT 2210	Principles of Horticulture Science	3
ECON 2300	Farm Business Management	3
NREM 1200	Introduction to Renewable Resources	3
AGEDS 3880	Agricultural Mechanics Applications	3
Total Credits		34

Major Specific Requirements - Professional Credits (C or higher required):

AGEDS 1100	Professional Development in Agricultural Education and Studies: New Student Seminar	1
AGEDS 2110A	High School Agriculture Programs	1
AGEDS 3100	Foundations of Agricultural Education Programs	3
AGEDS 4010	Planning Agriculture and Life Sciences Education Programs	3
AGEDS 4020	Methods of Teaching in Agriculture and Life Sciences	3
AGEDS 4160	Pre-Student Teaching Experience in Agricultural Education	1
AGEDS 4170	Supervised Teaching in Agriculture and Life Sciences	1-16
PSYCH 3330	Educational Psychology	3
PSYCH 2300	Developmental Psychology	3
SPED 4010	Teaching Secondary Students with Exceptionalities in General Education	3
Total Credits		22-37

Electives: Select courses to get to 128 credits.

Agricultural and Life Sciences Education, B.S.

Freshman

Fall	Credits Spring	Credits
AGEDS 1100	1 ENGL 2500	3
ANS 1140	2 ECON 1010	3
ANS 1010	2 AGRON 1810	3

BIOL 2110	3 BIOL 2120	3
BIOL 2110L	1 BIOL 2120L	1
ENGL 1500	3 Choose from Approved Ag Elective List	3
LIB 1600	1	
MATH 1400	3	
16		16

Sophomore

Fall	Credits Spring	Credits
CHEM 1630	4 PSYCH 2300	3
CHEM 1630L	1 Ethics Elective	3
NREM 1200	3 STAT 1040	3
ACCT 2840	3 American History Elective	3
AGEDS 3100	3 AGEDS 2110A or 2110C	1
AGEDS 3880	3 HORT 2210	3
17		16

Junior

Fall	Credits Spring	Credits
ECON 2300	3 Intl Perspectives Elective	3
AGEDS 3150	3 AGEDS 4010	3
PSYCH 3330	3 Elective	6
AGEDS 4880	3 AGRON 1820	3
Elective	3	
15		15

Senior

Fall	Credits Spring	Credits
AGEDS 3110	3 AGEDS 4160	1
AGEDS 4020	3 AGEDS 4170	1-16
Elective	6	
SPED 4010	3	
U.S. Cultures and Communities	3	
18		2-17

Minor - Agricultural and Life Sciences Education

The department offers a minor in agricultural and life sciences education which may be earned by completion of a minimum of 15 credits in agricultural education and studies courses, with a minimum of two courses at the 4000 level. The minor must include at least 9 credits that are not used to meet any other department, college, or university requirement. A minor will not meet state licensure requirements for teaching high school agriculture. Courses that can be taken for a minor are:

AGEDS 2110		
AGEDS 3100	Foundations of Agricultural Education Programs	3
AGEDS 3110	Presentation and Sales Strategies for Agricultural Audiences	3
AGEDS 3120	Science With Practice	3
AGEDS 3150	Personal, Professional, and Entrepreneurial Leadership in Agriculture	3
AGEDS 3270	Survey of Agriculture and Life Sciences Communication	3
AGEDS 3880	Agricultural Mechanics Applications	3
AGEDS 4020	Methods of Teaching in Agriculture and Life Sciences	3
AGEDS 4120	Internship in Agricultural Education and Studies	2-6
AGEDS 4140	Developing Agricultural Education Programs in Non-Formal Settings	2
AGEDS 4500	Farm Management and Operation	3
AGEDS 4510	Agricultural Law	3
AGEDS 4610	Innovation Diffusion and the Role of Agricultural and Extension Education	3
AGEDS 4880	Methods of Teaching Agricultural Mechanics	3
AGEDS 4900		1-3
AGEDS 4960A	International or AGEDS 4960 Domestic	1-3
AGEDS 4990	Undergraduate Research	1-30

Visit the departmental website at www.AgEds.iastate.edu/. (<http://www.AgEds.iastate.edu/.html>)

Graduate Study

The department offers the degrees of Master of Science and Doctor of Philosophy, with a major in agricultural education; a specialization in agricultural extension education; opportunities for emphasis in international agricultural education; and a minor for students majoring in other curricula. Graduate students who have earned a bachelor's degree in an agricultural discipline may plan a course of study that leads to teacher certification. Candidates pursuing the Master of Science degree may do so by completing either a thesis or nonthesis program of study.

Students have an opportunity to develop competence in disciplinary foundations and ethics, program planning, learning theory, instructional methods, program leadership and administration, program evaluation, research methodologies, data analysis and interpretation, writing for publication, and grant proposal writing.

The department also cooperates in the international development studies option of the General Graduate Studies Program. Courses and workshops

are offered, both on and off campus, for extension educators, teachers, and industry and government personnel.

Agricultural and Rural Policy Studies

AGRICULTURAL & RURAL POLICY STUDIES

College of Agriculture and Life Sciences

Agriculture is more than just farming; it is about food, energy, and conservation. Rural is more than just small towns; it is the linkages between cities, urban consumers, and the global economy. Our major prepares students to guide policy decisions impacting agriculture, the environment, and the well-being of rural communities. In short, our major is the people and policy side of agriculture. Students will learn about the social and policy dimensions of agriculture and about strategies to promote rural resiliency and community vitality. The major will train students to engage with diverse audiences to discuss controversial issues, to promote public-private partnerships, and to lead and manage policy programs. Our goal is to give students the tools to help rural people and places thrive in the 21st century.

Our curriculum is flexible to meet the interests and needs of each student. A specialization area outside the major is required. Internships, experiential learning, and study abroad are important parts of the major. Graduates work as policy and legislative advisors, agriculture and farmer relations specialists, government affairs specialists, public information and communications officers, extension educators, community and economic developers, and in agriculture.

Student Learning Outcomes

Students will develop the necessary skills to become effective leaders in agriculture-related companies, non-profit associations and organization, and state and local government agencies working on agriculture and rural issues. Specific learning outcomes include:

1. Making connections between agriculture, the environment, and rural communities.
2. Making linkages between local, national, and global agricultural systems.
3. Investigating how social, economic, and cultural systems affect decisions.
4. Analyzing information and recommending solutions to guide decisions.
5. Evaluating program and policy outcomes.
6. Communicating information and ideas to others to guide decisions.
7. Leading and managing policy programs.
8. Promoting civic engagement among diverse groups.

CURRICULUM IN AGRICULTURAL & RURAL POLICY STUDIES

Administered by the Department of Sociology

Total Degree Requirement: 120 cr.

The major in Agricultural and Rural Policy Studies requires a minimum of 120 credits and a 2.00 minimum GPA. Only 65 credits from a two-year institution may apply, which may include up to 16 technical credits. Up to 9 P-NP credits of free electives can be applied toward the degree.

University Requirements:

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
ENGL 3020	Business Communication	3
or ENGL 3090 Proposal and Report Writing		
LIB 1600	Introduction to College Level Research	1
U.S. Cultures and Communities from approved list (Met by SOC 3500)		3
International Perspectives from approved list (Met by SOC 3480 or SOC 3820)		3
CALS Communication Proficiency Requirement: A grade of C or better in 6 cr. of composition (ENGL 1500, ENGL 2500, ENGL 3020, or ENGL 3090); and a C or better in speech fundamentals (COMST 2140 or AGEDS 3110)		
Total Credits		10-16

CALS Requirements:

Mathematics from approved list (MATH 1400, MATH 1430, MATH 1450, MATH 1500, MATH 1510, MATH 1600, or MATH 1650) ¹		3
STAT 1010	Principles of Statistics ¹	3-4
or STAT 1040 Introduction to Statistics		
Physical Sciences from approved list (MTEOR 2060, [CHEM 1630 & CHEM 1630L], GEOL 1010, [GEOL 1020 & GEOL 1020L]) ¹		5
BIOL 1010	Introductory Biology ²	3
or BIOL 2110 Principles of Biology I		
Life Sciences from approved list (Met by AGRON 1810) ²		3
Ethics from approved list (Met by SOC 3250)		3
Humanities from approved list ³		3
Social Sciences from approved list (Met by SOC 2300)		3
AGEDS 3110, COMST 2140, or SPCM 2120 ⁴		3
Total Credits		20-30

¹ Math, Statistics, and Physical Sciences approved list: <https://www.cals.iastate.edu/student-services/math-stat-phys> (<https://www.cals.iastate.edu/student-services/math-stat-phys/>)

² Life Sciences approved list: <https://www.cals.iastate.edu/student-services/life-science> (<https://www.cals.iastate.edu/student-services/life-science/>)

³ Humanities approved list: <https://www.cals.iastate.edu/student-services/humanities> (<https://www.cals.iastate.edu/student-services/humanities/>)

⁴ Communications Proficiency approved list: <https://www.cals.iastate.edu/content/communications-proficiency> (<https://www.cals.iastate.edu/content/communications-proficiency/>)

Major Requirements -- Agricultural and Rural Policy Studies Core

SOC 1100	Orientation to Agricultural and Rural Policy Studies	1
SOC 2300	Rural Society in Transition	3
SOC 2620	Data Discovery, Analytics, and Visualization in the Social Sciences	3
SOC 2640	Facilitation of Public Issues in Agriculture	3
SOC 3250	Agriculture in Transition	3
SOC 3480	Global Poverty, Resources and Sustainable Development	3
SOC 3500	Human Diversity in Agriculture and the Food System	3
SOC 3820	Environmental Sociology	3
SOC 4150	Agrifood Policy and Social Change	3
SOC 4330	Strategies for Rural Resiliency and Vitality	3
SOC 4440	Sociology of Food and Agricultural Systems	3
AGEDS 3150	Personal, Professional, and Entrepreneurial Leadership in Agriculture	3
or POLS 4750	Management in the Public Sector	
Total Credits		34

Major Requirements -- Social Science Foundation

AGEDS 4510	Agricultural Law	3
ECON 1010	Principles of Microeconomics	3
ECON 2350	Introduction to Agricultural Markets	3
POLS 2830, POLS 3350, POLS 3440, or another approved POLS course		3
Total Credits		12

Major Requirements -- Agricultural Science Foundation

AGRON 1800	Global Agriculture in a Changing World	3
AGRON 1810	Introduction to Crop Science	3
ANS 1140	Survey of the Animal Industry	2
FSHN 2420	The US Food System	3

or AGRON 342C World Food Issues: Past and Present

Total Credits **11**

Major Requirements -- Minor or Multiple Major

Minimum of 15 cr. in a declared minor (3 cr. must stand alone); or a declared multiple or secondary major

Total Credits **15**

Electives

Free electives, OR a second minor, OR multiple major requirements

Total Credits **18**

AGRICULTURAL AND RURAL POLICY STUDIES, B.S.

Freshman

Fall	Credits Spring	Credits
SOC 1100	1 SOC 2620	3
SOC 2300	3 ECON 2350	3
SOC 2640	3 AGRON 1810	3
ECON 1010	3 ENGL 2500	3
ANS 1140	2 LIB 1600	1
ENGL 1500	3 Mathematics	3
15		16

Sophomore

Fall	Credits Spring	Credits
SOC 3480	3 SOC 3250	3
SOC 3500	3 POLS 3350, 3440, or 2830	3
AGRON 1800	3 FSHN 2420 or AGRON 3420	3
BIOL 1010 or 2110	3 STAT 1010 or 1040	3-4
Physical Science	3 Physical Science	1
Physical Science	1 Humanities	3
16		16-17

Junior

Fall	Credits Spring	Credits
SOC 4440	3 SOC 3820	3
AGEDS 3150 or POLS 4750	3 SOC 4150	3
COMST 2140 or AGEDS 3110	3 ENGL 3020 or 3090	3
Minor	3 Minor	3
Minor	3 Minor	3
15		15

Senior

Fall	Credits Spring	Credits
SOC 4330	3 AGEDS 4510	3
Minor	3 Free Elective	3

Free Elective	3 Free Elective	3
Free Elective	3 Free Elective	3
Free Elective	3	
15		12

GRADUATE STUDY

The department offers work for the degrees Master of Science and Doctor of Philosophy with majors in sociology and rural sociology and minor work for students majoring in other departments. For M.S. and Ph.D. departmental requirements, see Program of Graduate Study for Degrees in Sociology and Rural Sociology, available from the department office. The department offers concentrations in a number of areas, e.g., community studies and development; sociology of families, inequality, food systems, agriculture and environment; methodology; social change and development; criminology; the economy, organizations and work; and social psychology. The Department of Sociology does not offer a nonthesis master's program.

Graduates have a broad understanding of sociology, address complex societal problems, and communicate effectively with scientific colleagues and the general public in both formal and informal settings. They understand sociological theory, conduct research, and are prepared to educate college students and contribute to public policy. Although the department stipulates no language requirement for either the degree Master of Science or the degree Doctor of Philosophy, specifying competence in one or more languages may be desirable in some instances.

The department also participates in the interdepartmental program in interdepartmental majors in sustainable agriculture, transportation and water resources, and interdepartmental minors in gerontology (see Index).

Agricultural Business

The Department of Economics offers coursework for a Bachelor of Science degree in Agricultural Business. The major in Agricultural Business prepares students for advanced studies (e.g., Masters or Ph.D. in Agricultural Economics, Law School, MBA, etc.) and for careers in agricultural finance, management in agricultural supply and marketing industries, commodity merchandising and research, business research and management, farm and ranch operations, commercial farm management and appraisal, agricultural sales and marketing, agricultural reporting and public relations, agricultural extension, international activities, and government service. A minor in Agricultural Business is also possible.

Students majoring in Agricultural Business often choose elective coursework leading to minors in the College of Agriculture and Life Sciences or the Ivy College of Business, or that emphasize specific areas

within agricultural business such as finance, management, commodity analysis, research, agricultural sales and marketing, environmental economics, farm and ranch operations, international economics, agricultural extension, or government service. A major in Agricultural Business with a minor in Economics is not permitted; however, a double major in Agricultural Business and Economics is permitted.

Customization of the Agricultural Business major is possible. Students may request to pursue one of three Business Options in Finance, Marketing, or Supply Chain Management. Electing a Business Option does not change the overall requirements of the Agricultural Business major. Eligibility and coursework requirements for Business Options are maintained and approved by the Department of Economics and details are available on the department website.

Student Learning Outcomes

Graduates from the Department of Economics at Iowa State University are expected to be able to:

1. Understand and apply concept of scarcity, marginal analysis, opportunity cost and comparative advantage.
2. Critically analyze the efficiency and equity implications of market and non-market processes of allocation.
3. Evaluate policies, regulations, and business strategies using economic models and theories.
4. Use quantitative and qualitative information to evaluate economic question.
5. Understand the determinants of differences in economic performance over time and across space.

Curriculum in Agricultural Business

The major in Agricultural Business requires a minimum of 120 credits and a 2.00 minimum GPA. Only 65 credits from a two-year institution may apply, which may include up to 16 technical credits. In addition, at most 9 P-NP credits of free electives can be applied toward the degree, and a minimum of 18 credits must be earned from courses taught by the Department of Economics at ISU.

International Perspective (<http://www.registrar.iastate.edu/students/div-ip-guide/IntlPerspectives-current/>): 3 cr.

3 cr. from approved list.

U.S. Cultures & Communities (<http://www.registrar.iastate.edu/students/div-ip-guide/usdiversity-courses/>): 3 cr.

3 cr. from approved list.

Communication/Library: 13 cr.

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
One of the following		3

ENGL 3020	Business Communication	
ENGL 3090	Proposal and Report Writing	
ENGL 3140	Technical Communication	
One of the following		3
SPCM 2120	Fundamentals of Public Speaking	
AGEDS 3110	Presentation and Sales Strategies for Agricultural Audiences	
COMST 2140	Professional Communication	
LIB 1600	Introduction to College Level Research	1
Communication Proficiency Requirement: A grade of C or better in ENGL 2500, a C or better in either ENGL 1500 or (ENGL 3020 or ENGL 3090 or ENGL 3140), and a C or better in the speech fundamentals course (SPCM 2120 or AGEDS 3110).		

Total Credits 13

Humanities and Social Sciences: 6 cr.

ECON 1020	Principles of Macroeconomics	3
Three credits from approved course list.		3

Total Credits 6

Ethics: 3 cr.

3 cr. from approved list.

Life Sciences: 6 cr.

One of the following: 3

BIOL 1010	Introductory Biology	
BIOL 2110	Principles of Biology I	
Three credits from approved course list.		3

Total Credits 6

Mathematics : 10-11 cr.

One of the following: 4

MATH 1600	Survey of Calculus	
MATH 1650	Calculus I	

One of the following: 3-4

ECON 2070	Applied Economic Optimization	
MATH 1660	Calculus II	
STAT 2260	Introduction to Business Statistics I	3

Physical Sciences : 5 cr.

5 credits from approved course list. 5

Total Credits 5

Agricultural, Food, or Natural Resources Sciences: 6 cr.

6 cr. from approved list.

General Economics: 9-10 cr.

ECON 1010	Principles of Microeconomics	3
ECON 3010	Intermediate Microeconomics	3-4

One of the following: 3

ECON 3020	Intermediate Macroeconomics	
ECON 3530	Money, Banking, and Financial Institutions	
ECON 4920	Graduating Senior Survey	R

Total Credits 9-10

Business and Agricultural Business: 32 cr.

ACCT 2840	Financial Accounting	3
FIN 3010	Principles of Finance	3

Six credits from ACCT 2850 or any 3000-4890 ACCT, FIN, MKT, MGMT, MIS, or SCM courses. 6

ECON 1100	Orientation in Agricultural Business	1
ECON 2350	Introduction to Agricultural Markets	3
ECON 2920		1

Three credits from STAT 3260 or DS 2010 3

Nine credits of ECON 2300-2390, 3000-3890, 4000-4890 courses. 9

Three credits of 4000-4890 level ECON courses. 3

Total Credits 32

Electives: 22-24 cr.

Agricultural Business majors seeking a double major in Economics must take an additional 9 credits of economics courses beyond those required for the Economics major for a total of 47 credits in economics and must earn a minimum GPA of 2.0 across ECON 1010 Principles of Microeconomics, ECON 1020 Principles of Macroeconomics, ECON 3010 Intermediate Microeconomics, and ECON 3020 Intermediate Macroeconomics, with no grade in these lower than a C#.

Bachelor of Science, Agricultural Business

Freshman

Fall	Credits Spring	Credits
ECON 1100	1 ECON 1020	3
ECON 1010	3 ECON 2350	3
ECON 1010L	1 BIOL 1010 or 2110	3
ENGL 1500	3 ECON 2070 or MATH 1660	3-4
LIB 1600	1 Ag Science or Humanities	3
MATH 1600 or 1650	4	
Ag Science or Humanities	3	
16		15-16

Sophomore

Fall	Credits Spring	Credits
ACCT 2840	3 ENGL 2500	3
ECON 3010	3-4 STAT 3260 or DS 2010 ^b	3
ECON 2920A	1 CHEM 1630 or PHYS 1310	4
STAT 2260	3 CHEM 1630L or PHYS 1310L	1

Ag Science or Humanities	3 International Perspectives or Cultures and Communities	3
	Life Sciences	3

13-14 17

Junior

Fall	Credits Spring	Credits
Business elective ^a	3 ECON 2300-2390, 3000-3890, or 4000-4890	3
ECON 2300-2390, 3000-3890, or 4000-4890	6 FIN 3010	3
SPCM 2120 or AGEDS 3110	3 International Perspectives or Cultures and Communities	3
Ethics	3 ECON 3020 or 3530	3
	Elective	3
	15	15

Senior

Fall	Credits Spring	Credits
Business elective ^a	3 ECON 4000-4890	3
ENGL 3020, 3090, or 3140	3 ECON 4920	R
Electives	9 Electives	12
	15	15

a. Select six credits from ACCT 2850 or any 3000-4890 ACCT, FIN, MKT, MGMT, MIS, or SCM courses.

b. Students majoring in Economics or adding the Finance Business Option must take STAT 3260. Students must take at least 1 STAT course from Iowa State for graduation.

Agricultural Business Minor

The Department of Economics offers a minor in Agricultural Business. The minor requires at least 15 credits, including 6 credits in courses numbered 3000 or above taken at Iowa State University. The minor must include at least 3 credits that are not used to meet any other Department, College, or University requirement. Courses to be included in the minimum of 15 credits include the following:

ECON 1010	Principles of Microeconomics	3
ECON 2300	Farm Business Management	3
ECON 2350	Introduction to Agricultural Markets	3
ECON 3010	Intermediate Microeconomics	3-4

Three credits of ECON courses from: 3000-3890, 4000-4890 courses. 3

The Department of Economics has concurrent Bachelor of Science / Master of Science (B.S./M.S.) programs designed especially for seniors who wish to pursue advanced studies. Concurrent B.S./M.S. programs are agricultural business (B.S.) with agricultural economics (M.S.) or with

economics (M.S.). The concurrent B.S./M.S. program allows seniors to complete an M.S. degree within 12 months of B.S. graduation.

For more information about our concurrent undergraduate and graduate programs in Agricultural Economics, visit: <https://www.econ.iastate.edu/ms-program> (<https://www.econ.iastate.edu/ms-program/>).

See Master of Science or Ph.D. in Agricultural Economics.

Agricultural Communication OVERVIEW

Administered by the Department of Agricultural Education & Studies

The agricultural communication major provides students with critical knowledge and skills to be effective agricultural communicators.

Graduates will communicate about agricultural science with diverse audiences within and outside the agricultural sector locally, nationally, and globally, using various communication channels and tools.

Students build a foundational knowledge of agricultural sciences such as animal science, horticulture, agronomy, agricultural and rural policy studies, global resource systems, food science and human nutrition, and agricultural business. They become proficient in communicating diverse agricultural topics with stakeholders, using various communication channels, tools, and strategies. Among others, students will develop knowledge and skills in areas such as audience and media analysis, strategic communication, message development for both online and offline communication channels, critical and analytical thinking, technical and research writing, public speaking, facilitation, persuasive and informative communication, public relations, agricultural issue analysis, development of agricultural promotional materials, and embracing diversity and differences in agriculture.

Agricultural communication students will obtain skills that enable them to be versatile in their career choices, pursuing work in public policy, agricultural extension, agri-business, non-profit sectors, commodity groups, agricultural cooperatives, education, research, publishing, sales, media, and agency work.

Student Learning Outcomes

Graduates will be successful in drawing from agricultural and communication coursework as well as experiential learning opportunities through clubs and internships to meet the three overall program outcomes:

1. Demonstrate awareness of emerging issues in agriculture by engaging in conversations with the public and peers using various communication channels.
2. Identify target audiences and craft and deliver messages using appropriate communication channels.

3. Critically analyze the advancement of agricultural communication and its implications in regional, national, and international settings.

Curriculum in Agricultural Communication

Only 65 cr. from a two-year institution may apply, which may include up to 16 technical cr.; 9 P-NP cr. of general electives; 2.00 minimum GPA

University Requirements:

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
LIB 1600	Introduction to College Level Research	1
International Perspectives		3
U.S. Cultures and Communities		3
Total Credits		13

CALS Requirements:

Communication Proficiency:

6 cr. of English composition with a C or better and 3 cr. of speech fundamentals with a C or better

AGEDS 3110	Presentation and Sales Strategies for Agricultural Audiences	3
BIOL 2110	Principles of Biology I	3
BIOL 2120	Principles of Biology II	3
CHEM 1630	College Chemistry	4
CHEM 1630L	Laboratory in College Chemistry	1
ECON 1010	Principles of Microeconomics	3
or ECON 1020	Principles of Macroeconomics	
Ethics Elective from Approved List		3
Humanities Elective from Approved List		3
MATH 1400	College Algebra	3
STAT 1040	Introduction to Statistics	3
Total Credits		29

Major Requirements: Professional Communication:

AGEDS 1100	Professional Development in Agricultural Education and Studies: New Student Seminar	1
AGEDS 2110C	Agricultural Industries and Agencies	1
AGEDS 2150	Professional Development in Agricultural Education and Studies: Career Seminar	1
AGEDS 2270	Fundamentals of Visual Communication for Agriculture and Life Sciences	3
AGEDS 2630	Communicate with Impact in Agriculture, Natural Resources, and Life Science	3
AGEDS 3270	Survey of Agriculture and Life Sciences Communication	3

AGEDS 4120	Internship in Agricultural Education and Studies	3
AGEDS 4630	Communicating Contemporary Issues in Agriculture	3
Communications Elective from Approved List		21
Total Credits		39

Major Requirements: Agricultural Sciences and Economics

Select one CALS area, take 12 credits including 6 credits at 3000-4000 level	12
Select additional CALS area, take 6 credits any level	6
Select additional CALS area, take 6 credits any level	6
Select 9 credits from any CALS area	9
Total Credits	33

Electives: Select courses to bring total credits to 128.

Four-Year Plan

First Year

Fall	Credits Spring	Credits
AGEDS 1100	1 ENGL 2500	3
Agriculture and Life Science Elective	3 International Perspectives	3
Professional Communication Elective	3 AGEDS 2270	3
ENGL 1500	3 Agriculture and Life Science Elective	3
MATH 1400	3 LIB 1600	1
BIOL 2110	3 ECON 1010 or 1020	3
16		16

Second Year

Fall	Credits Spring	Credits
Agriculture and Life Science Elective	3 CHEM 1630	4
BIOL 2120	3 CHEM 1630L	1
AGEDS 2630	3 Professional Communication Elective	3
Agriculture and Life Science Elective	3 Agriculture and Life Science Elective	3
Ethics Elective	3 AGEDS 2110C	1
General Elective	1 Psychology Elective	3
	AGEDS 2150	1
16		16

Third Year

Fall	Credits Spring	Credits
AGEDS 3270	3 Professional Communication Elective	3
Agriculture and Life Science Elective	3 Agriculture and Life Science Elective	6
Professional Communication Elective	3 General Elective	1
US Diversity	3 AGEDS 3110	3
STAT 1040	3 Humanities Elective (from list)	3
General Elective	1	
	16	16

Fourth Year

Fall	Credits Spring	Credits
AGEDS 4120	3 Professional Communication Elective	6
Agriculture and Life Science Elective	3 General Elective	4
Professional Communication Elective	3 Agriculture and Life Science Elective	6
AGEDS 4630	3	
AGEDS 3150	3	
General Elective	1	
	16	16

Total Credits: 128

*To meet Ag Elective Requirements, students meet requirements in the following areas:

Select one technical agricultural area in which you will complete at least 12 credits (6 of these must be 3000-4000 level courses).

Select two other technical agricultural areas in which you will complete at least 6 credits (2 courses) in each area.

Select 9 additional credits from CALS coursework.

A 2.0 grade point average is required. This plan is a sample. Student plans may vary based on transfer credits, course availability and other factors.

Agricultural Studies

OVERVIEW

Administered by the Department of Agricultural Education and Studies

For undergraduate curricula in agriculture and life sciences education, and agricultural studies, leading to the degree of Bachelor of Science, see College of Agriculture and Life Sciences, Curricula.

The department offers three curricula for students desiring to enter careers in agriculture and related fields. These curricula are agricultural communication, agricultural and life sciences education and agricultural studies. The agricultural communication curriculum prepares graduates to communicate about agricultural science with diverse audiences within and outside the agricultural sector locally, nationally, and globally, using various communication channels and tools. The agricultural and life sciences education curriculum prepares persons for careers as agricultural education instructors, and educational specialists for industry, nonprofit organizations, and governmental agencies. The agricultural studies curriculum has two options, production and management and multidisciplinary. Graduates are prepared for careers in production agriculture and agricultural industry. Graduates of all three curricula accept positions in agricultural business, industry, agencies, and production agriculture.

Student Learning Outcomes

Graduates will have a broad base of agricultural knowledge, and will be skilled in decision making, planning, organizing, presenting, and evaluating information. Through the successful completion of the required coursework, active participation in clubs and organizations, and the acquisition of technical skills and experiences associated with work experiences, internships, and international travel, graduates of our baccalaureate programs meet the university, college, and departmental outcomes in the following nine areas:

1. Professional, interpersonal, and cross-cultural communications
2. Problem solving and critical thinking
3. Leadership
4. Entrepreneurship
5. Life-long learning
6. Ethics
7. Environmental awareness
8. U.S. diversity
9. International perspectives.

More information regarding the departmental learning outcomes can be found at www.ageds.iastate.edu/. (<http://www.ageds.iastate.edu/>)

Curriculum in Agricultural Studies

Administered by the Department of Agricultural Education and Studies. Students are encouraged to develop one or more areas of concentration in agricultural sciences and economics.

Production and Management Option

Total Degree Requirement: 120 cr.

Only 65 cr. from a two-year institution may apply which may include up to 16 technical cr.; 9 P-NP cr. of free electives; 2.00 minimum GPA.

University Requirements.:

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
	International Perspectives from approved list	3
LIB 1600	Introduction to College Level Research	1
	U.S. Cultures and Communities from approved list	3

Total Credits 13

CALS Requirements

Communications Proficiency:

6 cr. of English composition with a C or better and 3 cr. of speech fundamentals with a C or better.

AGEDS 3110	Presentation and Sales Strategies for Agricultural Audiences	3
BIOL 1010 or BIOL 2110	Introductory Biology Principles of Biology I	3
CHEM 1630	College Chemistry	4
CHEM 1630L	Laboratory in College Chemistry	1
ECON 1010	Principles of Microeconomics	3
	Ethics Elective from approved list	3
	Humanities Elective from approved list	3
	Life Science elective from approved list	3
MATH 1400	College Algebra	3
STAT 1040	Introduction to Statistics	3

Total Credits 29

Major Requirements

ACCT 2840	Financial Accounting	3
AGEDS 1100	Professional Development in Agricultural Education and Studies: New Student Seminar	1
AGEDS 2150	Professional Development in Agricultural Education and Studies: Career Seminar	1
AGEDS 3150	Personal, Professional, and Entrepreneurial Leadership in Agriculture	3
AGEDS 3270	Survey of Agriculture and Life Sciences Communication	3
AGEDS 4500	Farm Management and Operation	3
AGEDS 4510	Agricultural Law	3
AGRON 1810	Introduction to Crop Science	3
AGRON 1820	Introduction to Soil Science	3
AGRON 2800	Crop Development, Production and Management	3

ANS 1010	Working with Animals	2
ANS 1140	Survey of the Animal Industry	2
	And 6 credit hours from ANS, any level or approved list	6
ECON 2300	Farm Business Management	3
ECON 2350	Introduction to Agricultural Markets	3
	Econ 3000 Level from Department Approved List	3
NREM 1200	Introduction to Renewable Resources	3
	or NREM 1300 Natural Resources and Agriculture	

Total Credits 48

Other Required Course:

Electives: Select courses to get to 120 credits.

No more than 4 cr. of or 3970 may count toward graduation.

No more than 6 cr. of 4900 may count toward graduation.

Multidisciplinary Option

Total Degree Requirement: 120 cr.

Only 65 cr. from a two-year institution may apply which may include up to 16 technical cr.; 9 P-NP cr. of free electives; 2.00 minimum GPA.

University Requirements

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
LIB 1600	Introduction to College Level Research	1
	International Perspective from approved list	3
	US Diversity from approved list	3

Total Credits 13

CALS Requirements

Communications Proficiency:

6 cr. of English composition with a C or better and 3 cr. of speech fundamentals with a C or better.

BIOL 1010 or BIOL 2110	Introductory Biology Principles of Biology I	3
	Ethics Elective from approved list	3
	Humanities Elective from approved list	3
	Life Science Elective from approved list	3
MATH 1400	College Algebra	3
	Physical Science Elective from approved list	5
	Speech Elective from approved list	3
	Social Science Elective from approved list	3
STAT 1040	Introduction to Statistics	3

Total Credits 29

Major Requirements
Agriculture and Life Sciences Core

AGEDS 1100	Professional Development in Agricultural Education and Studies: New Student Seminar	1
AGEDS 2150	Professional Development in Agricultural Education and Studies: Career Seminar	1
AGEDS 4120	Internship in Agricultural Education and Studies	3
AGEDS 4900C	Business, Industry, and Production Agriculture	3
Select one CALS area, including 6 credits at 3000-4000 level taken at Iowa State *		15
Select one CALS area, including 6 credits at 3000-4000 level taken at Iowa State *		15
Select one other area, including 6 credits at 3000-4000 level taken at Iowa State *		15
Total Credits		53

* An individual course may only apply towards one area.

Other Required Course:
Electives: Select courses to get to 120 credits.
Preveterinary Studies

Preparation for admission to veterinary medicine may be accomplished through the agricultural studies curriculum.

Agricultural Studies, B.S.

Production and Management Option

Freshman

Fall	Credits Spring	Credits
AGEDS 1100	1 ANS 1140	2
ECON 1010	3 AGRON 1820	3
NREM 1200 or 1300	3 ANS 1010	2
MATH 1400	3 STAT 1040	3
ENGL 1500	3 ENGL 2500	3
LIB 1600	1 Humanities Elective	3
AGRON 1810	3	
	17	16

Sophomore

Fall	Credits Spring	Credits
AGEDS 2150	1 ACCT 2840	3
BIOL 1010	3 Life Science Elective	3
AGRON 2800	3 U.S. Cultures and Communities Elective	3
Intl Perspective Elective	3 ANS Elective	3
ECON 2350	3 Elective	3
	13	15

Junior

Fall	Credits Spring	Credits
ANS Elective	3 AGEDS 3110	3
AGEDS 3150	3 ECON 2300	3
CHEM 1630	4 Ethics Elective	3
CHEM 1630L	1 Elective	7
Elective	6	
	17	16

Senior

Fall	Credits Spring	Credits
AGEDS 4500	3 AGEDS 4510	3
AGEDS 3270	3 Elective	11
Econ Elective - Select from Approved List	3	
Elective	3	
	12	14

Total Credits: 120

Multidisciplinary Option

Freshman

Fall	Credits Spring	Credits
ENGL 1500	3 BIOL 1010	3
AGEDS 1100	1 ENGL 2500	3
LIB 1600	1 International Perspectives	3
MATH 1400	3 Humanities Elective	3
Area Course	3 Area Course	3
Social Science Elective	3	
	14	15

Sophomore

Fall	Credits Spring	Credits
AGEDS 2150	1 Free Elective	6
Free Elective	4 Area Course	3
Area Course	3 Area Course	3
Area Course	3 U.S. Cultures and Communities Elective	3
Physical Science Elective	5	
	16	15

Junior

Fall	Credits Spring	Credits
AGEDS 3150	3 Speech Elective	3
STAT 1040	3 Area Course	3
Ethics Elective	3 Area Course	3

Area Course	3 Area Course	3
Free Elective	3 Free Elective	3
15		15

Senior

Fall	Credits Spring	Credits
Free Elective	3 Free Elective	9
Life Science Elective	3 Area Course	3
Area Course	3 Area Course	3
Area Course	3	
Area Course	3	
15		15

Total Credits: 120

* A 2.00 grade point average is required.

Agricultural Systems Technology

The Department of Agricultural and Biosystems Engineering offers a Bachelor of Science degree in Agricultural Systems Technology (AST). Students majoring in AST choose between two options: Agricultural and Biosystems Management or Machine Systems. The department also offers a minor in Agricultural Systems Technology.

Successful AST graduates gain knowledge, skills, and abilities in solving technical problems, understanding the design process, excelling in authentic leadership, being aware of safety issues, having a quality orientation, effectively managing projects, and having a systems-thinking perspective. This translates to a holistic approach where AST graduates apply science, technology and engineering principles to manage complex agricultural and other production systems, including how the constituent sub-systems are interrelated and the broader impact of these systems.

Graduates find careers within a variety of agricultural industries, businesses, and organizations in the fields of agricultural machinery; off-road equipment; food, feed and grain processing; water quality; biorenewable resources; precision agriculture; or livestock production systems.

Common job duties of AST Agricultural and Biosystems Management graduates include:

- Technical support
- Operations management
- Production supervision
- Grain elevator management

Common job duties of AST Machine Systems graduates include:

- Precision agriculture support
- Testing or sales management
- Technical support
- Maintenance supervision

Student Learning Outcomes

Upon graduation, all AST students should be able to:

1. Apply knowledge of mathematics, science, and applied engineering to identify and solve applied science and technology problems.
2. Develop and conduct experiments and analyze and interpret resulting data.
3. Evaluate and adapt systems, components, processes to meet specified needs.
4. Function effectively on multi-disciplinary teams.
5. Communicate effectively, ethically, and professionally in written, oral, and other formats to technical and non-technical audiences.
6. Understand the potential impacts and limitations of solutions in global and societal contexts.
7. Recognize the need for, and demonstrate an ability to, engage in life-long learning.
8. Effectively apply modern scientific and technical tools necessary for professional practice to address contemporary issues in applied engineering and technology.

Upon graduation, AST students in the agricultural and biosystems management (ABM) option should be able to:

1. Design, implement, and evaluate best practices for the management of global and natural resource systems.
2. Integrate and utilize agricultural and biosystems applied engineering and technology to address contemporary issues in bio-based industries.
3. Evaluate the factors impacting the complex systems that sustain water, air, soils, food, and feed.

Upon graduation, AST students in the machine systems (M.S.) option should be able to:

1. Specify, manage, and test machine systems in the context of a complete agricultural, biological production or processing system.
2. Use and apply the technology of machine systems including power and information flows, function and interaction with biological materials.
3. Perform an energy and cost analyses of complete machine systems to ensure the success and sustainability of an enterprise.

For more information about the AST degree: <http://www.abe.iastate.edu/undergraduate-students/agricultural-systems-technology> ([http://](http://www.abe.iastate.edu/undergraduate-students/agricultural-systems-technology)

www.abe.iastate.edu/undergraduate-students/agricultural-systems-technology/)

Total Degree Requirement: 120 cr.

Only 65 cr. from a two-year institution may apply which may include up to 16 technical cr.; 9 P-NP cr. of free electives; 2.00 minimum GPA.

Communications Proficiency:

6 cr. of English composition with a C or better and 3 cr. of speech fundamentals with a C or better.

Communication/Library: 13 cr.

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
One of the following:		3
ENGL 3020	Business Communication	
ENGL 3090	Proposal and Report Writing	
ENGL 3140	Technical Communication	
AGEDS 3270	Survey of Agriculture and Life Sciences Communication	
One of the following:		3
SPCM 2120	Fundamentals of Public Speaking	
COMST 2140	Professional Communication	
AGEDS 3110	Presentation and Sales Strategies for Agricultural Audiences	
LIB 1600	Introduction to College Level Research	1
Total Credits		13

Mathematical, Physical, and Life Sciences: 25 cr.

MATH 1450	Applied Trigonometry	3
MATH 1510	Calculus for Business and Social Sciences	3
STAT 1040	Introduction to Statistics	3
CHEM 1630	College Chemistry	4
CHEM 1630L	Laboratory in College Chemistry	1
PHYS 1310	General Physics I	4
PHYS 1310L	General Physics I Laboratory	1
One of the following:		3
BIOL 1010	Introductory Biology	
BIOL 2110	Principles of Biology I	
BIOL 2120	Principles of Biology II	
BIOL 2510	Biological Processes in the Environment	
Life Sciences Elective from approved College of Agriculture and Life Sciences list		3
Total Credits		25

Business, Humanities, Ethics, and Social Sciences: 18 cr.

ACCT 2840	Financial Accounting	3
or ACCT 2150 Legal Environment of Business		

ECON 1010	Principles of Microeconomics	3
TSM 3700	Occupational Safety (Ethics)	3
Humanities course from College of Agriculture and Life Sciences list		3
International Perspectives course from University list		3
U.S. Cultures and Communities course from University list		3
Total Credits		18

Technical Core: 27 cr.

TSM 1100	Introduction to Technology	1
TSM 1110	Experiencing Technology	1
TSM 1150	Solving Technology Problems	3
TSM 1160	Introduction to Design in Technology	3
TSM 2010	Preparing for Workplace Seminar	1
TSM 2100	Fundamentals of Technology	3
TSM 2140	Managing Technology Projects	1
TSM 2700	Principles of Injury Prevention and Safety	3
TSM 3100	Total Quality Improvement	3
TSM 3630	Electrical Power and Electrical Machinery Systems	3
TSM 3970	Summer Internship in Technology	R
or TSM 3990 Internship in Technology		
TSM 4150	Applied Project Management in Technology	2
TSM 4160	Technology Capstone	3
Total Credits		27

TSM 3970 or 399 may count toward graduation

Agricultural and Biosystems Management Option: 37 cr.

TSM 4330	Precision Agriculture	3
Two of the following:		6
ECON 2300	Farm Business Management	
ECON 2350	Introduction to Agricultural Markets	
ECON 3320	Cooperatives	
ECON 3370	Agricultural Marketing	
MGMT 3700	Managing Organizations	
MGMT 3710	Organizational Behavior	
Select 20 credits from departmental list		20
8 credits of free electives		8
Total Credits		37

Machine Systems option: 37 cr.

TSM 2160	Advanced Technical Graphics, Interpretation, and CAD	2
ABE 2710, ABE 2720, or ABE 2730		1
TSM 2400	Introduction to Advanced Manufacturing and Metals Processing	3

TSM 3300	Agricultural Machinery and Power Management	3
TSM 3350	Tractor Power	4
TSM 3370	Fluid Power Systems Technology	3
TSM 3650	Electrical Controls and Sensor Systems	3
TSM 4330	Precision Agriculture	3
TSM 4430	Statics and Strength of Materials for Technology	3
TSM 4650	Automation Systems	3
9 credits of free electives		9
Total Credits		37

Agricultural Systems Technology, B.S. - Machine Systems

First Year

Fall	Credits	Spring	Credits
TSM 1100	1	TSM 1110	1
TSM 1160	3	TSM 1150	3
ENGL 1500	3	MATH 1510	3
LIB 1600	1	PHYS 1310	4
MATH 1450	3	PHYS 1310L	1
CHEM 1630	4	U.S. Cultures and Communities - see list ¹	3
CHEM 1630L	1		
16		15	

Second Year

Fall	Credits	Spring	Credits
TSM 2010	1	TSM 2160	2
TSM 2100	3	ABE 2710, 2720, or 2730	1
TSM 2140	1	TSM 2400	3
TSM 2700	3	STAT 1040	3
ACCT 2840	3	BIOL 1010 or 2110	3
ENGL 2500	3	ECON 1010	3
14		15	

Third Year

Fall	Credits	Spring	Credits	Summer	Credits
TSM 3350	4	TSM 3100	3	TSM 3970 or 3990	R
TSM 3630	3	TSM 3300	3		
TSM 4330	3	TSM 3370	3		

ENGL 3020, 3090, 3140, or AGEDS 3270	3	TSM 3650	3
Elective	3	Life Science - See list ³	3
16		15	
		0	

Fourth Year

Fall	Credits	Spring	Credits
TSM 4150	2	TSM 3700	3
TSM 4430	3	TSM 4160	3
SPCM 2120, COMST 2140, or AGEDS 3110	3	TSM 4650	3
International Perspectives - see list ¹	3	Humanities - See list ²	3
Elective	3	Elective	3
14		15	

¹ U.S. Diversity and International Perspectives (<https://www.registrar.iastate.edu/students/div-ip-guide/>)² Humanities Course List (<https://www.cals.iastate.edu/student-services/humanities/>)³ Life Sciences Course List (<https://www.cals.iastate.edu/student-services/life-science/>)⁴ Ethics Course List (<https://www.cals.iastate.edu/student-services/ethics/>)

Agricultural Systems Technology, B.S. - Agricultural & Biosystems Management

First Year

Fall	Credits	Spring	Credits
TSM 1100	1	TSM 1110	1
TSM 1160	3	TSM 1150	3
ENGL 1500	3	MATH 1510	3
LIB 1600	1	PHYS 1310	4
MATH 1450	3	PHYS 1310L	1
CHEM 1630	4	ECON 1010	3
CHEM 1630L	1		
16		15	

Second Year

Fall	Credits	Spring	Credits
TSM 2010		1 BIOL 1010 or 2110	3
TSM 2100		3 STAT 1040	3
TSM 2140		1 SPCM 2120, COMST 2140, or AGEDS 3110	3
TSM 2700		3 ECON/ MGMT Elective	3
ACCT 2840 or 2150		3 Option Elective ⁵	4
ENGL 2500		3	
14		16	

Third Year

Fall	Credits	Spring	Credits	Summer	Credits
TSM 3630		3 TSM 3100		3 TSM 3970 or 3990	R
ENGL 3020, 3090, 3140, or AGEDS 3270		3 TSM 3700	3		
Option Elective ⁵		3 Option Elective ⁵	4		
Option Elective ⁵		3 Life Science - see list ³	3		
U.S. Cultures and Communities - see list ¹		3 Elective	2		
15		15		0	

Fourth Year

Fall	Credits	Spring	Credits
TSM 4150		2 TSM 4160	3
TSM 4330		3 TSM 3300	3
Humanities - see list ²		3 TSM 3650	3
Option Elective ⁵		3 International Perspectives - see list ¹	3

Option Elective ⁵	3 ECON/ MGMT Elective	3
14		15

¹ U.S. Cultures and Communities and International Perspectives (<https://www.registrar.iastate.edu/students/div-ip-guide/>)

² Humanities Course List (<https://www.cals.iastate.edu/student-services/humanities/>)

³ Life Science Course List (<https://www.cals.iastate.edu/student-services/life-science/>)

⁴ Ethics Course List (<https://www.cals.iastate.edu/student-services/ethics/>)

⁵ Option Elective List (<https://www.abe.iastate.edu/undergraduate-students/agricultural-systems-technology/ast-curricula/>)

Minor in agricultural systems technology

The Department of Agricultural and Biosystems Engineering offers a minor in agricultural systems technology which may be earned by completing a minimum of 15 credits of technology systems management courses, which includes:

TSM 1150	Solving Technology Problems	3
TSM 2100	Fundamentals of Technology	3
9 credits from:		9
TSM 2700	Principles of Injury Prevention and Safety	
TSM 3100	Total Quality Improvement	
TSM 3220	Preservation of Grain Quality	
TSM 3220L	Preservation of Grain Quality Laboratory	
TSM 3240	Soil and Water Conservation Management	
TSM 3250	Biorenewable Systems	
TSM 3270	Livestock and Poultry Production: Facilities, Technology, and Management	
TSM 3300	Agricultural Machinery and Power Management	
TSM 3350	Tractor Power	
TSM 3370	Fluid Power Systems Technology	
TSM 3630	Electrical Power and Electrical Machinery Systems	
TSM 3650	Electrical Controls and Sensor Systems	
TSM 3700	Occupational Safety	
TSM 3710	Occupational Safety Management	
TSM 3720	Legal Aspects of Occupational Safety and Health	
TSM 3760	Fire Protection and Prevention	
TSM 3930E	Topics in Technology: Chemical Application Systems	
TSM 3930F	Topics in Technology: Agricultural Safety and Health	

TSM 4330	Precision Agriculture
TSM 4550	Feed Processing and Technology
TSM 4570	Feed Safety, Ingredient Quality and Analytics
TSM 4650	Automation Systems
TSM 4700	Industrial Hygiene: Physical, Chemical, and Biological Hazards
TSM 4710	Safety Laboratory
TSM 4770	Risk Analysis and Management

• At least six (6) credits of 3000-level or higher TSM classes (from the classes listed above)

• At least three (3) credits that are not used to meet any other department, college, or university requirement.

Agronomy

Undergraduate Study

Agronomy is the science and technology of producing plants that serve humans, using practices essential for maintaining and improving life. The Department of Agronomy offers a major leading to a degree of Bachelor of Science (B.S.) in agronomy. Graduates have the theoretical and practical knowledge needed for efficient and sustainable crop production. They are skilled in critical thinking, problem solving, communicating, and working effectively with others. They understand the ethical, cultural, and environmental dimensions of issues facing agronomists globally.

An agronomy major prepares students for employment in crop production and soil management, yield forecasting, precision farming, plant breeding, agricultural business and industry, agricultural service organizations, environmental and natural resource management, and farm management. Graduates pursue careers in the seed, fertilizer, and agricultural chemical industries as field agronomists, crop and soil management specialists, research technicians, sales and marketing specialists, and production managers. State and federal agencies employ agronomists as extension specialists, county extension directors, environmental and natural resource specialists, research associates, soil surveyors, soil conservationists, grain inspectors, integrated pest managers, land appraisers, agricultural lenders, and other science-based professionals.

An agronomy major also prepares students for graduate school. We offer a concurrent B.S./MBA degree. About a quarter of our students immediately continue into research-based M.S. and Ph.D. programs. As an undergraduate, there are many opportunities to be involved in research.

Department of Agronomy website - <http://www.agron.iastate.edu/>.
(<http://www.agron.iastate.edu/>)

Student Learning Outcomes

Upon graduation, students should be able to:

KNOWLEDGE: Graduates of our bachelor's degree program will demonstrate knowledge of the scientific principles and practices needed for success as an agronomist.

INTEGRATION AND PROBLEM-SOLVING: Graduates of our bachelor's degree program will integrate knowledge and skills to systematically assess, critically analyze, and sustainably manage agronomic systems.

PROFESSIONALISM AND CAREER READINESS: Graduates of our bachelor's degree program will demonstrate professional skills and career readiness.

COMMUNICATION: Graduates of our bachelor's degree program will communicate and engage effectively with diverse audiences.

DIVERSE WORLDVIEWS: Graduates of our bachelor's degree program will demonstrate knowledge of diverse worldviews that affect agronomic practices.

ETHICAL, ENVIRONMENTAL, AND ECOLOGICAL ASPECTS: Graduates of our bachelor's degree program will demonstrate knowledge of the ethical, environmental, and ecological aspects of agronomic practices.

Curriculum in Agronomy

Total Degree Requirement: 128 cr.

Only 65 cr. from a two-year institution may apply which may include up to 16 technical cr.; 9 P-NP cr. of free electives; 2.00 minimum GPA. A minimum of 15 credits of agronomy courses must be earned at Iowa State and not transferred from other institutions.

International Perspective: 3 cr.

3 cr. from approved International Perspective list: <http://www.registrar.iastate.edu/students/div-ip-guide/IntlPerspectives-current>
(<http://www.registrar.iastate.edu/students/div-ip-guide/IntlPerspectives-current/>)

U.S. Cultures and Communities: 3 cr.

3 cr. from approved U.S. Cultures and Communities list: <http://www.registrar.iastate.edu/students/div-ip-guide/usdiversity-courses>
(<https://www.registrar.iastate.edu/students/div-ip-guide/usdiversity-courses/>)

Communication/Library: 13 cr.

6 cr. of English composition with a C or better and 3 cr. of speech fundamentals with a C or better.

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
SPCM 2120	Fundamentals of Public Speaking	3

or AGEDS 3110 Presentation and Sales Strategies for Agricultural Audiences

LIB 1600	Introduction to College Level Research	1

One of the following:

ENGL 3020	Business Communication	3
ENGL 3090	Proposal and Report Writing	3
ENGL 3120	Communicating Science and Public Engagement	3
ENGL 3140	Technical Communication	3

Humanities: 3 cr.

3 cr. from approved humanities list: <http://www.cals.iastate.edu/student-services/humanities> (<http://www.cals.iastate.edu/student-services/humanities/>)

Social Sciences: 3 cr.

3 cr. from approved social sciences list: <http://www.cals.iastate.edu/student-services/social-sciences> (<http://www.cals.iastate.edu/student-services/social-sciences/>)

Ethics: 3 cr.

3 cr. from approved ethics list: <http://www.cals.iastate.edu/student-services/ethics> (<http://www.cals.iastate.edu/student-services/ethics/>)

Mathematical Sciences: 6 cr.

MATH 1400	College Algebra	3
STAT 1040	Introduction to Statistics	3

Physical Sciences: 8 cr.

CHEM 1630	College Chemistry	5
& 1630L	and Laboratory in College Chemistry	

One of the following:

AGRON 2590	Organic Compounds in Plants and Soils	3
BBMB 2210	Structure and Reactions in Biochemical Processes	3
CHEM 2310	Elementary Organic Chemistry	4
& 2310L	and Laboratory in Elementary Organic Chemistry	

Life and Biological Sciences: 7 cr.

BIOL 2120	Principles of Biology II	4
& 2120L	and Principles of Biology Laboratory II	
AGRON 3200	Genetics, Agriculture and Biotechnology	3
or BIOL 3130	Principles of Genetics	

Supporting Sciences: 15 cr.

Courses cannot be used to fulfill any other university, college, or Agronomy requirements. At least 9 cr. must be in courses numbered 3000 or above.

This requirement can be met in one of three ways:

- Complete at least 3 credits in basic or mathematics-intensive discipline (ACCT, BBMB, BIOL, CHEM, COMS, ECON, All Engineering,

GEOL, GEN, MATH, MTEOR, PHYS, STAT) as well as at least 6 additional credits in ANS, BIOL, BBMB, ENSCI, ENT, GEOL, HORT, GEN, MICRO, NREM, PLP, TSM. The other 6 credits can be a combination of the above department's courses and/or AGRON.

- Complete the courses needed to fulfill a certificate or second major that complements the student's academic and professional goals.

- By the end of the third semester before graduation, petition the Agronomy Curriculum Committee with a specific set of courses designed around "keeper of the land," "builder of genetic diversity," "explorer of plant life," "developer of bioenergy," "confronter of world hunger," or "designer of sustainable systems."

Agronomy Core: 45 cr.

AGRON 1050	Leadership Experience	R
AGRON 1100	Professional Development in Agronomy: Orientation	1
AGRON 1800	Global Agriculture in a Changing World	3
AGRON 1810	Introduction to Crop Science	3
AGRON 1820	Introduction to Soil Science	3
AGRON 1830	Basic Skills for Agronomists	1
AGRON 2060	Introduction to Weather and Climate	3
AGRON 2100	Professional Development in Agronomy: Career Planning	1
AGRON 2790	Field Exploration of Agronomy	3
AGRON 2800	Crop Development, Production and Management	3
AGRON 2810	Crop Physiology	3
AGRON 2820	Soil Conservation and Land Use	3
AGRON 3100	Professional Development in Agronomy: Work Experience	R
or AGRON 3110 Professional Internship in Agronomy		
AGRON 3420	World Food Issues: Past and Present	3
or AGRON 450C Issues in Sustainable Agriculture		
AGRON 3540	Soils and Plant Growth	4
& 3540L	and Soils and Plant Growth Laboratory	
AGRON 3830	Evaluation of Agronomic Systems	4
AGRON 4100	Professional Development in Agronomy: Senior Forum	1
Additional AGRON credits at the 3000-4000 level		6

Electives: 19 cr.

Additional free electives 19

Agronomy, B.S.

Freshman

Fall	Credits Spring	Credits
AGRON 1100	1 AGRON 1810	3
AGRON 1800	3 AGRON 1820	3
AGRON 1830	1 CHEM 1630 or 1770	4
BIOL 2120	3 CHEM 1630L or 1770L	1
BIOL 2120L	1 ENGL 2500	3
ENGL 1500	3 Math or Social Sciences	3
LIB 1600	1	
Math or Social Sciences	3	
	16	17

Sophomore

Fall	Credits Spring	Credits
AGRON 2060	3 AGRON 2810	3
AGRON 2100	1 AGRON 2820	3
AGRON 2790	3 SP CM 2120 or AGEDS 3110 - Speech choice	3
AGRON 2800	3 Organic Chemistry: AGRON 2590, BBMB 2210, OR CHEM 2310 & L	3-4
STAT 1040	3 Elective	3
Humanities	3	
	16	15-16

Junior

Fall	Credits Spring	Credits
AGRON 3200 or BIOL 3130	3 AGRON 3420 or 4500	3
AGRON 3540	3 AGRON 3830	4
AGRON 3540L	1 ENGL 3020, 3090, 3120, or 3140	3
Elective	6 International Perspectives	3
Supporting Sciences	3 Supporting Sciences	3
	16	16

Senior

Fall	Credits Spring	Credits
Additional Agronomy credits (3000+)	3 AGRON 4100	1
Elective	4 Additional Agronomy credits (3000+)	3
Ethics	3 Elective	6
U.S. Cultures and Communities	3 Supporting Sciences (3000+)	6

Supporting Sciences 3
(3000+)

16**16****Minor - Agronomy**

A minor in agronomy is earned by taking 18 credits consisting of the following:

- 6 credits of required courses;
- 3-6 credits of foundation courses;
- 6-9 credits of supporting courses.

At least 6 credits numbered 3000 or above are required and at least 3 credits must be taken at Iowa State University. The minor must include at least 3 credits that are not used to meet any other department, college, or university requirement.

A student may use up to:

- 3 credits of AGRON 4960A or AGRON 4960B;
- **Or** up to 2 credits from AGRON 3310 or AGRON 3700;
- **Or** up to 1 credit of AGRON 4900E or AGRON 4900G or AGRON 4900H or AGRON 4900Z

Required Courses (6 credits):

AGRON 1810	Introduction to Crop Science	3
AGRON 1820	Introduction to Soil Science	3

Foundation Courses - One or two courses from the list below (3-6 credits):

AGRON 1800	Global Agriculture in a Changing World	3
AGRON 2060	Introduction to Weather and Climate	3
AGRON 2800	Crop Development, Production and Management	3
AGRON 2820	Soil Conservation and Land Use	3

Supporting Courses (6-9 credits, 6 credits of which must be 3000+ level):

AGRON 2170	Weed Identification	1
AGRON 2590	Organic Compounds in Plants and Soils	3
AGRON 2700	Geospatial Technologies	3
AGRON 3160	Crop Structure-Function Relationships	3
AGRON 3170	Principles of Weed Science	3
AGRON 3200	Genetics, Agriculture and Biotechnology	3
AGRON 3340	Forage Crop Management	3
AGRON 3380	Seed Science and Technology	3
AGRON 3540	Soils and Plant Growth	3
AGRON 3600	Environmental Soil Science	3
AGRON 3920	Systems Analysis in Crop and Soil Management	3
AGRON 4050	Soil-Plant-Animal-Atmosphere Physics	3

AGRON 4210	Introduction to Plant Breeding	3
AGRON 4500	Issues in Sustainable Agriculture	3
AGRON 4590	Soil and Water Chemistry	4
AGRON 4630	Soil Formation and Landscape Relationships	3
AGRON 4770	Soil Physics	3
AGRON 4840	Organic Agricultural Theory and Practice	3
AGRON 4850	Soil and Environmental Microbiology	3
AGRON 4970	Agroecology Field Course	3

SOIL SCIENCE CERTIFICATE

Purpose

The certificate in soil science will prepare students with the skills needed for successful careers in the field of soil science. Soil science has key roles in achieving goals of sustainability as demonstrated by the functions of soil and their ecosystem services. Namely, soil is an important factor in addressing issues of food scarcity, water management, climate change, biodiversity loss, and human health. Students who complete the Iowa State University soil science certificate program will qualify for federal employment as a soil scientist. In addition, students completing the certificate will have met the educational component of the Soil Science Society of America's requirements for certification as a professional soil scientist and all U.S. states' educational criteria for licensure as a professional soil scientist.

Requirements

The certificate in soil science requires the completion of 31 credit hours, including a foundation course in soil science, 15 credits in supporting biological, physical, or Earth sciences, as well as 13 credits from approved categories of soil science courses.

At least 9 credits must be taken in soil science courses numbered at the 3000-level or above.

Courses for the certificate cannot be taken on a pass/not-pass basis.

Course Requirements for Soil Science Certificate

Foundation: 3 credits of required core course.

AGRON 1820	Introduction to Soil Science	3

Supporting Biological, Physical, or Earth Sciences: Choose 15 credits from approved list consisting of courses from the following designators: ABE, AGRON, AECL, BIOL, CHEM, CE, CRP, ENSCI, ENT, FOR, GEOL, HORT, LA, MTEOR, MICRO, NREM, PHYS.

Soil Science: Choose 13 credits with at least 2 credits from each of the following categories.

Soil Physical Properties or Soil Water Relationships (2 credits)

AGRON 2820	Soil Conservation and Land Use	3

AGRON 3600	Environmental Soil Science	3
AGRON 4050	Soil-Plant-Animal-Atmosphere Physics	3
AGRON 4770	Soil Physics	3
ABE 4310	Design and Evaluation of Soil and Water Conservation Systems	3
TSM 3240	Soil and Water Conservation Management	3
Soil Chemistry (2 credits)		
AGRON 2590	Organic Compounds in Plants and Soils	3
AGRON 4590	Soil and Water Chemistry	4
Soil Biology (2 credits)		
AGRON 3540	Soils and Plant Growth	3
AGRON 3540L	Soils and Plant Growth Laboratory	1
AGRON 4850	Soil and Environmental Microbiology	3
Soil Morphology and Geography (2 credits)		
AGRON 2700	Geospatial Technologies	3
AGRON 3700	Field Experience in Soil Description and Interpretation	1
AGRON 4630	Soil Formation and Landscape Relationships	3

The Soil Science Certificate may be earned at the same time as an ISU baccalaureate degree or after the completion of an associate of arts (AA) or associate of science (AS) degree or a baccalaureate degree from any accredited institution.

Information on the concurrent Agronomy bachelor's degree and MBA can be located here (<https://www.ivybusiness.iastate.edu/full-time-concurrent-mba/>).

Graduate Study

The Department of Agronomy seeks and promotes ways to manage and protect the resources that generate the world's agricultural productivity and wealth. The department offers programs leading to Master of Science (MS) and Doctor of Philosophy (PhD) degrees with majors in agricultural meteorology, crop production and physiology, plant breeding, and soil science. Online MS programs in agronomy and plant breeding are available, which are suitable for professionals working in industry or government. The MS in agronomy program also offers a graduate certificate. A graduate minor is offered in all these areas to on-campus students. Candidates pursuing the MS degree may do so by completing either a thesis or nonthesis academic plan. The department also cooperates with the interdepartmental majors in environmental science, genetics and genomics, plant biology, and sustainable agriculture.

A strong undergraduate program with fundamental training in biology, chemistry, mathematics, physics, and statistics is required for students interested in graduate study. Academic Plans are designed individually per the requirements of the Graduate College and each departmental

major. Graduate students are mentored by their major professor and a committee of supporting faculty.

Our on-campus graduate programs require students to be sponsored by a faculty member before admission. Assistantships are largely project-based, with the goal of participating in independent research to complete a thesis or dissertation.

The specific requirements of each graduate program can be found in its program handbook, which is available through the Graduate College.

Animal Ecology

Administered by the Department of Natural Resource Ecology and Management

The Animal Ecology curriculum provides its majors with an understanding of ecological principles and processes and their applications to natural resource management. This major is oriented toward students desiring a general and flexible program in environmental biology and for those planning graduate study. Graduates find employment as aquaculturists, aquatic ecologists, wildlife biologists, fisheries biologists, resource managers, and ecologists for industry, environmental consulting firms, natural resource and environmental agencies and organizations, zoos, and as educators. Graduates are able to communicate and work effectively in the multidisciplinary arena of ecology and natural resource management. Additionally, they recognize the importance of ethics in their field of study and are sensitive to cultural diversity and broad environmental concerns.

Students majoring in Animal Ecology may select from one or more of four options: Fisheries and Aquatic Sciences, Interpretation of Natural Resources, Pre-veterinary and Wildlife Care, or Wildlife. Each option has specific outcomes expectations that include (1) the scope of the specialization and its relationships to broader aspects of animal ecology, biotic resource management, and other allied scientific disciplines and professions, (2) career opportunities and requirements, and (3) knowledge and skills appropriate for employment at technical and practitioner levels in each discipline.

All options require three months (400 hours) of relevant work experience or study at a biological station prior to graduation. The latter may be accomplished at the university's affiliate field stations: Rod and Connie French Conservation Camp in Montana, Iowa Lakeside Laboratory at West Lake Okoboji, and Gulf Coast Research Laboratory at Ocean Springs, Mississippi. Information on these laboratories is available from the Department of Natural Resource Ecology and Management Student Services Center.

Pre-veterinary medicine preparation may be achieved while satisfying degree requirements in animal ecology.

Additional education and training can lead to other opportunities in such areas as research and management, natural resources planning and administration, teaching, and environmental consulting, among others. Graduate training is necessary for many specialized positions within the fields of animal ecology. Students preparing for graduate study should consult with their academic advisor concerning appropriate coursework.

Students wishing to be certified by the American Fisheries Society or The Wildlife Society need to consult with their advisors in selecting required courses in their respective programs. The formal application then needs to be completed and submitted for review by their professional societies. Certification in either society has many professional benefits and may be required or recommended for employment by federal and state agencies and private industry.

Students seeking certification to teach biology in secondary schools must meet requirements of the College of Health and Human Sciences as well as those of the Animal Ecology curriculum. In addition, they must apply formally for admission to the teacher education program (see Teacher Education Program). Students with an interest in careers in outdoor writing are encouraged to obtain a minor or a second major in journalism (see Journalism and Communication, Courses and Programs). Students who wish to pursue a job as a conservation officer may wish to minor in criminal justice (see Criminal Justice).

Student Learning Outcomes

Upon graduation, students should be able to:

1. Identify, explain and critically evaluate their own beliefs, values and actions in relation to professional and societal standards of ethics.

For any given situation, graduates identify, critically evaluate, and state their own beliefs and values as they relate to professional and societal ethical standards, for any given situation. They elaborate on how those values and beliefs impact their actions, and they explain which specific canons or principles of a professional code of ethics are applicable to a particular situation.

2. Anticipate, analyze and evaluate natural resource issues and opportunities, explaining the ecological, economic, and social consequences of natural resource actions at various scales and over time.

In the case of existing natural resource issues, graduates explain the ecological, economic, and social consequences that reasonably could be expected to occur as the result of actions taken to address the issue. The explanation includes considerations of the geographic area influenced by the issue as well as the time frame over which the consequences can be expected to occur. In the case of evolving circumstances, graduates predict natural resource issues that may arise as a result

of the circumstances and explain the ecological, economic and social consequences of those issues.

3. Actively seek the input and perspectives of diverse stakeholders regarding natural resource problems and issues.

Graduates identify the comprehensive list of individuals or groups who may be impacted by particular natural resource problems and issues. They are well versed in techniques for seeking and incorporating input and perspectives from those people, and they incorporate those inputs and perspectives into the decision-making process.

4. Assess, analyze, synthesize, and evaluate information fairly and objectively.

Not all information is equally sound or applicable in a particular situation. Graduates evaluate the validity and importance of information obtained from any source. Once evaluated, they use the information appropriately in the solution of natural resource problems.

5. Work effectively, both individually and with others, on complex, value-laden natural resource problems that require holistic problem-solving approaches.

Effective solution of natural resource problems often involves input from diverse constituencies with diverse value scales. When working individually, graduates incorporate those values into the solution of problems. Graduates work effectively with diverse individuals and groups to reach consensus on problem solutions.

6. Formulate and evaluate alternative solutions to complex problems and recommend and defend best alternatives.

The natural resource base with which we deal is capable of providing numerous goods and services to numerous publics. Graduates formulate multiple alternatives, as well as action plans, to achieve stakeholder objectives. They evaluate each of the feasible alternatives in terms of biological possibility, economic feasibility and social acceptability. They recommend best alternatives based on the stakeholders' objectives, and they justify their recommendations on the basis of sound science.

7. Communicate clearly and effectively with all audiences using appropriate oral, visual, electronic, and written techniques.

Graduates utilize the best form, or forms, of communication for effectively conveying information to, or seeking input from, a particular audience. They are proficient in all forms of communication and adjust their style or technique of communication to suit different audiences.

8. Recognize and interpret resource problems and opportunities across spatial scales from local to global.

Graduates recognize where resource problems and opportunities can or could exist, and they evaluate and interpret these for others. They,

evaluate and interpret for individual landowners at a very local scale as well as for problems that span multiple ownerships, regions and ecosystems.

9. Appreciate cultural diversity and understand the impact of the global distribution of people and wealth on natural resource use and valuation.

Different cultures, population densities, and income classes value and use natural resources in very different ways. Because natural resources often are used simultaneously by different groups, it is important for graduates to be able to account for those differing uses and valuations when making management decisions about natural resources.

10. Exercise leadership skills as professionals and engaged citizens.

Graduates organize, facilitate, and participate effectively in groups, teams, or organizations. They define problems or opportunities, implement action planning processes, work toward goals and justify actions taken.

11. Demonstrate creativity and innovation in identifying and pursuing opportunities that produce environmental, social, or economic value.

Graduates display creativity in a variety of situations and identify opportunities to promote understanding of natural resource issues. They demonstrate persistence when working with individuals who have diverse interests in order to build consensus and facilitate accomplishing stated objectives.

12. Exercise life-long learning skills developed before graduation.

Graduates articulate why life-long learning is important. Graduates find answers to their questions as they arise throughout life. They are capable of determining what they need to know to effectively deal with an issue or situation, and they know how to obtain the necessary knowledge. They have learned how to learn in the absence of teachers.

CURRICULUM IN ANIMAL ECOLOGY

Total Degree Requirement: 128 cr.

Only 65 cr. from a two-year institution may apply which may include up to 16 technical cr.; 9 P-NP cr. of free electives; 2.00 minimum GPA.

International Perspective: 3 cr.

U.S. Cultures and Communities: 3 cr.

Communications Proficiency (with grade of C or better):

6 cr. of English composition

3 cr. of speech fundamentals

Communication/Library 16 cr.

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
SPCM 2120	Fundamentals of Public Speaking	3
LIB 1600	Introduction to College Level Research	1

Plus 6 credits from the following: 6

ENGL 2070	Introduction to Creative Writing	
ENGL 3020	Business Communication	
ENGL 2750	Analysis of Popular Culture Texts	
ENGL 3030	Free-Lance Writing for Popular Magazines	
ENGL 3040	Creative Writing: Fiction	
ENGL 3050	Creative Writing: Nonfiction	
ENGL 3060	Creative Writing: Poetry	
ENGL 3090	Proposal and Report Writing	
ENGL 3100	Rhetorical Analysis	
ENGL 3120	Communicating Science and Public Engagement	
ENGL 3140	Technical Communication	
AGEDS 3110	Presentation and Sales Strategies for Agricultural Audiences	
PR 3050	Publicity Methods	
NREM 3300	Principles of Interpretation	
SPCM 3120	Business and Professional Speaking	
AGEDS 3270	Survey of Agriculture and Life Sciences Communication	

Humanities and Social Sciences: 6 cr.

Humanities course list: <https://www.cals.iastate.edu/student-services/humanities/>
 Humanities (https://www.cals.iastate.edu/student-services/humanities/)
 Social Science course list: <https://www.cals.iastate.edu/student-services/social-sciences/>
 Social Sciences (https://www.cals.iastate.edu/student-services/social-sciences/)

Approved humanities course	3
Approved social science course	3
Total Credits	6

Ethics: 3 cr.

3 cr. from approved ethics list: <https://www.cals.iastate.edu/student-services/ethics/>
 Ethics (https://www.cals.iastate.edu/student-services/ethics/)

Mathematical Sciences: 6 cr.

MATH 1400	College Algebra	3
STAT 1010	Principles of Statistics	3-4
or STAT 1040	Introduction to Statistics	
Total Credits		6-7

Physical Sciences: 14 cr.

CHEM 1630	College Chemistry	5
& 1630L	and Laboratory in College Chemistry	
or CHEM 1770	General Chemistry I	
& 1770L	and Laboratory in General Chemistry I	

CHEM 2310	Elementary Organic Chemistry	4
& 2310L	and Laboratory in Elementary Organic Chemistry	
or CHEM 3310	Organic Chemistry I	
& 3310L	and Laboratory in Organic Chemistry I	
PHYS 1150	Physics for the Life Sciences	5
& 1150L	and Laboratory in Physics for the Life Sciences	
or PHYS 1310	General Physics I	
& 1310L	and General Physics I Laboratory	
Total Credits		14

Biological Sciences: 24 cr.

NREM 1100	Orientation in Natural Resource Ecology and Management	1
NREM 1200	Introduction to Renewable Resources	3
NREM 2110	Careers in Natural Resources	1
AECL 2310	Principles of Wildlife & Fisheries Conservation	3
AECL 3120	Ecology	4
AECL 3650	Vertebrate Biology	4
BIOL 2110	Principles of Biology I	3
BIOL 2110L	Principles of Biology Laboratory I	1
BIOL 2120	Principles of Biology II	3
BIOL 2120L	Principles of Biology Laboratory II	1
Total Credits		24

Practical Experience:

FISHERIES AND AQUATIC SCIENCES OPTION

AECL 3210	Ichthyology	3
AECL 4860	Aquatic Ecology	3
AECL 4860L	Aquatic Ecology Laboratory	1
Choose one of two Mathematics sequences:		7-8

Sequence 1 (Calculus)

MATH 1430	Preparation for Calculus	
One of the following:		
MATH 1600	Survey of Calculus	
MATH 1650	Calculus I	

Sequence 2 (Statistics)

NREM 2400	Quantitative Problem Solving in Natural Resources	
or MATH 1430	Preparation for Calculus	
STAT 3010	Intermediate Statistical Concepts and Methods	

Plus 20 credits from approved list 20

Total Credits 34-35

INTERPRETATION OF NATURAL RESOURCES OPTION

AECL 3660	Natural History of Iowa Vertebrates	3
BIOL 3660	Plant Systematics	4

ENT 3700	Insect Biology	3
NREM 3030	Internship	1-3
NREM 3300	Principles of Interpretation	3
BIOL 4740	Plant Ecology	3
or FOR 3560	Dendrology	
One of the following:		3
AGRON 1820	Introduction to Soil Science	
AGRON 2060	Introduction to Weather and Climate	
ASTRO 1200	The Sky and the Solar System	
GEOL 1000	How the Earth Works	
GEOL 1010	Environmental Geology: Earth in Crisis	
GEOL 1080	Introduction to Oceanography	3
Plus additional credits from approved list to total 33 credit hours.		10-13
Total credits		33

PREVETERINARY & WILDLIFE CARE OPTION

ANS 2140	Domestic Animal Physiology	3
or BMS 3290	Anatomy and Physiology of Domestic Animals	
One of the following:		3
AECL 5510	Behavioral Ecology	
ANS 3360	Domestic Animal Behavior and Well-Being	
ANTHR 3170	Primate Behavior, Ecology, and Evolution	
BIOL 3540	Animal Behavior	
Three credits from the following:		3
AECL 3210	Ichthyology	
AECL 3660	Natural History of Iowa Vertebrates	
AECL 4570	Herpetology	
AECL 4570L	Herpetology Laboratory	
AECL 4580	Ornithology	
AECL 4580L	Ornithology Laboratory	
AECL 4590	Mammalogy	
AECL 4590L	Mammalogy Laboratory	
One of the following:		3-5
ANS 2140	Domestic Animal Physiology	
BMS 3290	Anatomy and Physiology of Domestic Animals	3
BIOL 3350	Principles of Human and Other Animal Physiology	
BIOL 3510	Comparative Vertebrate Anatomy	
BIOL 3520	Vertebrate Histology	
BIOL 4340	Endocrinology	
One of the following:		3
ANS 3310	Domestic Animal Reproduction	
BIOL 3130	Principles of Genetics	
BIOL 4230	Developmental Biology	

GEN 3200	Genetics, Agriculture and Biotechnology	
NREM 3150	Genetics for Natural Resource Managers	
At least three credits from the following list:		3-4
AECL 4420	Aquaculture	
AECL 4540	Principles of Wildlife Disease	
ANS 3190	Animal Nutrition	
ANS 4930	Workshop in Animal Science	
BIOL 3530	Introductory Parasitology	
BMS 7401	Intro to Aquatic Animal Medicine	
MICRO 2010	Introduction to Microbiology	
MICRO 2010L	Introductory Microbiology Laboratory	
3 or from course level 3000-5000 from AECL or NREM		3
Plus additional credits from approved list to total 33 credit hours.		9-12
Total credits		33

WILDLIFE OPTION

AECL 3710	Ecological Methods	3
AECL 4510	Wildlife Ecology and Management	3
BIOL 3130	Principles of Genetics	3
or GEN 3200	Genetics, Agriculture and Biotechnology	
or NREM 3150	Genetics for Natural Resource Managers	
BIOL 3660	Plant Systematics	4
Choose one of two Mathematics sequences		7-8
Sequence 1 (Calculus)		
MATH 1430	Preparation for Calculus	
One of the following:		
MATH 1600	Survey of Calculus	
MATH 1650	Calculus I	
Sequence 2 (Statistics)		
NREM 2400	Quantitative Problem Solving in Natural Resources	
or MATH 1430	Preparation for Calculus	
STAT 3010	Intermediate Statistical Concepts and Methods	
Six credits from the following list:		6
AECL 4570	Herpetology	
AECL 4570L	Herpetology Laboratory	
AECL 4580	Ornithology	
AECL 4580L	Ornithology Laboratory	
AECL 4590	Mammalogy	
AECL 4590L	Mammalogy Laboratory	
Six credits from the following list:		6
AECL 4550	International Wildlife Issues	
ENVS 2830	Introduction to Environmental Politics and Policies	
ENVS 2930	Environmental Planning	

NREM 2700	Foundations in Natural Resource Policy and History	
NREM 3850	Natural Resource Policy	
NREM 4520	Ecosystem Management: Integrating Ecology, Society, and Policy	
NREM 4600	Controversies in Natural Resource Management	
AMIN 3130	Native Land, Water, and Resources	
At least three credits from the following list:		3-4
AECL 4150	Ecology of Freshwater Invertebrates, Plants, and Algae	
AECL 4540	Principles of Wildlife Disease	
AECL 5160	Avian Ecology	
AECL 5510	Behavioral Ecology	
ANTHR 3170	Primate Behavior, Ecology, and Evolution	
BIOL 3150	Biological Evolution	
BIOL 3360	Ecological and Evolutionary Animal Physiology	
BIOL 3540	Animal Behavior	
BIOL 3540L	Laboratory in Animal Behavior	
BIOL 4710	Introductory Conservation Biology	
EEOB 5070	Advanced Animal Behavior	
ENT 3700	Insect Biology	
At least five credits from the following list:		5
AECL 4150	Ecology of Freshwater Invertebrates, Plants, and Algae	
AGRON 3170	Principles of Weed Science	
BIOL 3550	Plants and People	
BIOL 4540	Plant Anatomy	
BIOL 4560	Principles of Mycology	
BIOL 4740	Plant Ecology	
EEOB 5640	Wetland Ecology	
FOR 3560	Dendrology	
FOR 3580	Forest Herbaceous Layer: Ecology and Identification.	
NREM 3570	Midwestern Prairie Plants	
Plus additional credits from approved list to total 45 credit hours.		0-5
Total credits		45

Animal Ecology, B.S. - Fisheries and Aquatic Sciences

Freshman

Fall	Credits	Spring	Credits
BIOL 2110	3	BIOL 2120	3
BIOL 2110L	1	BIOL 2120L	1
NREM 1100	1	NREM 1200	3

MATH 1400	3	ENGL 1500	3
CHEM 1630	4	LIB 1600	1
CHEM 1630L	1	STAT 1010 or 1040	3-4
Required Elective	3		
		16	14-15

Sophomore

Fall	Credits	Spring	Credits
AECL 3650	4	AECL 2310	3
NREM 2110	1	CHEM 2310	3
AECL 3120	4	CHEM 2310L	1
MATH Calculus Elective	4	SPCM 2120	3
ENGL 2500	3	Free Elective / Restricted Elective	3
		Required Elective	3
		16	16

Junior

Fall	Credits	Spring	Credits
PHYS 1150	4	AECL 3210	3
PHYS 1150L	1	Communications Elective	3
AECL 4860	3	Restricted Elective	3
AECL 4860L	1	Required Elective	3
Restricted Elective	6	Free Elective	3
Required Elective	3		
		18	15

Senior

Fall	Credits	Spring	Credits
Required Elective	3	Restricted Electives	7
Restricted Elective	6	Communications Elective	3
Free Electives	8	Free Electives	6
		17	16

* To complete degree program in 4 years students must maintain an average of 16 credits per semester.

** Initial math course is determined on the basis of high school math and placement test scores. A non-credit course (Math 10) maybe be required at additional costs.

***In scheduling coursework, students should pay particular attention to courses with limited offerings (e.g., offered only on alternate years) and to course sequences (i.e., where a course serves as a prerequisite for another course).

Animal Ecology, B.S. - Interpretation of Natural Resources option

Freshman

Fall	Credits Spring	Credits
BIOL 2110	3 BIOL 2120	3
BIOL 2110L	1 BIOL 2120L	1
NREM 1100	1 NREM 1200	3
Required Elective	3 ENGL 1500	3
MATH 1400**	3 STAT 1010 or 1040	3-4
CHEM 1630	4 LIB 1600	1
CHEM 1630L	1	
	16	14-15

Sophomore

Fall	Credits Spring	Credits
AECL 3650	4 CHEM 2310	3
NREM 2110	1 CHEM 2310L	1
AECL 3120	4 SPCM 2120	3
Earth Science Elective	3 Free Elective/ Restricted Elective	3
ENGL 2500	3 Required Elective	3
	AECL 2310	3
	15	16

Junior

Fall	Credits Spring	Credits
PHYS 1150	4 NREM 3300	3
PHYS 1150L	1 Communications Elective	3
Botany or Restricted Elective	3-4 AECL 3660	3
ENT 3700	3 Required Elective	3
Required Elective	3 BIOL 3660	4
Free Elective	3	
	17-18	16

Senior

Fall	Credits Spring	Credits
Restricted Elective	6-7 Botany or Restricted Elective	3
Required Elective	3 Restricted Elective	3
Free Electives	7 Communications Elective	3
	NREM 3030	1-3
	Free Electives (if needed)	8
	16-17	18-20

* To complete degree program in 4 years students must maintain an average of 16 credits per semester.

** Initial math course is determined on the basis of high school math and placement test scores. A non-credit course (Math 10) maybe be required at additional costs.

***In scheduling coursework, students should pay particular attention to courses with limited offerings (e.g., offered only on alternate years) and to course sequences (i.e., where a course serves as a prerequisite for another course).

Animal Ecology, B.S. - Pre-Vet & Wildlife Care option

Freshman

Fall	Credits Spring	Credits
BIOL 2110	3 BIOL 2120	3
BIOL 2110L	1 BIOL 2120L	1
NREM 1100	1 NREM 1200	3
Required Elective	3 ENGL 1500	3
MATH 1400	3 STAT 1010 or 1040	3-4
CHEM 1630 [#]	4 LIB 1600	1
CHEM 1630L [#]	1	
	16	14-15

Sophomore

Fall	Credits Spring	Credits
AECL 3650	4 CHEM 2310 [#]	3
NREM 2110	1 CHEM 2310L [#]	1
AECL 3120	4 SPCM 2120	3
Restricted Elective	3 Free Elective/ Restricted Elective	3
ENGL 2500	3 Required Elective	3
	AECL 2310	3
	15	16

Junior

Fall	Credits Spring	Credits
PHYS 1150	4 NREM 3300	3
PHYS 1150L	1 ANS 2140 or BMS 3290	3
Restricted Elective	3 Natural History Elective	3
Required Elective	3 Required Elective	3
Free Elective	6 Free Elective	6
	17	18

Senior

Fall	Credits Spring	Credits
Restricted Elective	6 Restricted Elective	3
Genetics/Development Elective	3 Communications Elective	3
Required Elective	3 Free Elective	9

Communications Elective	3	
Free Elective	2	
	17	15

* To complete degree program in 4 years students must maintain an average of 16 credits per semester.

** In scheduling coursework, students should pay attention to courses with limited offerings, (e.g., offered only on alternate years) and to course sequences (i.e., where a course serves as a prerequisite for another course).

Admission to the ISU College of Veterinary Medicine requires a different set of Chemistry and Physics courses. Students should plan to enroll in Chemistry 1770, 1770L, 1780, 3310, 3310L and 3320. The Physics requirement is PHYS 1310 and 1310L.

Animal Ecology, B.S. - Wildlife option

Freshman

Fall	Credits	Spring	Credits
BIOL 2110	3	BIOL 2120	3
BIOL 2110L	1	BIOL 2120L	1
NREM 1100	1	NREM 1200	3
MATH 1400	3	ENGL 1500	3
CHEM 1630	4	LIB 1600	1
CHEM 1630L	1	STAT 1010 or 1040	3-4
Required Elective	3		
	16		14-15

Sophomore

Fall	Credits	Spring	Credits
AECL 3650	4	CHEM 2310	3
NREM 2110	1	CHEM 2310L	1
AECL 3120	4	SPCM 2120	3
MATH Calculus Elective	4	Free Elective / Restricted Elective	3
ENGL 2500	3	Required Elective	3
		AECL 2310	3
	16		16

Junior

Fall	Credits	Spring	Credits
PHYS 1150	4	BIOL 3660	4
PHYS 1150L	1	Communications Elective	3
AECL 3710	3	Restricted Electives	6
Restricted Electives	6	Required Elective	3
Required Elective	3		
	17		16

Senior

Fall	Credits	Spring	Credits
AECL 4510	3	Restricted Electives	9
Restricted Electives	6	Communications Elective	3
Required Elective	3	Free Elective	3
Free Electives	6		
	18		15

* To complete degree program in four years students must maintain an average of 16 credits per semester.

** Initial math course is determined on the basis of high school math and placement test scores. A non-credit course (Math 10) maybe be required at additional costs.

*** In scheduling coursework, students should pay attention to courses with limited offerings, (e.g., offered only on alternate years) and to course sequences (i.e., where a course serves as a prerequisite for another course). It is critical that students take AECL 3710 fall semester of the junior year and AECL 4510 fall semester of the senior year.

Minor - Animal Ecology

The department offers a minor in animal ecology that may be earned by taking 15 credits in the department including:

AECL 3120	Ecology	4
AECL 3650	Vertebrate Biology	4
NREM 1200	Introduction to Renewable Resources	3

Plus, four additional credits of Animal Ecology or NREM courses at the 3000 level or above.

The minor must include at least 3 credits that are not used to meet any other department, college, or university requirement.

Animal Science

The Department of Animal Science Undergraduate Program intends for its graduates to be able to explain the symbiotic relationship of animals and humans, to contribute to the solution of complex problems of animal enterprise management, and to apply their knowledge and skills in a technically demanding global community. Graduates of our program will be knowledgeable about sustainable animal production practices that also ensure animal health and well-being and stewardship of natural resources.

To enable learners to pursue a wide array of career interests, the department offers learning experiences ranging from the basic to the applied sciences. Learner outcomes for these goals, for each of our courses, and other information defining the program can be found at our

web site: <https://www.ans.iastate.edu/undergraduate-students> (<https://www.ans.iastate.edu/undergraduate-students/>). Our program is designed to provide career skills appropriate to job market needs. Our faculty goals include providing superior academic advising to enable students to fulfill their objectives.

Student Learning Outcomes

Learning outcomes for the Animal and Dairy Science majors dictate that, upon completion of the program, graduates will be able to:

- Apply scientifically based practices for the care, management, and study of managed animals and animal products.
- Communicate in oral and written formats.
- Describe the contemporary domestic and global issues impacting animal science.
- Contribute or lead team efforts to achieve group goals.
- Utilize effective life-long learning skills.
- Evaluate the impacts of animal management practices on economic, sociological, and environmental sustainability.

The department offers the degrees Bachelor of Science in animal science and Bachelor of Science in dairy science. A double major in animal and dairy science is not permitted. However, combining either the animal science or dairy science majors with other curricula is permitted. A limit of 6 credits each in Intercollegiate Judging (Animal Science 4750), or any independent study course (4900 courses) can be applied toward a degree. A limit of 4 credits of Undergraduate Teaching Experience (Animal Science 4970) can be applied toward a degree.

The department offers a minor in Animal Science and a minor in Meat Science. Certificates in Beef Cattle Production Management, Dairy Cattle Management, Swine Production Management, Poultry Production Management, and Equine Science and Management are also offered. Both the animal science curricula and dairy science curricula allow complementary work toward admission to veterinary medical school and other professional schools, which may be done while satisfying requirements for the Bachelor of Science degree. A program that combines Bachelor of Science and Master of Science in animal science is offered. In addition, a program that combines a Bachelor of Science and Master of Business Administration is offered. The Department facilitates student participation in the Midwest Poultry Consortium and the Swine Science Online program to offer additional training in poultry and swine production, respectively.

Curriculum in Animal Science

Students majoring in animal science will complete the degree requirements listed below. If desired, a student may also choose a specialized option. To earn a degree in Animal Science from Iowa State University a minimum of 15 credits in Animal Science must be

earned from courses taught in the Animal Science department at ISU. A minimum of 15 credits of animal science coursework must be earned at Iowa State University.

Total Degree Requirement: 128 cr.

Only 65 cr. from a two-year institution may apply which may include up to 16 technical cr.; 9 P-NP cr. of free electives; 2.00 minimum GPA.

International Perspectives

Approved International Perspectives course	3

U.S. Cultures and Communities

Approved U.S. Cultures and Communities course	3

Communications Proficiency (with a C or better)

English composition	6
Speech fundamentals	3
Total Credits	9

Communication/Library

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
LIB 1600	Introduction to College Level Research	1
One course from the following:		3
SPCM 2120	Fundamentals of Public Speaking	
AGEDS 3110	Presentation and Sales Strategies for Agricultural Audiences	
COMST 2140	Professional Communication	
One course from the following:		3
ENGL 3020	Business Communication	
ENGL 3090	Proposal and Report Writing	
ENGL 3120	Communicating Science and Public Engagement	
ENGL 3140	Technical Communication	
AGEDS 3270	Survey of Agriculture and Life Sciences Communication	

Total Credits	13

Humanities and Social Sciences

Approved Humanities course	3
Approved Social Science course	3
Total Credits	6

Ethics

Approved Ethics course	3

Mathematical Sciences

One course from the following:		3-4
MATH 1400	College Algebra	
MATH 1430	Preparation for Calculus	

MATH 1500	Discrete Mathematics for Business and Social Sciences	
MATH 1600	Survey of Calculus	
MATH 1650	Calculus I	
One course from the following:		3-4
STAT 1010	Principles of Statistics	
STAT 1040	Introduction to Statistics	
STAT 2260	Introduction to Business Statistics I	
Total Credits		6-8

Physical Sciences

A minimum of 8 credits are required. These requirements are specific to option and are listed with each option below.

Biological Sciences

BIOL 2120	Principles of Biology II	3
BIOL 2120L	Principles of Biology Laboratory II	1
ANS 3510	Principles of Domestic Animal Genetics	3
or BIOL 3130	Principles of Genetics	
or GEN 3200	Genetics, Agriculture and Biotechnology	
MICRO 2010 & 2010L	Introduction to Microbiology and Introductory Microbiology Laboratory	3-4
or MICRO 3020 & 3020L	Biology of Microorganisms and Microbiology Laboratory	
Total Credits		10-11

Business

One course from the following:		3
ACCT 2840	Financial Accounting	
ECON 1010	Principles of Microeconomics	
ECON 1020	Principles of Macroeconomics	
Total Credits		3

Animal Science Core

ANS 1010	Working with Animals	2
ANS 1100	Orientation in Animal Science and ISU	1
ANS 1140	Survey of the Animal Industry	2
ANS 2100	Career Preparation in Animal Science	1
ANS 2110	Issues Facing Animal Science	1
ANS 2140	Domestic Animal Physiology	3
ANS 2140L	Domestic Animal Anatomy and Physiology Lab	1
ANS 2700	Foods of Animal Origin	2
ANS 3190	Animal Nutrition	3
ANS 3200	Animal Feeds and Feeding	3
ANS 3310	Domestic Animal Reproduction	3

ANS 3520	Genetic Improvement of Domestic Animals	3
ANS 4110	Addressing Issues in Animal Science	1
Total Credits		26

General Animal Science

CHEM 1630 & 1630L	College Chemistry and Laboratory in College Chemistry	5
or CHEM 1770 & 1770L	General Chemistry I and Laboratory in General Chemistry I	
CHEM 3310	Organic Chemistry I	3
or BBMB 2210	Structure and Reactions in Biochemical Processes	
Three courses from the following:		9
ANS 2160	Equine Science	
ANS 2230	Poultry Science	
ANS 2240	Companion Animal Science	
ANS 2250	Swine Science	
ANS 2260	Beef Cattle Science	
ANS 2280	Laboratory Animal Science	
ANS 2290	Sheep Science	
ANS 2350	Dairy Cattle Science	

One course from the following:		2-4
ANS 3130	Exercise Physiology of Animals	
ANS 3240	Food Processing for Companion Animals	
ANS 3360	Domestic Animal Behavior and Well-Being	
ANS 3370	Lactation	
ANS 3450	Growth and Development of Domestic Animals	
ANS 3600	Fresh Meat Science and Applied Muscle Biology	
BIOL 3140	Principles of Molecular Cell Biology	
BIOL 3520	Vertebrate Histology	
BIOL 3530	Introductory Parasitology	
ENT 3720	Livestock Entomology	
ENT 3740	Insects and Our Health	
MICRO 3100	Medical Microbiology	
VDPAM 4870	Livestock Disease Prevention	
TSM 3270	Livestock and Poultry Production: Facilities, Technology, and Management	
AGRON 3340	Forage Crop Management	
One course from the following:		3
ANS 4150	Equine Systems Management	
ANS 4240	Companion Animal Systems Management	
ANS 4250	Swine Systems Management	
ANS 4260	Beef Cattle Systems Management	
ANS 4290	Sheep Systems Management	

ANS 4340	Dairy Systems Management	
One course from the following:		2-3
ANS 4150	Equine Systems Management	
ANS 4190	Advanced Animal Nutrition	
ANS 4240	Companion Animal Systems Management	
ANS 4250	Swine Systems Management	
ANS 4260	Beef Cattle Systems Management	
ANS 4290	Sheep Systems Management	
ANS 4340	Dairy Systems Management	
ANS 4600	Science and Technology of Value Added Meat Products	
FSHN 4100	Food Analysis	
FSHN 4200	Food Microbiology	
MICRO 4070	Microbiological Safety of Foods of Animal Origins	

Total Credits **24-27**

Additional free electives required for Animal Science 23-29

Pre-Veterinary Medicine Option

BIOL 2110	Principles of Biology I	3
BIOL 2110L	Principles of Biology Laboratory I	1
CHEM 1770	General Chemistry I	4
CHEM 1770L	Laboratory in General Chemistry I	1
CHEM 1780	General Chemistry II	3
CHEM 3310	Organic Chemistry I	3
CHEM 3310L	Laboratory in Organic Chemistry I	1
BBMB 3010	Survey of Biochemistry	3
	or BBMB 3160 Principles of Biochemistry	
	or BBMB 4040 Biochemistry I	
	or BBMB 4200 Mammalian Biochemistry	
PHYS 1310 & 1310L	General Physics I and General Physics I Laboratory	5
9 credits of upper-level biomedical science courses (refer to the College of Veterinary Medicine for complete list: https://vetmed.iastate.edu/future-dvm-students/still-exploring/pre-veterinary-requirements/foundational-course-requirements/)		9
Three courses from the following:		9
ANS 2160	Equine Science	
ANS 2230	Poultry Science	
ANS 2240	Companion Animal Science	
ANS 2250	Swine Science	
ANS 2260	Beef Cattle Science	
ANS 2280	Laboratory Animal Science	
ANS 2290	Sheep Science	

ANS 2350	Dairy Cattle Science	
One course from the following:		2-4
ANS 3130	Exercise Physiology of Animals	
ANS 3240	Food Processing for Companion Animals	
ANS 3360	Domestic Animal Behavior and Well-Being	
ANS 3370	Lactation	
ANS 3450	Growth and Development of Domestic Animals	
ANS 3600	Fresh Meat Science and Applied Muscle Biology	
BIOL 3140	Principles of Molecular Cell Biology	
BIOL 3520	Vertebrate Histology	
BIOL 3530	Introductory Parasitology	
ENT 3720	Livestock Entomology	
ENT 3740	Insects and Our Health	
MICRO 3100	Medical Microbiology	
VDPAM 4870	Livestock Disease Prevention	
TSM 3270	Livestock and Poultry Production: Facilities, Technology, and Management	
AGRON 3340	Forage Crop Management	
One course from the following:		3
ANS 4150	Equine Systems Management	
ANS 4240	Companion Animal Systems Management	
ANS 4250	Swine Systems Management	
ANS 4260	Beef Cattle Systems Management	
ANS 4290	Sheep Systems Management	
ANS 4340	Dairy Systems Management	
One course from the following:		2-3
ANS 4150	Equine Systems Management	
ANS 4190	Advanced Animal Nutrition	
ANS 4240	Companion Animal Systems Management	
ANS 4250	Swine Systems Management	
ANS 4260	Beef Cattle Systems Management	
ANS 4290	Sheep Systems Management	
ANS 4340	Dairy Systems Management	
ANS 4600	Science and Technology of Value Added Meat Products	
FSHN 4100	Food Analysis	
FSHN 4200	Food Microbiology	
MICRO 4070	Microbiological Safety of Foods of Animal Origins	

Total Credits **49-52**

Additional free electives required for the Pre-veterinary Medicine Option 8-14

* The Iowa State University College of Veterinary Medicine academic requirements are met by completion of this option (<https://vetmed.iastate.edu/future-dvm-students/still-exploring/pre-veterinary-requirements/foundational-course-requirements/>).

Animal Science, B.S. - GENERAL ANIMAL SCIENCE FOCUS

Freshman

Fall	Credits Spring	Credits
ANS 1100	1 ANS 1140	2
ANS 1010	2 CHEM 1770 or 1630	4
ENGL 1500	3 CHEM 1770L or 1630L	1
BIOL 2120	3 Humanities - elective list	3
BIOL 2120L	1 SPCM 2120, COMST 2140, or AGEDS 3110	3
LIB 1600	1 STAT 1010, 1040, or 2260	3-4
MATH 1400, 1430, 1500, 1600, or 1650	3-4	
Soc. Sci. - elective list	3	
	17-18	16-17

Sophomore

Fall	Credits Spring	Credits
ANS 2110	1 ANS 2100	1
ANS 2000 - elective list	3 ANS 2140	3
ANS 2000 - elective list	3 ANS 2140L	1
BBMB 2210	3 ANS 2000 - elective list	3
ANS 2700	2 ENGL 2500	3
ANS 2700L	1 MICRO 2010 or 3020	2-3
ECON 1010, 1020, or ACCT 2840	3 MICRO 2010L or 3020L	1
	Free elective	3
	16	17-18

Junior

Fall	Credits Spring	Credits
ANS 3190	3 ANS 3200	3
ANS 3310	3 ANS 3520	3
ANS 3510	3 ANS 3000 - elective list	3
undefined	Ethics -elective list	3
undefined	Free elective	3
	9	15

Senior

Fall	Credits Spring	Credits
ANS 4110	1 ANS 4000 - Option 2	3
ANS 4000 - Option 1	3 International Perspective - elective list	3

ENGL 3020, 3090, 3120, 3140, or AGEDS 3270	3 Free elective	3
Free elective	3 Free elective	3
Free elective	3 Free elective	4
Free elective	3	
	16	16

This is only one of many equally-sound schedule sequences.

Free electives and specified group electives are often chosen to complement the student's career focus. The student's academic advisor assists with developing scheduling schemes that prepare students individually for careers in the animal industry. They are explained fully in ANS 1100 and through appointments with the student's advisor.

Animal Science, B.S. - PRE-VETERINARY FOCUS

Freshman

Fall	Credits Spring	Credits
ANS 1100	1 ANS 1140	2
ANS 1010	2 CHEM 1770	4
BIOL 2110	3 CHEM 1770L	1
BIOL 2110L	1 Humanities - elective list	3
ENGL 1500	3 SPCM 2120, AGEDS 3110, or COMST 2140	3
LIB 1600	1 STAT 1010, 1040, or 2260	3-4
MATH 1400, 1430, 1500, 1600, or 1650	3-4	
Soc. Sci. - elective list	3	
	17-18	16-17

Sophomore

Fall	Credits Spring	Credits
ANS 2110	1 ANS 2140	3
ANS 2000 - elective list	3 ANS 2140L	1
ANS 2000 - elective list	3 ANS 2000 - elective list	3
BIOL 2120	3 CHEM 3310	3
BIOL 2120L	1 CHEM 3310L	1
CHEM 1780	3 ENGL 2500	3
ECON 1010, 1020, or ACCT 2840	3 ANS 2700	2
	ANS 2700L	1
	17	17

Junior

Fall	Credits Spring	Credits
ANS 2100	1 ANS 3200	3

ANS 3190	3	ANS 3520	3
ANS 3310	3	ANS 3000 - elective list	3
GEN 3200 or BIOL 3130	3	BBMB 3010, 3160, 4040, or 4200	3
MICRO 2010 or 3020	2-3	U.S. Cultures and Communities - elective list	3
MICRO 2010L or 3020L	1		
Ethics - electives list	3		
16-17		15	

Senior

Fall	Credits	Spring	Credits
ANS 4110	1	ANS 4000 - Option 2	3
ANS 4000 - Option 1	3	International Perspective - elective list	3
ENGL 3020, 3090, 3120, 3140, or AGEDS 3270	3	Free elective	3
PHYS 1310	4	Free elective	3
PHYS 1310L	1	Free elective	3
Free elective	3		
Free elective	2		
17		15	

This is only one of many equally-sound schedule sequences.

* Credits currently required for application to Veterinary Medicine program at ISU (55 credits)

General Chemistry with lab (7)

Organic Chemistry with lab (4)

Biochemistry (3)

General Physics with lab (4)

General Biology with lab (8)

Genetics/Animal Breeding (3)

Mammalian Anatomy and/or Physiology (3)

Biomedical Sciences (9)

English Composition (6)

Oral Communication (3)

Humanities and/or Social Sciences (6)

Other Electives (8)

Minors: Animal Science and Meat Science

All minors require at least 15 credits, including at least 6 credits in courses numbered 3000 or above taken at Iowa State University. The minor must include at least 3 credits that are not used to meet any other department, college, or university requirement.

The department offers a minor in Animal Science. The minor requires:

ANS 1010	Working with Animals	2
ANS 1140	Survey of the Animal Industry	2
ANS 2140	Domestic Animal Physiology	3
ANS 2140L	Domestic Animal Anatomy and Physiology Lab	1
One course from the following:		3
ANS 2160	Equine Science	
ANS 2230	Poultry Science	
ANS 2240	Companion Animal Science	
ANS 2250	Swine Science	
ANS 2260	Beef Cattle Science	
ANS 2290	Sheep Science	
ANS 2350	Dairy Cattle Science	
ANS 2700 & 2700L	Foods of Animal Origin and Foods of Animal Origin Laboratory	
One course from the following:		3
ANS 3130	Exercise Physiology of Animals	
ANS 3190	Animal Nutrition	
ANS 3310	Domestic Animal Reproduction	
ANS 3450	Growth and Development of Domestic Animals	
ANS 3520	Genetic Improvement of Domestic Animals	
One course from the following:		2-3
ANS 3190	Animal Nutrition	
ANS 3200	Animal Feeds and Feeding	
ANS 3310	Domestic Animal Reproduction	
ANS 3240	Food Processing for Companion Animals	
ANS 3360	Domestic Animal Behavior and Well-Being	
ANS 3370	Lactation	
ANS 3450	Growth and Development of Domestic Animals	
ANS 3520	Genetic Improvement of Domestic Animals	
ANS 3600	Fresh Meat Science and Applied Muscle Biology	
ANS 4190	Advanced Animal Nutrition	

Total Credits 16-17

A total of 9 credits must be earned at Iowa State University in animal science coursework. Students interested in the Animal Science minor should contact an Animal Science advisor.

Minor - Meat Science

The department offers a minor in Meat Science. The minor requires:

ANS 2700	Foods of Animal Origin	2
ANS 2700L	Foods of Animal Origin Laboratory	1
ANS 3600	Fresh Meat Science and Applied Muscle Biology	3

ANS 4600	Science and Technology of Value Added Meat Products	3
One course from the following:		1
ANS 4900C	Independent Study: Meat Science	
5-6 Credits from the following		5-6
ANS 3240	Food Processing for Companion Animals	
FSHN 3050	Food Quality Management and Control	
FSHN 3110	Food Chemistry	
FSHN 4030	Food Laws and Regulations	
FSHN 4060	Sensory Evaluation of Food	
FSHN 4100	Food Analysis	
FSHN 4120	Food Product Development	
FSHN 4200	Food Microbiology	
FSHN 4710	Food Processing	
MICRO 4070	Microbiological Safety of Foods of Animal Origins	
Total Credits		15-16

Students interested in the Meat Science minor should contact an Animal Science advisor.

The Department of Animal Science offers certificates in:

- Beef Cattle Production Management
- Dairy Cattle Production Management
- Equine Science and Management
- Poultry Production Management
- Swine Production Management

All certificates require at least 24 credits, including at least 18 credits at the 3000 or 4000 level. All courses applied to the certificate must be taken for a grade. A cumulative GPA of 2.0 is required to complete the program and receive the certificate.

Beef Cattle Production Management Foundation Course (3 credits)

ANS 2260	Beef Cattle Science	3

Fundamental Disciplines in Animal Science (9 credits)

ANS 3200	Animal Feeds and Feeding	3
ANS 3310	Domestic Animal Reproduction	3
ANS 3520	Genetic Improvement of Domestic Animals	3

Expertise Expansion (3 credits)

AGRON 2800	Crop Development, Production and Management	3
AGRON 3340	Forage Crop Management	3
ANS 3330	Embryo Transfer and Related Technologies	3
ANS 3360	Domestic Animal Behavior and Well-Being *	3
ANS 3450	Growth and Development of Domestic Animals *	3

ANS 3600	Fresh Meat Science and Applied Muscle Biology *	3
TSM 3270	Livestock and Poultry Production: Facilities, Technology, and Management *	3
TSM 4550	Feed Processing and Technology	3
TSM 4570	Feed Safety, Ingredient Quality and Analytics	3
VDPAM 4870	Livestock Disease Prevention	3

* Course fulfills the Animal Science degree discipline expansion requirement unless designated as a unique course in the certificate

Enterprise Management (3 credits)

AGEDS 4510	Agricultural Law	3
ECON 2300	Farm Business Management ^	3
ECON 2350	Introduction to Agricultural Markets	3
ECON 3320	Cooperatives	3
ECON 3340	Entrepreneurship in Agriculture	3

^ Course is a prerequisite for ANS 4260

Beef Cattle Production Emphasis (6 credits)

ANS 4260	Beef Cattle Systems Management	3
ANS 3990A	Animal Science Internship: Graded Internship Experience	3

Dairy Cattle Production Management Certificate Foundation Course (3 credits)

ANS 2350	Dairy Cattle Science	3

Fundamental Disciplines in Animal Science (9 credits)

ANS 3200	Animal Feeds and Feeding	3
ANS 3310	Domestic Animal Reproduction	3
ANS 3370	Lactation	3

Expertise Expansion (3 credits)

AGRON 2800	Crop Development, Production and Management	3
AGRON 3340	Forage Crop Management	3
ANS 3330	Embryo Transfer and Related Technologies	3
ANS 3350	Dairy Cattle Evaluation	3
ANS 3450	Growth and Development of Domestic Animals *	3
ANS 3520	Genetic Improvement of Domestic Animals	3
ANS 4190	Advanced Animal Nutrition	2
FSHN 4070	Microbiological Safety of Foods of Animal Origins	3
MICRO 3020	Biology of Microorganisms	3
TSM 3270	Livestock and Poultry Production: Facilities, Technology, and Management *	3

TSM 4550	Feed Processing and Technology *	3
TSM 4570	Feed Safety, Ingredient Quality and Analytics *	3

* Courses fulfill the Animal Science degree discipline expansion requirement unless designated as a unique course in the certificate

Enterprise Management (3 credits)

AGEDS 4510	Agricultural Law	3
ECON 2300	Farm Business Management ^	3
ECON 2350	Introduction to Agricultural Markets	3
ECON 3320	Cooperatives	3
ECON 3340	Entrepreneurship in Agriculture	3
ECON 3370	Agricultural Marketing	3

^ Course is a prerequisite for ANS 4340

Dairy Cattle Production Emphasis (6 credits)

ANS 4340	Dairy Systems Management	3
or ANS 4350	Applied Dairy Farm Evaluation	
ANS 3990A	Animal Science Internship: Graded Internship Experience	3

Equine Science and Management Certificate Foundation Course (3 credits)

ANS 2160	Equine Science	3

Fundamental Disciplines in Animal Science (6 credits)

ANS 3200	Animal Feeds and Feeding	3
ANS 3310	Domestic Animal Reproduction	3

Equine Expertise Expansion (6 credits)

ANS 2170	Equine Farm Practicum	2
ANS 3060	Equine Evaluation	3
ANS 3130	Exercise Physiology of Animals *	3
ANS 3160	Equine Reproduction Lab	3
ANS 3170A	Fundamentals of Equine Behavior and Training: Young Horses at Halter	1
ANS 3170B	Fundamentals of Equine Behavior and Training: Yearlings	3

* Courses fulfill the Animal Science degree discipline expansion requirement unless designated as a unique course in the certificate

Expertise Expansion (3 credits)

ACCT 2150	Legal Environment of Business	3
AGEDS 4510	Agricultural Law	3

AGRON 3340	Forage Crop Management	3
ANS 3330	Embryo Transfer and Related Technologies	3
ANS 3360	Domestic Animal Behavior and Well-Being *	3
ANS 3370	Lactation	3
ANS 3450	Growth and Development of Domestic Animals *	3
ECON 3200	Labor Economics	3
ECON 3340	Entrepreneurship in Agriculture	3

* Courses fulfill the Animal Science degree discipline expansion requirement unless designated as a unique course in the certificate

Equine Management Emphasis (6 credits)

ANS 4150	Equine Systems Management	3
ANS 3990A	Animal Science Internship: Graded Internship Experience	3

Poultry Production Management Certificate Foundation Course (3 credits)

ANS 2230	Poultry Science	3

Fundamental Disciplines in Animal Science (9 credits)

ANS 3200	Animal Feeds and Feeding	3
ANS 3310	Domestic Animal Reproduction	3
ANS 3520	Genetic Improvement of Domestic Animals	3

Expertise Expansion (3 credits)

ANS 3360	Domestic Animal Behavior and Well-Being *	3
ANS 3450	Growth and Development of Domestic Animals *	3
ANS 3600	Fresh Meat Science and Applied Muscle Biology *	3
TSM 3270	Livestock and Poultry Production: Facilities, Technology, and Management *	3
TSM 4550	Feed Processing and Technology	3
TSM 4570	Feed Safety, Ingredient Quality and Analytics	3
VDPAM 4870	Livestock Disease Prevention	3
ANS 3730A	Poultry Products Technology #	3
ANS 3730B	Applied Avian Physiology #	3
ANS 3730C	Avian Health #	3
ANS 3730D	Poultry Nutrition #	3

* Courses fulfill the Animal Science degree discipline expansion requirement unless designated as a unique course in the certificate

Courses are held as part of the Midwest Poultry Consortium COE courses during the summer

Enterprise Management (3 credits)

AGEDS 4510	Agricultural Law	3
ECON 2300	Farm Business Management	3
ECON 2350	Introduction to Agricultural Markets	3
ECON 3320	Cooperatives	3
ECON 3340	Entrepreneurship in Agriculture	3

Poultry Production Emphasis (6 credits, to include ANS 3990 and choice of one 4000-level management)

ANS 3990A	Animal Science Internship: Graded Internship Experience	3
ANS 4730A	Poultry Enterprise Management #	3
ANS 4730B	Breeder Flock and Hatchery Management #	3

Courses are held as part of the Midwest Poultry Consortium COE courses during the summer

Swine Production Management Certificate Foundation Course (3 credits)

ANS 2250	Swine Science	3

Fundamental Disciplines in Animal Science (9 credits)

ANS 3200	Animal Feeds and Feeding	3
ANS 3310	Domestic Animal Reproduction	3
ANS 3520	Genetic Improvement of Domestic Animals	3

Expertise Expansion (3 credits)

AGRON 2800	Crop Development, Production and Management	3
ANS 3330	Embryo Transfer and Related Technologies	3
ANS 3360	Domestic Animal Behavior and Well-Being *	3
ANS 3450	Growth and Development of Domestic Animals *	3
ANS 3600	Fresh Meat Science and Applied Muscle Biology *	3
ANS 3800C	Employee Management for the Swine Industry	1
ANS 3800D	Farrowing Management	1
ANS 3800E	Swine Feed Mill Management	1
ANS 3800F	Marketing and Risk Management in the Swine Industry	1
ANS 3800G	Swine Nursery and Finishing Management	1
ANS 3820	Swine Ventilation Systems and Management	1
ANS 3830	Swine Manure and Nutrient Management	1
ANS 3840	Swine Health and Biosecurity	1
TSM 3270	Livestock and Poultry Production: Facilities, Technology, and Management *	3
TSM 4550	Feed Processing and Technology	3

TSM 4570	Feed Safety, Ingredient Quality and Analytics	3
VDPAM 4870	Livestock Disease Prevention	3

* Courses fulfill the Animal Science degree discipline expansion requirement unless designated as a unique course in the certificate

Enterprise Management (3 credits)

AGEDS 4510	Agricultural Law	3
ECON 2300	Farm Business Management	3
ECON 2350	Introduction to Agricultural Markets	3
ECON 3320	Cooperatives	3
ECON 3340	Entrepreneurship in Agriculture	3

Swine Production Emphasis (6 credits)

ANS 4250	Swine Systems Management	3
ANS 3990A	Animal Science Internship: Graded Internship Experience	3

Graduate Study

The department offers work for the degrees Master of Science and Doctor of Philosophy with majors in animal breeding and genetics; meat science; animal physiology; animal science; and an interdepartmental program in nutritional sciences which has an option in animal nutrition. Minor work is offered in these areas to students taking major work in other departments.

A strong undergraduate program is required for students interested in graduate study. Fundamental training in biology, chemistry, mathematics, and statistics is requisite to a satisfactory graduate program. Graduate programs in animal science include supporting work in areas such as agricultural engineering, agronomy; anatomy; biochemistry; chemistry; economics; environmental science; food science and human nutrition; genetics; microbiology; physics; physiology; and statistics. Students may choose graduate programs involving a co-major with one of these areas. Graduate work in meat science is offered as a co-major in animal science and food science and human nutrition.

The department also cooperates in the interdepartmental program in professional agriculture and interdepartmental majors in genetics, immunobiology, microbiology, MCDB (molecular, cellular, and developmental biology), neuroscience, nutritional sciences, and toxicology (see Index (<http://catalog.iastate.edu/azindex/>)).

The foreign language requirement, if any, is established on an individual basis by the program-of-study committee appointed to guide the work of the student.

Biochemistry (AGLS)

The Roy J. Carver Department of Biochemistry, Biophysics and Molecular Biology (<https://www.bbmb.iastate.edu>) offers majors in biochemistry in the College of Liberal Arts and Sciences and in the College of Agriculture and Life Sciences. Biochemists seek to understand life processes in terms of chemical and physical principles. Students in the biochemistry majors develop foundational analytical skills while exploring frontiers in biotechnology and medicine. Graduates in biochemistry will have a rigorous background in chemistry, biology, and physics. Biochemistry coursework focuses on the development of problem-solving skills, critical thinking, communication, and research design. The Biochemistry degree includes focused specializations towards professional goals, including three prescribed options: **Research & Biotechnology**, **Pre-Medicine**, and **Biophysics**.

Graduates with a Biochemistry B.S. degree will be prepared for postgraduate studies in the chemical or biological sciences, medical and health professional training, or immediate laboratory research in biochemistry, biotechnology, or pharmacy. Graduates are also equipped to pursue careers in teaching, technical writing, science communication and policy, intellectual property law, and biotechnology entrepreneurship. The biochemistry major is accredited by the American Society for Biochemistry and Molecular Biology (ASBMB). As such our learning objectives align with ASBMB core concepts.

Student Learning Outcomes

Upon graduation, students should be able to:

- Explain and provide examples to illustrate the biochemical principles underlying the following:
 - a. How energy is required and transformed in biological systems.
 - b. How macromolecular structure determines function and regulation.
 - c. How information storage and flow are dynamic and interactive.
 - d. How biochemistry and biology are driven by evolution and homeostasis
- Apply and justify appropriate techniques to characterize and quantify biomolecules in biological systems.
- Execute effective multimodal communication of the research process and results.
- Implement and justify best practices for laboratory safety and research ethics.

College of Agriculture and Life Sciences Learning Outcomes

Graduates with a Biochemistry B.S. degree from the College of Agriculture and Life Sciences should be able to:

- Explain the role of biochemistry in biotechnology entrepreneurship, pharmaceuticals, agriculture, and allied fields.
- Demonstrate collaboration and leadership in research teams.
- Explain biochemical cycles that impact global ecosystems.

Biochemistry Major in the College of Agriculture and Life Sciences

The Bachelor of Science (B.S.) degree in Biochemistry requires the Biochemistry Core and one of the following three prescribed options. The options represent focused specializations for professional goals, including **Research & Biotechnology**, **Pre-Medicine**, and **Biophysics**. As majors in the College of Agriculture and Life Sciences, Biochemistry students must meet College of Agriculture and Life Sciences and University-wide requirements for graduation in addition to those stated below. Focus option-approved science electives can be found on the Biochemistry website (<https://www.bbmb.iastate.edu/approved-course-lists/>).

Total Degree Requirement: 120 cr.

CALS majors require a minimum of 120 credits, including a minimum of 45 credits at the 3000/4000 level. Only 65 cr. from a two-year institution may apply which may include up to 16 technical cr.; 9 P-NP cr. of free electives; 2.00 minimum GPA.

International Perspectives: 3 cr.

3 cr. from approved International Perspectives list: <http://www.registrar.iastate.edu/students/div-ip-guide/IntlPerspectives-current> (<http://www.registrar.iastate.edu/students/div-ip-guide/IntlPerspectives-current/>)

U.S. Cultures and Communities : 3 cr.

3 cr. from approved U.S. Cultures and Communities list: <http://www.registrar.iastate.edu/students/div-ip-guide/usdiversity-courses> (<https://www.registrar.iastate.edu/students/div-ip-guide/usdiversity-courses/>)

College of Agriculture and Life Sciences General Education Electives: 9 cr.

Humanities

3 cr. from approved humanities list: <http://www.cals.iastate.edu/student-services/humanities> (<http://www.cals.iastate.edu/student-services/humanities/>)

Social Sciences

3 cr. from approved social sciences list: <http://www.cals.iastate.edu/student-services/social-sciences> (<http://www.cals.iastate.edu/student-services/social-sciences/>)

Ethics

3 cr. from approved ethics list: <http://www.cals.iastate.edu/student-services/ethics> (<http://www.cals.iastate.edu/student-services/ethics/>)

Communications Proficiency: 11 cr.

6 cr. of English composition with a C or better and 3 cr. of speech fundamentals with a C or better.

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
or ENGL 2500H	Written, Oral, Visual, and Electronic Composition: Honors	
SPCM 2120	Fundamentals of Public Speaking	3
LIB 1600	Introduction to College Level Research	1
BBMB 3110	Writing Scientific Reports in Biochemistry *	1
*BBMB 3110 fulfills the upper-level Communications Proficiency Requirement		
Total Credits		11

Biochemistry Core

The major in biochemistry requires completion of the Biochemistry Core and one of three focus options. Each defined option includes specific supporting coursework in Biology; Chemistry; Mathematics and/or Statistics.

BBMB 1010	Introduction to Biochemistry	2
BBMB 1020	Introduction to Biochemistry Laboratory	1
BBMB 2010	Chemical Principles in Biological Systems	2
BBMB 3110	Writing Scientific Reports in Biochemistry ¹	1
BBMB 3120	Experimental Research Skills in Biochemistry	2
BBMB 4040	Biochemistry I	3-4
or BBMB 5040	Amino Acids and Proteins	
& BBMB 5050	and Bioenergetics and Metabolism	
BBMB 4050	Biochemistry II	3-4
or BBMB 5060	Membrane Biochemistry	
& BBMB 5070	and Biochemistry of Nucleic Acids	
BBMB 4100	Analysis of Scientific Literature	2
BBMB 4110	Techniques in Biochemical Research	4
BBMB 4610	Molecular Biophysics	2
BBMB 5610L	Laboratory in Molecular Biophysics	2-3
or CHEM 3220L	Laboratory in Physical Chemistry	
PHYS 2310	Introduction to Classical Physics I	5
& 2310L	and Introduction to Classical Physics I Laboratory	
PHYS 2320	Introduction to Classical Physics II	5
& 2320L	and Introduction to Classical Physics II Laboratory	

BBMB 4990	Undergraduate Research (highly encouraged elective)	arr †
Total Credits		34-37 †

† Arranged with instructor.

¹ BBMB 3110 fulfills the ISU upper-level Communication Proficiency requirement.

* Prior to graduation all students take the spring semester ASBMB Annual Exam as a measure of program outcomes assessment.

Biochemistry Program of Study: Research & Biotechnology

Students interested in careers in biotechnology research and/or graduate studies in biochemistry, chemistry, or bioscience fields may opt for the Research & Biotechnology Option. The College of Agriculture and Life Sciences (CALS) electives allow specialization in agricultural biochemistry or plant biochemistry.

In addition to the Biochemistry Core (above):

CHEM 2010	Advanced General Chemistry	5-7
or CHEM 1770	General Chemistry I	
& CHEM 1780	and General Chemistry II	
CHEM 2010L	Laboratory in Advanced General Chemistry	1
or CHEM 1770L	Laboratory in General Chemistry I	
or CHEM 1770LL	Laboratory in General Chemistry II	
CHEM 3250	Chemical Thermodynamics	3
CHEM 3310	Organic Chemistry I	3
CHEM 3320	Organic Chemistry II	3
CHEM 3330L	Laboratory in Organic Chemistry I (for Chemistry and Biochemistry Majors)	1-2
or CHEM 3310LL	Laboratory in Organic Chemistry I	
CHEM 3340L	Laboratory in Organic Chemistry II (for Chemistry and Biochemistry Majors)	1-2
or CHEM 3320LL	Laboratory in Organic Chemistry II	
MATH 1650	Calculus I	8
& MATH 1660	and Calculus II	
STAT 2010	Introduction to Statistical Concepts and Methods	4
or STAT 3050	Engineering Statistics	
BIOL 2110	Principles of Biology I	3
BIOL 2120	Principles of Biology II	3
BIOL 3130	Principles of Genetics	4
& 3130L	and Genetics Laboratory	
BIOL 3140	Principles of Molecular Cell Biology	3

Agricultural & Molecular Sciences from approved list	9
Total Credits	51-55

Biochemistry Program of Study: Pre-Medicine

Students interested in qualifying for medical school training for careers as a Doctor of Medicine (MD) or Doctor of Osteopathic Medicine (DO) may opt for the Pre-Medicine Option. Allied health professions (e.g., Physician Assistant, Dentistry, and Ophthalmology) may also consider the Pre-Medicine Option. The CALS option is especially suited to careers in Veterinary Medicine.

In addition to the Biochemistry Core (above):

CHEM 1770 & 1770L & CHEM 1780 & CHEM 1780L or CHEM 2010 & 2010L	General Chemistry I and Laboratory in General Chemistry I and General Chemistry II and Laboratory in College Chemistry II Advanced General Chemistry and Laboratory in Advanced General Chemistry	6-9
CHEM 3250	Chemical Thermodynamics	3
CHEM 3310 & 3310L	Organic Chemistry I and Laboratory in Organic Chemistry I	4
CHEM 3320 & 3320L	Organic Chemistry II and Laboratory in Organic Chemistry II	4
MATH 1650 & MATH 1660	Calculus I and Calculus II	8
STAT 2010 or STAT 3050	Introduction to Statistical Concepts and Methods Engineering Statistics	3-4
PSYCH 1010 or PSYCH 2300	Introduction to Psychology Developmental Psychology	3
SOC 1340	Introduction to Sociology	3
BIOL 2110	Principles of Biology I	3
BIOL 2110L	Principles of Biology Laboratory I	1
BIOL 2120	Principles of Biology II	3
BIOL 2120L	Principles of Biology Laboratory II	1
BIOL 3130	Principles of Genetics	3
BIOL 3140	Principles of Molecular Cell Biology	3
Physiology & Bioscience Electives from approved list		6
Total Credits		54-58

Biochemistry Program of Study: Biophysics

Students interested in research careers focused on the biophysical basis of life processes may opt for the Biophysics Option. The CALS electives offer specialization in agricultural biophysics or plant biophysics.

In addition to the Biochemistry Core (above):

CHEM 2010 or CHEM 1770 & CHEM 1780	Advanced General Chemistry General Chemistry I and General Chemistry II	5-7
CHEM 2010L or CHEM 1770L or CHEM 1770LL	Laboratory in Advanced General Chemistry Laboratory in General Chemistry I Laboratory in General Chemistry I	1
CHEM 3240	Introductory Quantum Mechanics	3
CHEM 3250	Chemical Thermodynamics	3
CHEM 3310	Organic Chemistry I	3
CHEM 3320	Organic Chemistry II	3
MATH 1650 & MATH 1660	Calculus I and Calculus II	8
MATH 2650	Calculus III	4
MATH 2660	Elementary Differential Equations	3
MATH 3170	Theory of Linear Algebra	4
STAT 2010 or STAT 3050 or STAT 2310	Introduction to Statistical Concepts and Methods Engineering Statistics Probability and Statistical Inference for Engineers	4
COMS 2070	Fundamentals of Computer Programming	3
BIOL 2110	Principles of Biology I	3
BIOL 2120	Principles of Biology II	3
Agricultural & Physical Sciences from approved list		6
Total Credits		56-58

Four Year Plans

Biochemistry B.S. Program of Study, College of Agriculture and Life Sciences *Research & Biotechnology Option* Sample Four-Year Plan

First Year

Fall	Credits Spring	Credits
BBMB 1010	2 BBMB 1020	1
BBMB 1100	1 BBMB 1110	1
MATH 1650	4 MATH 1660	4
CHEM 1770	4 CHEM 1780	3
CHEM 1770N	1 BIOL 2110	3
LIB 1600	1 SPCM 2120	3
ENGL 1500	3	

16

15

Second Year

Fall	Credits Spring	Credits
MATH 2650, 2660, 2670, STAT 2010, or STAT 3050	3-4 BBMB 2010	2
CHEM 3310	3 CHEM 3320	3
CHEM 3310L	1 CHEM 3320L	1
PHYS 2310	4 PHYS 2320	4
PHYS 2310L	1 PHYS 2320L	1
BIOL 2120	3 ENGL 2500	3
	BBMB 4990	1
15-16		15

Third Year

Fall	Credits Spring	Credits
BBMB 4040	3 BBMB 4050	3
BBMB 3110*	1 BIOL 3140	3
BBMB 3120	2 BBMB 4100	2
BIOL 3130	3 BBMB 4990	2
BIOL 3130L	1 International Perspectives Elective	3
BBMB 4990	2 General Education Elective	3
General Education Elective	3	
15		16

Fourth Year

Fall	Credits Spring	Credits
BBMB 4110	4 CHEM 3250	3
Upper-level Agriculture or Mol. Sci. Elective	3 CHEM 3220L or BBMB 4610 <i>and</i> BBMB 5610L	3-4
Upper-level Agriculture or Mol. Sci. Elective	3 BBMB 4990	2
BBMB 4990	2 Upper-level Agriculture or Mol. Sci. Elective	3
General Education Elective	3 U.S. Cultures and Communities Elective	3
15		14-15

"General Education Electives" include 3 credits each in Humanities, Ethics, and Social Sciences.

* BBMB 3110 fulfills the upper-level communication proficiency requirement.

Biochemistry B.S. Program of Study, College of Agriculture and Life Sciences *Pre-Medicine Option* Sample Four-Year Plan

First Year

Fall	Credits Spring	Credits
BBMB 1010	2 BBMB 1020	1
BBMB 1100	1 BBMB 1110	1
MATH 1650	4 MATH 1660	4
CHEM 1770	4 CHEM 1780	3
CHEM 1770N	1 CHEM 1780L	1
LIB 1600	1 BIOL 2110	3
ENGL 1500	3 BIOL 2110L	1
16		14

Second Year

Fall	Credits Spring	Credits
BIOL 2120	3 BBMB 2010	2
BIOL 2120L	1 CHEM 3320	3
CHEM 3310	3 CHEM 3320L	1
CHEM 3310L	1 PHYS 2320	4
PHYS 2310	4 PHYS 2320L	1
PHYS 2310L	1 ENGL 2500	3
PSYCH 1010	3	
16		14

Third Year

Fall	Credits Spring	Credits
BBMB 4040	3 BBMB 4050	3
BBMB 3110*	1 BIOL 3140	3
BBMB 3120	2 BBMB 4100	2
BIOL 3130	3 BBMB 4990	2
STAT 2010	4 SOC 1340	3
General Education Elective	3 International Perspectives Elective	3
16		16

Fourth Year

Fall	Credits Spring	Credits
BBMB 4110	4 CHEM 3250	3
Upper-level Upper-level Physiology & Biosci. Elective	3 CHEM 3220L or BBMB 4610 <i>and</i> BBMB 5610L	3-4
BBMB 4990	2 BBMB 4990	2
SPCM 2120	3 Upper-level Physiology & Biosci. Elective	3

General Education Elective	3 U.S. Cultures and Communities Elective	3
15		14-15

"General Education Electives" include 3 credits each in Humanities and Ethics. MCAT recommended Soc 1340 satisfies the Social Sciences requirement.

* BBMB 3110 fulfills the upper-level communication proficiency requirement.

Biochemistry B.S. Program of Study, College of Agriculture and Life Sciences

Biophysics Option

Sample Four-Year Plan

First Year

Fall	Credits Spring	Credits
BBMB 1010	2 BBMB 1020	1
BBMB 1100	1 BBMB 1110	1
MATH 1650	4 MATH 1660	4
CHEM 1770	4 CHEM 1780	3
CHEM 1770N	1 BIOL 2110	3
LIB 1600	1 SPCM 2120	3
ENGL 1500	3	
16		15

Second Year

Fall	Credits Spring	Credits
MATH 2650	4 BBMB 2010	2
CHEM 3310	3 CHEM 3320	3
PHYS 2310	4 PHYS 2320	4
PHYS 2310L	1 PHYS 2320L	1
BIOL 2120	3 ENGL 2500	3
	BBMB 4990	1
	International Perspective Elective	3
15		17

Third Year

Fall	Credits Spring	Credits
BBMB 4040	3 BBMB 4050	3
BBMB 3110*	1 CHEM 3250	3
BBMB 3120	2 BBMB 4100	2
MATH 2660	3 MATH 3170	4
COMS 2070	3 BBMB 4990	2

BBMB 4990	1 U.S. Cultures and Communities Elective	3
General Education Elective	3	
16		17

Fourth Year

Fall	Credits Spring	Credits
BBMB 4110	4 CHEM 3240	3
BBMB 4990	2 CHEM 3220L or BBMB 4610 <i>and</i> BBMB 5610L	3-4
STAT 2310	4 BBMB 4990	3
Upper-level Agricultural or Phys. Elective	3 Upper-level Agricultural or Phys. Elective	3
General Education Elective	3 General Education Elective	3
16		15-16

"General Education Electives" include 3 credits each in Humanities, Ethics, and Social Sciences.

* BBMB 3110 fulfills the upper-level communication proficiency requirement.

The Roy J. Carver Department of Biochemistry, Biophysics, and Molecular Biology offers a single minor in Biochemistry, administered by the College of Liberal Arts and Sciences.

See Biochemistry Undergraduate Minor.

Concurrent Bachelor of Science (B.S.)/ Master of Science (M.S.) Degrees

The department offers a concurrent enrollment degree program in either Biochemistry or Biophysics that allows ISU undergraduate students to obtain both the B.S. and M.S. degrees in about five years. The program is open to undergraduate students in the College of Liberal Arts and Sciences and in the College of Agriculture and Life Sciences. The concurrent degrees can be useful to students entering various career tracks. For those considering careers as research specialists, entry positions with higher-level responsibilities, and a higher-level salary, are made possible with the M.S. degree. For those considering careers as research directors, which require advanced study, the M.S. degree provides an advantage for admission into Ph.D. programs at the most competitive and prestigious graduate schools. Similarly, the M.S. degree can be a competitive advantage for admission in to medical, dental, law, veterinary medicine, or other professional schools.

Application to the program is made near the end of the junior undergraduate (third) year. Concurrent B.S./M.S. degree students begin research for the M.S. thesis during the summer semester after their junior year and are eligible for research assistantships, which are renewable based on academic standing and satisfactory research performance.

The M.S. thesis requires intensive experience in original, independent laboratory research under the close supervision of a faculty mentor. To apply, see the concurrent B.S./M.S. application instructions found on the department's Graduate Study web page (<https://www.bbmb.iastate.edu/graduate-study/>).

Concurrent Bachelor of Science/Graduate Certificate

The Bachelor of Science /Graduate Certificate program is intended for exceptional undergraduate students majoring in Biochemistry. In this program, the student completes all of the requirements for the B.S. degree and the graduate certificate in a four-year period by combining the requirements of the two programs. The student enters the Graduate College after he/she achieves junior status and develops a plan of coursework (graduate and undergraduate) subject to the approval of the Director of Certificate (DOC). Required graduate courses are BBMB 5040, BBMB 5050, BBMB 5060, BBMB 5070, BBMB 5610 and BBMB 5610L. The student must satisfy the requirements of the B.S. in Biochemistry (121 credits) and the Graduate Certificate in Biochemistry (12 credits). Six credits of graduate coursework can satisfy some requirements of the B.S. degree. To apply for the B.S./Graduate Certificate, submit the application form found on the Graduate College Forms web page.

Biochemistry and Biophysics are the science and technology used to understand the mechanisms underlying biological processes at the molecular level, with an emphasis on the fundamental relationships among the chemical, physical, and biological sciences. The Roy J. Carver Department of Biochemistry, Biophysics, and Molecular Biology (BBMB) administers Doctor of Philosophy (Ph.D.), Master's (M.S.), and Graduate Certificate programs (<https://www.bbmb.iastate.edu/graduate-study/>) that lead to an advanced degree or certificate in these disciplines. The prerequisite to graduate study is a sound undergraduate background in biology, chemistry, mathematics, and physics.

BBMB offers Doctor of Philosophy and master's degrees in Biochemistry and in Biophysics that are designed to train students to independently conceive and carry out original research. BBMB also offers two graduate certificate programs in Biochemistry that provide a mechanism for formal recognition of focused graduate study in a specialized area that is less comprehensive than that required for a master's degree. BBMB participates in the Interdepartmental majors of Bioinformatics and Computational Biology; Genetics and Genomics; Immunobiology; Molecular, Cellular, and Developmental Biology; Neuroscience; Plant Biology; and Toxicology. All graduate degree students in BBMB are required to teach as part of their training.

Master's (M.S.) Degree

The M.S. degree programs in Biochemistry and in Biophysics are useful for students who prefer to undertake research training without the longer-term commitment required for the Ph.D. degree. It is also useful for students interested more in the technical aspects of research rather than

in careers as research directors. The program requires about 3 years on average to complete and the successful defense of an independent research dissertation is required. About half the time required to earn the degree is spent on advanced coursework and professional seminars, and the other half is devoted to research undertaken in the laboratory under the close supervision of a faculty mentor. Financial support is available. To apply, applicants first submit the free BBMB online application found on the department website, which is used as a screening tool.

NOTE: Students interested in a research career are encouraged to consider the Ph.D. track. Students may enter the Biochemistry or Biophysics M.S. degree program as a direct admit to a faculty research group at any time during the year.

Doctor of Philosophy (Ph.D.) Degree

The Ph.D. programs in Biochemistry and in Biophysics are designed to train students in the ability to independently conceive and carry out original research in the general area of the chemistry or physics of the processes of life. The programs require about 5-6 years on average to complete and the successful defense of an independent research dissertation. The majority of the time required to earn the degree is spent doing research on the dissertation project in the laboratory under the close supervision of a faculty mentor. Considerable time also is devoted to advanced coursework and professional seminars. Financial support is available. To apply, applicants first submit the free BBMB online application found on the department website, which is used as a screening tool. Students may enter the Biochemistry or Biophysics Ph.D. degree programs either as a rotation student in the fall semester or as a direct admit to a faculty research group at any time during the year.

Minor in Biochemistry

Graduate students in other M.S. and/or Ph.D. programs at ISU can earn a graduate minor in Biochemistry by completing 12 credits of the following courses with a grade point average of 3.0 or above: at least 6 credits from BBMB 5040, BBMB 5050, BBMB 5060 and BBMB 5070 and at least 6 credits of other BBMB 5000- and 6000-level courses. A student wishing to declare a minor in Biochemistry should arrange for a member of the graduate faculty in Biochemistry to serve on the POS Committee and submit the required form found on the Graduate College Forms page.

Graduate Certificate in Biochemistry

The graduate certificate in Biochemistry is designed for students who have a B.S. degree in Biochemistry or a related field and wish to advance their knowledge by taking additional coursework at the graduate level. The graduate certificate courses may be taken either on-line or on campus. Candidates for a graduate certificate in Biochemistry are admitted in the Graduate College. A total of 12 credits is required that includes BBMB 5040, BBMB 5050, BBMB 5060 and BBMB 5070, plus four additional credits of BBMB coursework at the 5000-level. The 12 credits earned in the graduate certificate program may be applied to meet

the course requirements of a M.S. or Ph.D. program in Biochemistry at Iowa State University (ISU) if the student is accepted into one of these programs. To apply for the graduate certificate in Biochemistry, submit the ISU online application.

Biology

Interdepartmental Undergraduate Program

Iowa State University is a major center for research and education in the biological sciences. With over 200 faculty in the life sciences, students have the opportunity to learn from some of the nation's leaders in biological research and teaching and to participate in innovative, meaningful research projects that explore frontiers of biology. Few other universities have such a wealth of faculty expertise available to undergraduate students, making Iowa State's Biology Program the logical choice for those who want to participate in a thriving academic community.

The faculties of the Department of Ecology, Evolution, and Organismal Biology and the Department of Genetics, Development, and Cell Biology jointly offer the undergraduate biology major. This high-quality academic program has the flexibility to accommodate a range of career goals while taking advantage of the university's strengths in science and technology. A bachelor's degree in biology provides excellent preparation for graduate study in biological disciplines ranging from the molecular to the ecological levels, and for entrance into various professional schools, such as human medicine, physical therapy, or veterinary medicine. The major is well suited for those who plan to teach biology, who wish to enter government or industrial employment in health or environmental professions, or who prefer educational breadth as an end in itself. By working with our professional advisors, it is possible to design a unique program of study that will meet student needs and objectives.

Students with special interests and aptitudes should consider combining biology with a minor or a second major in another subject, such as chemistry, environmental studies, journalism, mathematics, music, statistics, or many other subjects offered by the university.

Customizing a Degree

Biology encompasses an amazing diversity of disciplines and scales of study ranging from molecules to the biosphere. The biology major offers a rich variety of coursework addressing most of the areas of biology. The major's curriculum requirements offer tremendous flexibility in creating an individualized program of study to facilitate achievement of a student's career goals, while simultaneously assuring some exposure to all areas of biology and providing complementary knowledge from supporting courses in chemistry, physics, and math/statistics.

While flexibility is the hallmark of the biology major, the breadth of the field can also be challenging. Thus, in an effort to provide more guidance to students who desire such, the major also provides six advising tracks, or areas of specialization, for students who wish to focus on subfields of biology or who have specific career goals in mind. Course plans for each area of specialization are listed on the biology web site. The areas are:

Pre-medical and Human Health Professions--This area emphasizes preparation for further study in medical school or allied human health professions such as dentistry, optometry, genetic counseling, physical therapy, occupational therapy, physician assistant, nursing, chiropractic, and others. It also will prepare students for a broad range of careers in the biological sciences. Students are urged to determine the specific entrance requirements for the professional schools where they might study and to plan a program of study accordingly, in addition to following the basic plan.

Pre-veterinary--An eventual degree in Veterinary Medicine can lead to a wide variety of careers, including private clinical practice in small animal medicine or agricultural animal production. But pre-veterinary students can also prepare themselves for careers in animal research, public health, laboratory animal medicine, food safety, regulatory medicine, and education. Specific requirements for entrance to the Iowa State Veterinary College or other schools should be consulted as programs of study are planned, in addition to following the basic plan.

Molecular and Cellular Biology--Students specializing in this field will explore the structure, function, and interactions of the molecules and sub-cellular features that make up living cells. This area is particularly designed for those who plan to pursue a career in research in molecular or cell biology or in related areas such as biochemistry, genetics, microbiology, developmental biology, human medicine, or veterinary medicine. Many students in this area will choose to go on to graduate school.

Ecology and Conservation Biology--Ecologists examine the interactions and relationships that living organisms have with each other and their environment. Conservation biologists study the nature and status of Earth's biodiversity with the aim of protecting species, their habitats, and ecosystems from excessive rates of extinction and loss. Students who choose this specialization may go on to work for a non-profit environmental group; an environmental consulting firm; a local, state, or federal agency; or other related organizations. Many students in this area will choose to go on to graduate school.

Evolution and Biodiversity--This area provides students with a sound understanding of evolutionary principles and the biological patterns that result from evolutionary change. Students have the opportunity to explore, in depth, the biodiversity found within a wide range of groups of organisms. Students who choose this specialization may go on to work for a non-profit environmental group; an environmental consulting firm;

a local, state, or federal agency; or other related organizations. Many students in this area will choose to go on to graduate school.

Teacher licensure—Biology majors seeking recommendation for licensure to teach biology in secondary schools must meet requirements of the Teacher Education Program as well as those of the Biology Program. In addition, they must apply formally for admission to the teacher education program. See the section on Teacher Education for a list of licensure areas, degree requirements, and other information about this program.

Other Opportunities

Undergraduate research—Students who have interests in biological research are encouraged to become involved in the research projects of faculty members on campus. Those doing so may receive credit for the experience in BIOL 4990 Undergraduate Research Experience. Making the effort to find a suitable research mentor and engaging in research work can be one of the most valuable experiences of an undergraduate education. Internship experiences are often available at other universities, zoos, museums, governmental and non-governmental entities focused on environmental issues, and industrial or government laboratories. Students participating in such projects may receive internship credit in BIOL 4940 Biology Internship.

Field trip courses – The Biology Program offers two field trip courses: BIOL 3930 (North American Field Trips in Biology) and BIOL 3940 (International Field Trips in Biology). In recent years field trip opportunities to Honduras and Spain have been available. These courses involve a pre-trip seminar followed by one-week to one-month long field trip at a time when academic year classes are not in session. The classes are low enrollment and allow extensive interaction between instructors and students in locations of biological interest.

International experience—Because major discoveries in science often result from global efforts, biology majors are encouraged to include an international or study abroad component in their degree programs. This can be done by participating in international field trips originating from the ISU campus in BIOL 3940 International Field Trips in Biology. In addition, many students choose to study abroad, attending a university in another country for up to a year as an exchange student. Minors in a foreign language can also add an international emphasis to a degree in biology.

Courses Offered at Other Locations

In addition to biological science courses taught on campus, students may take courses at various remote locations and arrange to have the credits count toward the advanced courses required in the biology major. Attending a summer field station adds an important component to an undergraduate program of study.

Gulf Coast Research Laboratory—The Gulf Coast Research Laboratory is affiliated with the University of Southern Mississippi. Iowa State students

may register for marine biology courses and transfer credit to their degree programs under the number BIOL 4800 Studies in Marine Biology. Written permission of the Biology Program Director is required for this arrangement.

Summer Biological Field Stations—Courses taken at summer field stations may be transferred to Iowa State University as credit in BIOL 4810 Summer Field Studies. Such stations are found throughout the country and often offer courses that emphasize the adaptation of plants and animals to unique environments. See www.biology.iastate.edu (<http://www.biology.iastate.edu/>) for links to Iowa Lakeside Laboratory and other field stations in different biomes, e.g., marine/coastal, Great Lakes, taiga, deciduous forests, deserts, Rocky Mts., etc.

Organization for Tropical Studies—Iowa State students may register for courses in tropical biology taught in Costa Rica by the Organization for Tropical Studies. Credit is transferred to Iowa State as BIOL 4820 Tropical Biology. For further information, contact the Biology Student Services Office in 103 Bessey Hall.

Student Learning Outcomes

Upon graduation, students should be able to:

- Explain and apply the core biological concepts of:
 - Evolution
 - Structure and function
 - Information flow, exchange, and storage
 - Pathways and transformations of energy and matter
 - How systems are interconnected and interact:
- Apply the process of science.
- Use quantitative reasoning.
- Use modeling and simulation.
- Utilize, communicate with, and collaborate with other disciplines.
- Understand the relationship between science and society.

Undergraduate Study

Biology majors start their studies in the biological sciences by taking a two-semester long Principles of Biology course sequence:

BIOL 2110	Principles of Biology I	3
BIOL 2110L	Principles of Biology Laboratory I	1
BIOL 2120	Principles of Biology II	3
BIOL 2120L	Principles of Biology Laboratory II	1

During the first year, students also take BIOL 1100 Introduction to Biology and BIOL 1110 Opportunities in Biology, which are half-semester courses designed to introduce the student to the discipline of biology and

opportunities for careers in biology. Students transferring into the biology major take BIOL 1120 in place of BIOL 1100 and BIOL 1110.

Students then explore, in any order depending on their interests, four upper-level core courses including: concepts of ecology in BIOL 3120; the principles of genetics in BIOL 3130 and BIOL 3130L; cell and molecular biology in BIOL 3140; and evolutionary biology in BIOL 3150. Biology majors must take an additional 21 credits of advanced biological science courses at the 3000 level, or above, from an approved list of courses. Many of these courses have as prerequisites BIOL 2110/L and BIOL 2120/L, so students do not need to complete the four upper-level core courses before taking advanced courses. Of these advanced courses, at least 9 credits must be taken as BIOL courses, and a minimum of two laboratory or field courses must also be included from an approved list.

Biology majors should carefully consider their selection of upper-level courses to allow them to emphasize one, or more, of the sub-disciplines of Biology relevant to their post-baccalaureate objectives. Most biology courses numbered 3000 or above can be used to satisfy the additional credit requirement. Some courses taught in other departments can also be applied to the biology major. Advanced students should consider including 5000 level courses in their programs. The Biology Program's web site has a complete listing of acceptable upper-level life science courses.

Biology majors must demonstrate competency in their understanding of the biological sciences. A 2.0 cumulative average is required in biology and advanced biology coursework. In order to graduate, a student must have a cumulative average in the major of at least 2.00.

General requirements

Students may earn the B.S. degree in Biology from either the College of Liberal Arts and Sciences or from the College of Agriculture and Life Sciences. Students in the College of Liberal Arts and Sciences must fulfill the College of Liberal Arts and Sciences and University-wide requirements for graduation in addition to those stated for the major. Students in the College of Agriculture and Life Sciences must meet University-wide requirements for graduation and requirements for that college. Contact the Student Services Office for details regarding differences in general education and course requirements that are specific to these colleges.

Supporting course requirements – Understanding biology requires a basic understanding of the physical sciences and mathematics. Consequently, a minimum number of credits in general chemistry, organic chemistry, biochemistry, and physics is required. See the Biology Program Web Site for specific supporting science requirements.

The Math requirement is competency based. After demonstrating competency in algebra and trigonometry, biology majors must take two semesters of calculus; or two semesters of Statistics; or one semester of

calculus and one semester of Statistics chosen from a list of approved courses available on the Biology Program Web Site and in the Biology Program Office.

Given the important role of communications in the modern sciences, biology majors must demonstrate communication competency by earning a minimum of C in ENGL 2500 Written, Oral, Visual, and Electronic Composition or equivalent composition courses and in one advanced writing course numbered ENGL 3020 through ENGL 3160, or JLMC 3470, or SPCM 2120. (Students in the College of Agriculture and Life Sciences are required to earn a C or better in ENGL 1500, as well.)

Curriculum in Biology

Administered by the Departments of Ecology, Evolution, and Organismal Biology; and Genetics, Development and Cell Biology. Students should consult the Biology Student Services Office, 103 Bessey (or biology@iastate.edu) for the appropriate course selections for professional or graduate school preparation.

Total Degree Requirement: 120 cr.

Only 65 cr. from a two-year institution may apply which may include up to 16 technical cr.; 9 P-NP cr. of free electives; 2.00 minimum GPA.

Biology: 23.5 cr.

2.00 GPA average required.

BIOL 1100	Biology Major Orientation	1
BIOL 1110	Opportunities in Biology	0.5
BIOL 2110	Principles of Biology I	3
BIOL 2110L	Principles of Biology Laboratory I	1
BIOL 2120	Principles of Biology II	3
BIOL 2120L	Principles of Biology Laboratory II	1
BIOL 3120	Ecology	4
BIOL 3130	Principles of Genetics	3
BIOL 3130L	Genetics Laboratory	1
BIOL 3140	Principles of Molecular Cell Biology	3
BIOL 3150	Biological Evolution	3
Total Credits		23.5

Advanced Biology: 21 cr.

2.00 GPA average required. Must include two approved Advanced Biology labs. See the Biology Program website for list of approved Advanced Biology courses, or consult an advisor in the Biology Student Services office, 103 Bessey Hall.

Biology advanced courses (from approved list)	9
Additional approved biology advanced courses	12
Total Credits	21

Mathematical Sciences 7 cr.

Students in College of Agriculture and Life Sciences must have a Math and Statistics.

MATH 1600 or MATH 1650 and STAT 1010 or STAT 1040

Or		
MATH 1650 & MATH 1660	Calculus I and Calculus II	8
Or		
STAT 1010 or STAT 1040 and STAT 3010		4-7

Physical Sciences

General Chemistry: 5 cr. minimum

CHEM 1630 & 1630L	College Chemistry and Laboratory in College Chemistry	5

Or		
CHEM 1770 & 1770L	General Chemistry I and Laboratory in General Chemistry I	5
CHEM 1780 & 1780L	General Chemistry II and Laboratory in College Chemistry II	4

Organic Chemistry: 4 cr. minimum

CHEM 2310 & 2310L	Elementary Organic Chemistry and Laboratory in Elementary Organic Chemistry	4

Or		
CHEM 3310 & 3310L	Organic Chemistry I and Laboratory in Organic Chemistry I	4
CHEM 3320 & 3320L	Organic Chemistry II and Laboratory in Organic Chemistry II	4

Biochemistry: 3 cr.

BBMB 3160	Principles of Biochemistry	3

Or		
BBMB 4040	Biochemistry I	3

Or		
BBMB 4200	Mammalian Biochemistry	3

Physics: 5 cr. minimum

PHYS 1150 & 1150L	Physics for the Life Sciences and Laboratory in Physics for the Life Sciences	5

Or		
PHYS 1310 & 1310L	General Physics I and General Physics I Laboratory	5
PHYS 1320 & 1320L	General Physics II and General Physics II Laboratory	5

International Perspectives: 3 cr.**U.S. Cultures and Communities: 3 cr.****Communication/Information Literacy**

Students must earn a C or better in ENGL 2500 and the advanced communication course. Additionally, students in the College of Agriculture and Life Sciences must earn a C or better in ENGL 1500. Students should consult their advisor to discuss advanced communication course options other than SPCM 2120.

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
LIB 1600	Introduction to College Level Research	1
SPCM 2120	Fundamentals of Public Speaking	3

Total Credits 10

Humanities and Social Sciences

Chosen from approved lists.

LAS - Biology

Note: Students must have completed 3 years of a single world language or take 4-8 credits of university level world language.

Humanities	12
Social Sciences	9
Career Preparation (LAS 2030)	1

Total Credits 22

Humanities and Social Sciences

Chosen from approved lists.

CALS - Biology

Note: Students in CALS - Biology must take an approved speech course and an approved Math and Statistics course.

Humanities	3
Social Sciences	3
Ethics	3
Total Credits	9

Biology, B.S. (College of Agriculture and Life Sciences)

The minimum number of credits required to graduate is 120. Students are required to take 21 credits in advanced biology of which 9 credits must be from the Biology Program (BIOL). At least two advanced courses must have a lab or field component.

General Sample Plan

Freshman

Fall	Credits	Spring	Credits	Summer	Credits
BIOL 1100		1 BIOL 2120		3 All Summers: Consider internship, study abroad, field stations, research, clinical observation	
BIOL 1110		0.5 BIOL 2120L		1	
BIOL 2110		3 Chemistry*		4	
BIOL 2110L		1 Social Science Choice		3	
CHEM 1630 or 1770*		4 Math/Stat Choice*		4	
CHEM 1630L or 1770L*		1			
ENGL 1500 or 2500		3			
LIB 1600		1			
14.5		15		0	

Sophomore

Fall	Credits	Spring	Credits
ENGL 2500 (or Elective)		3 BIOL 3130	3
BIOL 3140		3 BIOL 3130L	1
Chemistry or Elective*		3-4 Biochemistry*	3
Advanced Biology		3 Math/Stat Choice*	4
Humanities Choice		3 Elective Choice	3
15-16		14	

Junior

Fall	Credits	Spring	Credits
BIOL 3120		4 BIOL 3150	3

Advanced Biology	3 Advanced Biology with Lab	4
PHYS 1150 or 1310*	4 PHYS 1320 (or Elective)*	4
PHYS 1150L or 1310L*	1 PHYS 1320L (or Elective)*	1
Ethics Choice	3 U.S. Cultures and Communities	3
15		15

Senior

Fall	Credits	Spring	Credits
Advanced Biology		4 Advanced Biology with Lab	4
International Perspectives		3 Advanced Biology	3
SPCM 2120 or COMST 2140		3 Minor or Electives	9
Minor or Electives		6	
16		16	

Total Credits: 120.5-121.5

* Students should meet with an academic advisor to determine the proper plans for chemistry, math and physics before selecting those options above.

Biology, B.S. (College of Agriculture and Life Sciences)

Pre-Medical Sample Plan

Please note that professional school requirements vary by program.

Freshman

Fall	Credits	Spring	Credits	Summer	Credits
BIOL 1100		1 BIOL 2120		3 All Summers: Consider internship, study abroad, field stations, research, clinical observation	
BIOL 1110		0.5 BIOL 2120L		1	
BIOL 2110		3 CHEM 1780		3	
BIOL 2110L		1 CHEM 1780L		1	
CHEM 1770		4 MATH 1600 or 1650		4	
CHEM 1770L		1 PSYCH 1010		3	
ENGL 1500 or 2500		3			
LIB 1600		1			
14.5		15		0	

Sophomore

Fall	Credits	Spring	Credits
BIOL 3140		3 Advanced Biology Choice	3
CHEM 3310		3 BIOL 3130	3
CHEM 3310L		1 BIOL 3130L	1
ENGL 2500 (or Elective)		3 CHEM 3320	3
STAT 1040 or 1010		3-4 CHEM 3320L	1
FSHN 3670		1 Ethics Choice Elective	3 2
14-15		16	

Junior

Fall	Credits	Spring	Credits
BBMB 3160 or 4040		3 BBMB 4050 (Or Advanced Biology Choice)	3
BIOL 3500		4 BIOL 3350	3
SOC 1340		3 BIOL 3350L	1
PHYS 1310		4 U.S. Cultures and Communities	3
PHYS 1310L		1 PHYS 1320 PHYS 1320L	4 1
		Take MCAT in May or June Submit application in June or July	
15		15	

Senior

Fall	Credits	Spring	Credits
Advanced Biology Choice		3 Advanced Biology Choice	3
SPCM 2120 or COMST 2140		3 BIOL 3150	3
BIOL 3120 (with lab)		4 Humanities Choice	3
International Perspectives Elective		3 Elective	6
		3	
16		15	

Total Credits: 120.5-121.5**Biology, B.S. (College of Agriculture and Life Sciences)****Pre-Physician Assistant Sample Plan**

Please note that professional school requirements vary by program.

Freshman

Fall	Credits	Spring	Credits	Summer	Credits
BIOL 1100		1 BIOL 2120		3 All Summers: Consider internship, study abroad, field stations, research, clinical observation	
BIOL 1110		0.5 BIOL 2120L		1	
BIOL 2110		3 CHEM 1780		3	
BIOL 2110L		1 CHEM 1780L		1	
CHEM 1770		4 MATH 1600 or 1650		4	
CHEM 1770L		1 PSYCH 1010		3	
ENGL 1500		3			
LIB 1600		1			
14.5		15		0	

Sophomore

Fall	Credits	Spring	Credits
BIOL 3140		3 Advanced Biology Choice	3
CHEM 2310		3 BIOL 3130	3
CHEM 2310L		1 BIOL 3130L	1
Or CHEM 3310 & CHEM 3310L		Elective	3
ENGL 2500 (or Elective)		3 International Perspectives + Humanities Choice	3
STAT 1040 or 1010		3-4 PSYCH 2300	3
FSHN 3670		1	
14-15		16	

Junior

Fall	Credits	Spring	Credits
BBMB 3160		3 Advanced Biology	3
BIOL 3120		4 BIOL 3350	3
BIOL 3500		4 BIOL 3350L	1
Elective		2 U.S. Cultures and Communities + Ethics	3
PSYCH 4600		3 PHYS 1150/L or PHYS 1310/L	5
16		15	

Senior

Fall	Credits	Spring	Credits
Advanced Biology Choice		3 Advanced Biology Choice	3
Written Communication/ Speech		3 Elective	3
BIOL 3150		3 Elective	3
Elective		3 Elective	3
Elective		3 Elective	3
15		15	

Total Credits: 120.5-121.5**Biology, B.S. (College of Agriculture and Life Sciences)****Pre-Physical Therapy Sample Plan**

Please note that professional school requirements vary by program.

Freshman

Fall	Credits	Spring	Credits	Summer	Credits
BIOL 1100		1 BIOL 2120		3 All Summers: Consider internship, study abroad, field stations, research, clinical observation	
BIOL 1110		0.5 BIOL 2120L		1	
BIOL 2110		3 CHEM 1780		3	
BIOL 2110L		1 CHEM 1780L		1	
CHEM 1770		4 MATH 1600 or 1650		4	
CHEM 1770L		1 PSYCH 1010		3	
ENGL 1500 or 2500		3			
LIB 1600		1			
14.5		15		0	

Sophomore

Fall	Credits	Spring	Credits
BIOL 3140		3 Advanced Biology	3
CHEM 2310		3 BIOL 3130	3
CHEM 2310L		1 BIOL 3130L	1
ENGL 2500 (or Elective)		3 Elective	3
STAT 1010 or 1040		3-4 International Perspectives +Humanities Choice	3
FSHN 3670		1 Elective (Psych course recommended)	3
14-15		16	

Junior

Fall	Credits	Spring	Credits
BBMB 3160		3 Advanced Biology	3

U.S. Cultures and Communities + Ethics	3 BIOL 3350	3
BIOL 3500	4 BIOL 3350L	1
PHYS 1310	4 Elective	3
PHYS 1310L	1 PHYS 1320	4
	PHYS 1320L	1
15		15

Senior

Fall	Credits	Spring	Credits
Advanced Biology Choice		3 Advanced Biology Choice	3
SPCM 2120 or COMST 2140		3 Elective	3
BIOL 3120 (with lab)		4 BIOL 3150	3
Elective		3 Elective	3
Elective		3 Elective	3
16		15	

Total Credits: 120.5-121.5**Minor**

A minor in Biology is offered by the Biology Program and administered by the College of Liberal Arts and Sciences. The minor requires 15 credits in Biology and includes the completion of the specific courses listed below and 7 credits in biology courses numbered 3000 or above. Three (3) credits of the required courses must apply only to the minor. For more information, see the Biology Program web site or contact the Student Services Office in 103 Bessey Hall.

BIOL 2110	Principles of Biology I	3
BIOL 2110L	Principles of Biology Laboratory I	1
BIOL 2120	Principles of Biology II	3
BIOL 2120L	Principles of Biology Laboratory II	1
Additional BIOL courses 3000-level and above		7
Total Credits		15

The Biology Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

Graduate Programs

Biology is an undergraduate major only. Persons interested in graduate study in the biological sciences should apply directly to one of the life science graduate programs at Iowa State University.

Programs

- Bioinformatics and Computational Biology
- Ecology and Evolutionary Biology
- Genetics
- Molecular Cellular and Developmental Biology
- Neuroscience
- Plant Biology
- Toxicology
- Immunobiology
- Environmental Science

Interdisciplinary Graduate Studies

A non-thesis master's degree in Interdisciplinary Graduate Studies (biological sciences) has been established particularly for those who wish to have a more diversified program of advanced study than that generally permitted by specific departments and programs.

Culinary Food Science (AGLS)

The Culinary Food Science degree is an interdisciplinary program that combines the principles of food science and culinary skills development. As a graduate, you'll combine food product development skills and entrepreneurial talents with scientific knowledge, to create new innovative food products and recipes.

The Culinary Food Science major is an approved Culinology® program through the Research Chefs Association.

The department also offers a culinary food science minor.

Student Learning Outcomes

Upon graduation, students should be able to:

- Communicate effectively in their field of study using written, oral, visual and/or electronic forms.
- Demonstrate proficiency in ethical data collection and interpretation, literature review and citation, critical thinking and problem solving.
- Participate effectively in a group or team.
- Integrate creativity, innovation, or entrepreneurship in ways that produce value.
- Explain how human activities impact the natural environment and how societies are affected.

- Meet program specific learning outcomes for the Culinary Food Science major.

Degree Requirements

Administered by the Department of Food Science and Human Nutrition

Total Degree Requirement: 120 cr.

Students must fulfill International Perspectives and U.S. Cultures and Communities requirements by selecting coursework from approved lists. These courses may also be used to fulfill other area requirements. Only 65 cr. from a two-year institution may apply to the degree which may include up to 16 technical cr.; 9 P-NP cr. of electives; 2.00 minimum GPA.

International Perspectives: 3 cr.
U.S. Cultures and Communities: 3 cr.
Communications and Library: 10 cr.

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
LIB 1600	Introduction to College Level Research	1
SPCM 2120	Fundamentals of Public Speaking	3
Total Credits		10

Humanities and Social Sciences: 9-15 cr.

FSHN 2200	American Food and Culture	3
ECON 1010	Principles of Microeconomics	3
If a Culinary Food Science student in the College of Health and Human Sciences, select:		6

Additional Humanities course

Additional Humanities or Social Science course

Ethics: 3 cr. (Included as part of the Humanities and Social sciences requirement)

FSHN 3420	World Food Issues: Past and Present	3

Mathematical Sciences: 6-8 cr.

Select at least 3 credits from: 3-4

MATH 1400	College Algebra	
MATH 1430	Preparation for Calculus	
MATH 1600	Survey of Calculus	
MATH 1650	Calculus I	

Select at least 3 credits from: 3-4

STAT 1010	Principles of Statistics	
STAT 1040	Introduction to Statistics	

Total Credits **6-8**

Physical Sciences: 9 cr.

CHEM 1630	College Chemistry	4
or CHEM 1770 General Chemistry I		
CHEM 1630L	Laboratory in College Chemistry	1

or CHEM 1770L Laboratory in General Chemistry I		
CHEM 2310	Elementary Organic Chemistry	3
CHEM 2310L	Laboratory in Elementary Organic Chemistry	1
Total Credits		9

Biological Sciences: 10-11 cr.

BBMB 3010	Survey of Biochemistry	3
BIOL 2120	Principles of Biology II	3
BIOL 2120L	Principles of Biology Laboratory II	1
MICRO 2010	Introduction to Microbiology	2-3
or MICRO 3020 Biology of Microorganisms		
MICRO 2010L	Introductory Microbiology Laboratory	1
or MICRO 3020L Microbiology Laboratory		
Total Credits		10-11

Animal Science Coursework: 6 cr.

ANS 2700	Foods of Animal Origin	2
ANS 2700L	Foods of Animal Origin Laboratory	1
ANS 4600	Science and Technology of Value Added Meat Products	3
Total Credits		6

Food Science and Human Nutrition: 42 cr.

FSHN 1010	Food and the Consumer	3
FSHN 1040	Introduction to Professional Skills in Culinary Science	2
FSHN 1100	Professional and Educational Preparation	1
FSHN 1670	Introductory Human Nutrition and Health	3
FSHN 2030	Contemporary Issues in Food Science and Human Nutrition	1
FSHN 2140	Scientific Study of Food	3
FSHN 2150	Advanced Food Preparation Laboratory	2
FSHN 3050	Food Quality Management and Control	2
FSHN 2070	Processing of Foods: Basic Principles and Applications	3
FSHN 3110	Food Chemistry	3
FSHN 3110L	Food Chemistry Laboratory	1
FSHN 3140	Professional Development for Culinary Food Science and Food Science Majors	1
FSHN 4030	Food Laws and Regulations	2
FSHN 4060	Sensory Evaluation of Food	3
FSHN 4070	Microbiological Safety of Foods of Animal Origins	3
FSHN 4110	Food Ingredient Interactions and Formulations	2
FSHN 4120	Food Product Development	3
FSHN 4200	Food Microbiology	3

Take one of the following courses for 2 credits: 2

FSHN 4910B	Supervised Work Experience: Food Science	
or FSHN 491 Supervised Work Experience: Culinary Science		
Total Credits		43

Hospitality Management: 12 cr.

HSPM 1330	Food Safety Certification	1
HSPM 3800	Food Production Management	3
HSPM 3800L	Food Production Management Experience	3
HSPM 3830	Wine and Spirits in Hospitality Management	2
or FSHN 5090 Sensory Evaluation of Wines		
HSPM 4870	Fine Dining Management	3
Total Credits		12

Electives 1-13 cr. Select from any university coursework to earn at least 120 total credits.

Go to FSHN courses.

Culinary Food Science, B.S.**First Year**

Fall	Credits	Spring	Credits
FSHN 1100	1	FSHN 1040	2
CHEM 1630	4	FSHN 1670	3
or 1770			
CHEM 1630L	1	FSHN 2070	3
or 1770L			
FSHN 1010	3	BIOL 2120	3
MATH 1400,	3-4	BIOL 2120L	1
1430, 1600,			
or 1650			
ENGL 1500	3	ECON 1010	3
LIB 1600	1		
16-17		15	

Second Year

Fall	Credits	Spring	Credits
CHEM 2310	3	FSHN 2140	3
CHEM 2310L	1	FSHN 2150	2
ENGL 2500	3	BBMB 3010	3
FSHN 2030	1	MICRO 2010	2-3
or 3020			
FSHN 2200	3	MICRO 2010L	1
or 3020L			
HSPM 1330	1	STAT 1040	3-4
or 1010			
SPCM 2120	3		
15		14-16	

Third Year

Fall	Credits	Spring	Credits	Summer	Credits
ANS 2700		2 FSHN 3050		2 FSHN 4910B or 4910D	2
ANS 2700L		1 FSHN 4030		2	
FSHN 3110		3 HSPM 3800		3	
FSHN 3110L		1 HSPM 3800L		3	
FSHN 3140		1 Humanities or social science (CHHS) or elective (CALS)		3	
FSHN 4110		2 Elective*		3	
FSHN 4200		3			
Electives*		1-3			
14-16		16		2	

Fourth Year

Fall	Credits	Spring	Credits
FSHN 4060		3 ANS 4600	3
FSHN 4070		3 FSHN 3420	3
FSHN 4910B or 4910D (if not yet completed)		2 FSHN 4120	3
HSPM 3830 (if not taking FSHN 5090 Spring)		2 Humanities (CHHS) or Elective (CALS)	3
HSPM 4870		3 Elective*	3
U.S. Cultures and Communities		3	
16		15	

* Choose elective courses to total equal to or greater than 120 credits. Planned course offerings may change and students need to check the online Schedule of Classes each term to confirm course offerings: <https://classes.iastate.edu> (<https://classes.iastate.edu/>). This sequence is only an example. The number of credits taken each semester should be based on the individual student's situation. Factors that may affect credit hours per semester include student ability, employment, health, activities, and grade point consideration.

More information on the Culinary Food Science minor can be found here: www.catalog.iastate.edu/collegeofagricultureandlifesciences/foodscienceandhumannutrition/#undergraduateminortext.

Dairy Science

Students majoring in Dairy Science will complete the degree requirements listed here. If desired, a student may also include the specialized option in pre-veterinary medicine. A minimum of 15 credits of animal science coursework must be earned at Iowa State University.

Student Learning Outcomes

Upon graduation, students should be able to:

- Demonstrate a comprehensive knowledge of dairy science, dairy management, and agribusiness.
- Communicate in oral and written formats.
- Describe contemporary domestic and global issues impacting dairy science.
- Contribute or lead team efforts to achieve group goals.
- Utilize effective life-long learning skills.
- Evaluate the impacts of dairy management practices on economic, sociological, and environmental sustainability.

Total Degree Requirement: 128 cr.

Only 65 cr. from a two-year institution may apply which may include up to 16 technical cr.; 9 P-NP cr. of free electives; 2.00 minimum GPA.

International Perspectives

Approved International Perspectives course 3

U.S. Cultures and Communities

Approved U.S. Cultures and Communities course 3

Communications Proficiency

English composition 6

Speech fundamentals 3

Total Credits 9

Communication/Library

ENGL 1500 Critical Thinking and Communication 3

ENGL 2500 Written, Oral, Visual, and Electronic Composition 3

LIB 1600 Introduction to College Level Research 1

One course from the following: 3

AGEDS 3110 Presentation and Sales Strategies for Agricultural Audiences

COMST 2140 Professional Communication

SPCM 2120 Fundamentals of Public Speaking

Total Credits 10

Humanities and Social Sciences

Approved Humanities course	3
Approved Social Science course	3

Total Credits **6**

Ethics

Approved Ethics course	3

Mathematics and Business

One course from the following: 3

ECON 1010	Principles of Microeconomics
ECON 1020	Principles of Macroeconomics
ACCT 2840	Financial Accounting

One course from the following: 3-4

STAT 1010	Principles of Statistics
STAT 1040	Introduction to Statistics
STAT 2260	Introduction to Business Statistics I

One course from the following: 3-4

MATH 1400	College Algebra
MATH 1500	Discrete Mathematics for Business and Social Sciences
MATH 1600	Survey of Calculus
MATH 1650	Calculus I

Total Credits **9-11**

Biological Sciences

BIOL 2110	Principles of Biology I	3
BIOL 2110L	Principles of Biology Laboratory I	1
BIOL 2120	Principles of Biology II	3
BIOL 2120L	Principles of Biology Laboratory II	1
BIOL 3130	Principles of Genetics	3
or GEN 3200	Genetics, Agriculture and Biotechnology	
MICRO 2010 & 2010L	Introduction to Microbiology and Introductory Microbiology Laboratory	3-4
or MICRO 3020 & 3020L	Biology of Microorganisms and Microbiology Laboratory	

Total Credits **14-15**

Physical Sciences

A minimum of 8 credits are required. These requirements are specific to option and are listed with each option below.

Dairy Sciences Option

ANS 1010	Working with Animals	2
ANS 1100	Orientation in Animal Science and ISU	1
ANS 1140	Survey of the Animal Industry	2

ANS 2100	Career Preparation in Animal Science	1
ANS 2110	Issues Facing Animal Science	1
ANS 2140	Domestic Animal Physiology	3
ANS 2140L	Domestic Animal Anatomy and Physiology Lab	1
ANS 2350	Dairy Cattle Science	3
ANS 2700 & 2700L	Foods of Animal Origin and Foods of Animal Origin Laboratory	3
or FSHN 1010	Food and the Consumer	
ANS 3190	Animal Nutrition	3
ANS 3200	Animal Feeds and Feeding	3
ANS 3310	Domestic Animal Reproduction	3
ANS 3370	Lactation	3
ANS 3520	Genetic Improvement of Domestic Animals	3
ANS 4110	Addressing Issues in Animal Science	1
ANS 4340	Dairy Systems Management	3
ANS 4350	Applied Dairy Farm Evaluation	3
CHEM 1630 & 1630L	College Chemistry and Laboratory in College Chemistry	5
or CHEM 1770 & 1770L	General Chemistry I and Laboratory in General Chemistry I	
CHEM 3310	Organic Chemistry I	3
or BBMB 2210	Structure and Reactions in Biochemical Processes	
Four credits (minimum) from the following:		4
AGRON 3340	Forage Crop Management	
ANS 3320A	Laboratory Methods in Animal Reproduction: Livestock, Companion, and Laboratory Animals	
or ANS 3320	Laboratory Methods in Animal Reproduction: Equine	
or ANS 3330	Embryo Transfer and Related Technologies	
ANS 3360	Domestic Animal Behavior and Well-Being	
ANS 3450	Growth and Development of Domestic Animals	
ANS 3600	Fresh Meat Science and Applied Muscle Biology	
ANS 4150	Equine Systems Management	
ANS 4190	Advanced Animal Nutrition	
ANS 4240	Companion Animal Systems Management	
ANS 4250	Swine Systems Management	
ANS 4260	Beef Cattle Systems Management	
ANS 4290	Sheep Systems Management	
ANS 4600	Science and Technology of Value Added Meat Products	
ECON 3320	Cooperatives	
FSHN 3050	Food Quality Management and Control	
FSHN 4030	Food Laws and Regulations	
FSHN 4100	Food Analysis	

MICRO 3100	Medical Microbiology	
MICRO 3530	Introductory Parasitology	
MICRO 3740	Insects and Our Health	
MICRO 4020	Microbial Genetics and Genomics	
MICRO 4070	Microbiological Safety of Foods of Animal Origins	
FSHN 4200	Food Microbiology	
MICRO 4200	Food Microbiology	
MICRO 4750	Immunology	
VDPAM 4870	Livestock Disease Prevention	3
Total Credits		54

Additional free electives for the Dairy Sciences option 26-29

Pre-Veterinary Medicine Option

ANS 1010	Working with Animals	2
ANS 1100	Orientation in Animal Science and ISU	1
ANS 1140	Survey of the Animal Industry	2
ANS 2100	Career Preparation in Animal Science	1
ANS 2110	Issues Facing Animal Science	1
ANS 2140	Domestic Animal Physiology	3
ANS 2140L	Domestic Animal Anatomy and Physiology Lab	1
ANS 2350	Dairy Cattle Science	3
ANS 2700 & 2700L	Foods of Animal Origin and Foods of Animal Origin Laboratory	3
or FSHN 1010	Food and the Consumer	
ANS 3190	Animal Nutrition	3
ANS 3200	Animal Feeds and Feeding	3
ANS 3310	Domestic Animal Reproduction	3
ANS 3370	Lactation	3
ANS 3520	Genetic Improvement of Domestic Animals	3
ANS 4110	Addressing Issues in Animal Science	1
ANS 4340	Dairy Systems Management	3
ANS 4350	Applied Dairy Farm Evaluation	3
CHEM 1770	General Chemistry I	4
CHEM 1770L	Laboratory in General Chemistry I	1
CHEM 1780	General Chemistry II	3
CHEM 3310	Organic Chemistry I	3
CHEM 3310L	Laboratory in Organic Chemistry I	1
BBMB 3010	Survey of Biochemistry	3
or BBMB 3160	Principles of Biochemistry	
or BBMB 4040	Biochemistry I	
or BBMB 4200	Mammalian Biochemistry	
PHYS 1310 & 1310L	General Physics I and General Physics I Laboratory	5

Four credits (minimum) from the following: 4

AGRON 3340	Forage Crop Management	
ANS 3320A	Laboratory Methods in Animal Reproduction: Livestock, Companion, and Laboratory Animals	1
or ANS 3320E	Laboratory Methods in Animal Reproduction: Equine	
ANS 3360	Domestic Animal Behavior and Well-Being	
ANS 3450	Growth and Development of Domestic Animals	
ANS 3600	Fresh Meat Science and Applied Muscle Biology	
ANS 4150	Equine Systems Management	
ANS 4190	Advanced Animal Nutrition	
ANS 4240	Companion Animal Systems Management	
ANS 4250	Swine Systems Management	
ANS 4260	Beef Cattle Systems Management	
ANS 4290	Sheep Systems Management	
ANS 4600	Science and Technology of Value Added Meat Products	
ECON 3320	Cooperatives	
FSHN 4030	Food Laws and Regulations	
FSHN 4100	Food Analysis	
MICRO 3100	Medical Microbiology	
MICRO 3530	Introductory Parasitology	
MICRO 3740	Insects and Our Health	
MICRO 4020	Microbial Genetics and Genomics	
MICRO 4070	Microbiological Safety of Foods of Animal Origins	
MICRO 4210	Food Microbiology Laboratory	

Total Credits 64

Additional free electives for the Pre-Veterinary Medicine Option 11-14

* The Iowa State University College of Veterinary Medicine academic requirements are met by completion of this option (<http://vetmed.iastate.edu/academics/prospective-students/admissions/academic-requirements> (<http://vetmed.iastate.edu/academics/prospective-students/admissions/academic-requirements/>)).

Dairy Science, B.S. - General

Freshman

Fall	Credits Spring	Credits
ANS 1100	1 ANS 1140	2
ANS 1010	2 CHEM 1770 or 1630	4
BIOL 2110	3 CHEM 1770L or 1630L	1
BIOL 2110L	1 Humanities - elective list	3
ENGL 1500	3 SPCM 2120, AGEDS 3110, AGEDS 3270, or COMST 2140	3

LIB 1600	1 STAT 1010, 1040, or 2260	3-4
MATH 1400, 1500, 1600, or 1650	3-4	
Social Science - elective list	3	

17-18**16-17****Sophomore**

Fall	Credits Spring	Credits
ANS 2110	1 ANS 2100	1
ANS 2350	3 ANS 2700 & 2700L or FSHN 1010	3
BIOL 2120	3 ANS 2140	3
BIOL 2120L	1 ANS 2140L	1
BBMB 2210	3 ENGL 2500	3
ECON 1010	3 MICRO 2010 or 3020	2-3
Free Elective	3 MICRO 2010L or 3020L	1
	Free Elective	3
17		17-18

Junior

Fall	Credits Spring	Credits
ANS 3190	3 ANS 3200	3
ANS 3310	3 ANS 3520	3
GEN 3200 or BIOL 3130	3 ANS 3370	3
U.S. Cultures and Communities - elective list	3 Free Elective	3
Free Elective	3 Ethics - elective list	3
15		15

Senior

Fall	Credits Spring	Credits
ANS 4110	1 ANS 4350	3
ANS 4340	3 International Perspectives - elective list	3
ANS Elective	3 ANS Elective	3
Free Elective	3 Free Elective	3
Free Elective	3 Free Elective	4
Free Elective	3	
16		16

Important Note: This is only one of many equally-sound schedule sequences.

Free electives and specified group electives are often chosen to complement the student's career focus. The student's academic advisor assists with developing scheduling schemes that prepare students individually for careers in the animal industry. They are explained fully in ANS 1100 and through appointments with the

student's advisor in Dairy Science. Typical career areas include Advanced Degree in Dairy Science, Business and Finance, Agriculture Promotion and Information, Dairy Food Industry, Agricultural Sales and Marketing, International Agriculture, Animal Production and General Agribusiness and Pre-Veterinary Medicine.

Dairy Science, B.S. - Pre-Veterinary Medicine option**Freshman**

Fall	Credits Spring	Credits
ANS 1100	1 ANS 1140	2
ANS 1010	2 CHEM 1770	4
BIOL 2110	3 CHEM 1770L	1
BIOL 2110L	1 Humanities - elective list	3
ENGL 1500	3 SPCM 2120, AGEDS 3110, AGEDS 3270, or COMST 2140	3
LIB 1600	1 STAT 1010, 1040, or 2260	3-4
MATH 1400, 1500, 1600, or 1650	3-4	
Social Science - elective list	3	

17-18**16-17****Sophomore**

Fall	Credits Spring	Credits
ANS 2110	1 ANS 2100	1
ANS 2350	3 ANS 2700 & 2700L or FSHN 1010	3
BIOL 2120	3 ANS 2140	3
BIOL 2120L	1 ANS 2140L	1
CHEM 1780	3 CHEM 3310	3
ECON 1010	3 CHEM 3310L	1
Ethics - elective list	3 ENGL 2500	3
	Free Elective	3
17		18

Junior

Fall	Credits Spring	Credits
ANS 3190	3 ANS 3200	3
ANS 3310	3 ANS 3520	3
GEN 3200 or BIOL 3130	3 ANS 3370	3
CHEM 3320	3 BBMB 3010, 3160, 4040, or 4200	3
MICRO 2010 or 3020	2-3 U.S. Cultures and Communities - elective list	3
MICRO 2010L or 3020L	1	
15-16		15

Senior

Fall	Credits	Spring	Credits
ANS 4110		1 ANS 4350	3
ANS 4340		3 International Perspectives - elective list	3
ANS Elective		3 ANS Elective	3
PHYS 1310		4 Free Elective	3
PHYS 1310L		1 Free Elective	4
Free Elective		4	
		16	16

* Credits currently required for application to Veterinary Medicine program at ISU (55 credits)

General Chemistry with lab (7)

Organic Chemistry with lab (4)

Biochemistry (3)

General Physics with lab (4)

General Biology with lab (8)

Genetics/Animal Breeding (3)

Mammalian Anatomy and/or Physiology (3)

English Composition (6)

Oral Communication (3)

Humanities and/or Social Science (8)

Other Electives (8)

Diet and Exercise (AGLS)

OVERVIEW

Diet and Exercise, B.S./M.S.

Administered by the Department of Food Science and Human Nutrition and Department of Kinesiology.

This is an accelerated program with concurrent enrollment in the undergraduate and graduate degree programs. Courses included have been approved as meeting the academic requirements of the Didactic Program in Dietetics (DPD) in preparation for admission to accredited dietetics internship programs; the DPD is accredited by the Accreditation Council for Education in Nutrition and Dietetics, the accrediting agency of the Academy of Nutrition and Dietetics. There is a \$30 fee for the verification statement of completion of the accredited dietetics program. Additionally, courses are included to meet the American College of Sports Medicine (ACSM) requirements for certification at the level of Certified Exercise Physiologist.

The Diet and Exercise program of study is not offered as an additional major, it is only offered as a full degree program. Students pursuing the Diet and

Exercise degree program are allowed to pursue additional majors in other eligible programs of study if desired.

Student Learning Outcomes

Upon graduation, students should be able to:

- Communicate effectively in their field of study using written, oral, visual and/or electronic forms.
- Demonstrate proficiency in ethical data collection and interpretation, literature review and citation, critical thinking and problem solving.
- Participate effectively in a group or team.
- Integrate creativity, innovation, or entrepreneurship in ways that produce value.
- Explain how human activities impact the natural environment and how societies are affected.
- Meet program specific learning outcomes for the Diet & Exercise major.

Degree Requirements

Total Degree Requirements: 120 cr. for bachelor's degree and 36-40 cr. for master's degree

International Perspectives: 3 cr.

U.S. Cultures and Communities: 3 cr.

Students must fulfill International Perspectives and U.S. Cultures and Communities requirements by selecting coursework from approved lists. These courses may also be used to fulfill other area requirements.

Communications and Library: 10 cr.

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
LIB 1600	Introduction to College Level Research	1
SPCM 2120	Fundamentals of Public Speaking	3
Total Credits		10

Social Sciences: 6 cr.

PSYCH 1010	Introduction to Psychology	3
KIN 3660	Exercise Psychology	3
Total Credits		6

Mathematical Sciences: 6-8 cr.

Select at least 3 credits from:		3-4
MATH 1400	College Algebra	
MATH 1430	Preparation for Calculus	
MATH 1600	Survey of Calculus	
MATH 1650	Calculus I	
Select at least 3 credits from:		3-4
STAT 1010	Principles of Statistics	
STAT 1040	Introduction to Statistics	

STAT 2260	Introduction to Business Statistics I	
Total Credits		6-8

Physical Sciences: 13 cr.

Select from: 5

CHEM 1630 & 1630L	College Chemistry and Laboratory in College Chemistry	
or CHEM 177 & 1770L	General Chemistry I and Laboratory in General Chemistry I	
CHEM 2310	Elementary Organic Chemistry	3
CHEM 2310L	Laboratory in Elementary Organic Chemistry	1
PHYS 1150	Physics for the Life Sciences	4
or PHYS 1310	General Physics I	
Total Credits		13

Biological Sciences: 13 cr.

BBMB 3010	Survey of Biochemistry	3
BIOL 2550	Fundamentals of Human Anatomy	3
BIOL 2550L	Fundamentals of Human Anatomy Laboratory	1
BIOL 2560	Fundamentals of Human Physiology	3
BIOL 2560L	Fundamentals of Human Physiology Laboratory	1
MICRO 2010	Introduction to Microbiology	2
Total Credits		13

Diet and Exercise undergraduate courses to be completed or in progress when applying for admission to the program: 21-23 cr.

Select from: 1-2

FSHN 1100	Professional and Educational Preparation	
or KIN 2520	Introduction to the Discipline of Kinesiology and Orientation and Learning Community in	
& KIN 2530	Kinesiology and Health	
FSHN 1670	Introductory Human Nutrition and Health	3
FSHN 2140	Scientific Study of Food	3
FSHN 2150	Advanced Food Preparation Laboratory	1-2
or FSHN 1150	Food Preparation Laboratory	
FSHN 2650	Metabolism, Nutrition and Health	3
FSHN 3400	Foundations of Dietetic Practice	2
FSHN 3600	Advanced Nutrition and the Regulation of Metabolism in Health and Disease	3
HS 1100	Personal and Consumer Health	3
KIN 2580	Principles of Physical Fitness and Conditioning	2
Total Credits		21-23

Acceptance into the B.S./M.S. PROGRAM is required BEFORE spring semester of the THIRD year.**Humanities and Ethics: 6-9 cr.**

Select 6 credits from approved Humanities list 6

Select 3 credits from approved Ethics list 3

Note: If ethics course is on the humanities list, it can meet both requirements.

Diet and Exercise remaining undergraduate courses to complete the bachelor's degree requirements: 42 cr.

HS 3800	Worksite Health Promotion	3
or HS 3500	Human Diseases	
ATR 2200	Basic Athletic Training	2
or HS 1050	First Aid and Emergency Care	
KIN 2590	Leadership Techniques for Fitness Programs	3
KIN 3450	Management of Health-Fitness Programs and Facilities	3
or FSHN 3920	Food and Nutrition Services Management	
KIN 3580	Exercise Physiology	3
KIN 3590	Exercise Physiology Lab	1
Select two from:		6
KIN 3550	Biomechanics	
KIN 3600	Sociology of Physical Activity and Health	
KIN 3720	Motor Control and Learning Across the Lifespan	
KIN 4580	Principles of Fitness Assessment and Exercise Prescription	
KIN 4800	Functional Anatomy	
KIN 4620	Medical Aspects of Exercise	3
FSHN 3610	Nutrition and Health Assessment	2
FSHN 3670	Medical Terminology for Health Professionals	1
FSHN 4300	U.S. Health Systems and Policy	2
FSHN 4660	Nutrition Counseling and Education Methods	3
HSPM 1330	Food Safety Certification	1
HSPM 3800	Food Production Management	3
HSPM 3800L	Food Production Management Experience	3
NUTRS 5630	Community Nutrition and Health *	3
Total Credits		42

Diet and Exercise graduate courses to complete the master's degree requirements: 36-40 cr.

FSHN 5900C	Special Topics: Teaching **	1
FSHN 6810	Seminar **	1
FSHN 6820	Research Presentation and Discussion **	
NUTRS 5100	Advanced Nutrition and Metabolism in Health and Disease: Macronutrients	2

NUTRS 5110	Advanced Nutrition and Metabolism in Health and Disease: Micronutrients	2
NUTRS 5610	Medical Nutrition and Disease I	4
NUTRS 5630	Community Nutrition and Health *	3
NUTRS 5640	Medical Nutrition and Disease II *	4
KIN 5010	Research Methods in Physical Activity	3
KIN 5050	Research Laboratory Techniques in Exercise Physiology	3
KIN 5500	Advanced Physiology of Exercise I	3
or KIN 5510	Advanced Physiology of Exercise II	
STAT 5101	Statistical Methods for Data Analysis	4
Select 3-6 additional credits (FSHN students select 3 credits, KIN students select 6 credits) from:		3-6
KIN 5500	Advanced Physiology of Exercise I	
KIN 5510	Advanced Physiology of Exercise II	
KIN 5670	Exercise and Health: Behavior Change	
KIN 5700	Physical Activity Assessment for Health Related Research	
KIN 5730X	Impact of Physical Activity on Healthy Aging	
Select 2-3 credits for creative component or 6 credits for thesis research:		2-6
FSHN 5990	Creative Component	
KIN 5990	Creative Component	
KIN 6990	Research	
NUTRS 6990	Research in Nutritional Sciences	

* Course counts toward both bachelor's and master's degrees.

** Requirement for students in the FSHN Department.

Go to FSHN courses.

Go to KIN courses.

Diet and Exercise, B.S./M.S.

First Year

Fall	Credits	Spring	Credits
FSHN 1100	1-2	FSHN 1670	3
or KIN 2520 <i>and</i> KIN 2530			
CHEM 1630	4	ENGL 2500	3
or 1770			
CHEM 1630L	1	HS 1100	3
or 1770L			
ENGL 1500	3	KIN 2580	2

LIB 1600	1	STAT 1010, 1040, or 2260	3-4
MATH 1400,	3-4	1430, 1600, or 1650	
PSYCH 1010	3		
16-18		14-15	

Second Year

Fall	Credits	Spring	Credits	Summer	Credits
BIOL 2550	3	FSHN 2650	3	SPCM 2120	3
BIOL 2550L	1	BIOL 2560	3		
KIN 3660	3	BIOL 2560L	1		
CHEM 2310	3	BBMB 3010	3		
CHEM 2310L	1	FSHN 2140	3		
KIN 2590	3	FSHN 1150	1-2		
		or 2150			
HSPM 1330	1	MICRO 2010	2		
15		16-17		3	

Third Year

Fall	Credits	Spring	Credits	Summer	Credits
FSHN 3400	2	Acceptance into the program required before spring of the third year		KIN 5990, FSHN 5990, KIN 6990, or NUTRS 6990	1-3
FSHN 3600	3	FSHN 3610	2	STAT 5101	4
KIN 3580	3	FSHN 3670	1		
KIN 3590	1	HSPM 3800	3		
ATR 2200	2	HSPM 3800L	3		
or HS 1050					
PHYS 1150	4	Select two courses from:	6-7		
or 1310					
Apply for admission to the BS/MS program by Oct. 1		KIN 3550, 3600, 3720, 4580, or 4800			
15		15-16		5-7	

Fourth Year

Fall	Credits	Spring	Credits	Summer	Credits
KIN 5050		3 KIN 5010		3 KIN 5990, FSHN 5990, KIN 6990, or NUTRS 6990	1-3
NUTRS 5610		4 KIN 5510		3	
NUTRS 5630 (Time conflict with NUTRS 5010 next fall)		3 NUTRS 5640		4	
FSHN 4300		2 FSHN 6820 (FSHN Dept)		0	
FSHN 6820 (FSHN Dept)		0 KIN 4620		3	
KIN 5500, 5510, 5670, 5700, or 5730X		3			
15		13		1-3	

Fifth Year

Fall	Credits	Spring	Credits
NUTRS 5100		2 NUTRS 5110	2
FSHN 6820 (FSHN Dept)		0 FSHN 6810 (FSHN Dept)	1
FSHN 5900C		1 KIN 3450 or FSHN 3920	3
Additional: KIN 5500, KIN 5510, KIN 5670, KIN 5700, KIN 5730X		3 KIN 6990, NUTRS 6990, KIN 5990, or FSHN 5990	2
HS 3500 or 3800		3 FSHN 4660	3

Humanities/ Ethics course	3 Humanities/ International Perspectives	3
12		14

Planned course offerings may change, and students need to check the online Schedule of Classes each term to confirm course offerings: <http://classes.iastate.edu/>. This sequence is only an example.

Dietetics (AGLS)

Dietitians are nutrition experts who strive for optimal health and nutrition of individuals and the population. The curriculum for the dietetics program as well as the diet and exercise program meet the academic requirements of the Didactic Program in Dietetics and prepares students for a career in the field of dietetics. The program is accredited by the Accreditation Council for Education in Nutrition and Dietetics, the accrediting agency for the Academy of Nutrition and Dietetics.

Student Learning Outcomes

Upon graduation, students should be able to:

- Communicate effectively in their field of study using written, oral, visual and/or electronic forms.
- Demonstrate proficiency in ethical data collection and interpretation, literature review and citation, critical thinking and problem solving.
- Participate effectively in a group or team.
- Integrate creativity, innovation, or entrepreneurship in ways that produce value.
- Explain how human activities impact the natural environment and how societies are affected.
- Meet program specific learning outcomes for the Dietetics major.

Administered by the Department of Food Science and Human Nutrition

The dietetics undergraduate curriculum meets the academic requirements as the Didactic Program in Dietetics and is accredited by the Accreditation Council for Education in Nutrition and Dietetics, the accrediting agency of the Academy of Nutrition and Dietetics. Graduates of the program are eligible to apply to ACEND®-accredited graduate programs, or complete a graduate degree and an accredited dietetic internship, to be eligible to take the exam to become a Registered Dietitian Nutritionist. There is a \$30 fee for the verification statement of completion of the accredited dietetics program.

Total Degree Requirement: 120 cr.

Students must fulfill International Perspectives and U.S. Cultures and Communities requirements by selecting coursework from approved lists. These courses may also be used to fulfill other area requirements. Only

65 cr. from a two-year institution may apply to the degree which may include up to 16 technical cr.; 9 P-NP cr. of electives; 2.00 minimum GPA.

International Perspectives: 3 cr.

U.S. Cultures and Communities: 3 cr.

Communications and Library: 10 cr.

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
LIB 1600	Introduction to College Level Research	1
SPCM 2120	Fundamentals of Public Speaking	3
Total Credits		10

Humanities and Social Sciences: 6-12 cr.

Select Humanities course from approved list	3
PSYCH 1010 Introduction to Psychology	3
If CHHS student, select:	6
Additional Humanities course	
Additional Humanities or Social Science course	

Ethics: 3 cr.

FSHN 3420	World Food Issues: Past and Present	3

Mathematical Sciences: 6-8 cr.

Select at least 3 credits from:		3-4
MATH 1400	College Algebra	
MATH 1430	Preparation for Calculus	
MATH 1600	Survey of Calculus	
MATH 1650	Calculus I	
Select at least 3 credits from:		3-4
STAT 1010	Principles of Statistics	
STAT 1040	Introduction to Statistics	
Total Credits		6-8

Physical Sciences: 9 cr.

Select from:		5
CHEM 1630 & 1630L or CHEM 1770 & 1770L	College Chemistry and Laboratory in College Chemistry General Chemistry I and Laboratory in General Chemistry I	
CHEM 2310	Elementary Organic Chemistry	3
CHEM 2310L	Laboratory in Elementary Organic Chemistry	1
Total Credits		9

Biological Sciences: 17-18 cr.

BBMB 3010	Survey of Biochemistry	3
BIOL 2120	Principles of Biology II	3
BIOL 2120L	Principles of Biology Laboratory II	1
BIOL 2550	Fundamentals of Human Anatomy	3

BIOL 2550L	Fundamentals of Human Anatomy Laboratory	1
Select at least 3 credits from:		3-4
BIOL 2560 & 2560L	Fundamentals of Human Physiology and Fundamentals of Human Physiology Laboratory	
BIOL 3350	Principles of Human and Other Animal Physiology	
MICRO 2010	Introduction to Microbiology	2
MICRO 2010L	Introductory Microbiology Laboratory	1
Total Credits		17-18

Food Science and Human Nutrition: 44-45 cr.

FSHN 1100	Professional and Educational Preparation	1
FSHN 1670	Introductory Human Nutrition and Health	3
FSHN 2140	Scientific Study of Food	3
FSHN 2150	Advanced Food Preparation Laboratory	1-2
or FSHN 1150	Food Preparation Laboratory	
FSHN 2420	The US Food System	3
FSHN 2650	Metabolism, Nutrition and Health	3
FSHN 3400	Foundations of Dietetic Practice	2
FSHN 3600	Advanced Nutrition and the Regulation of Metabolism in Health and Disease	3
FSHN 3610	Nutrition and Health Assessment	2
FSHN 3620	Nutrition and Health Throughout the Lifecycle	3
FSHN 3670	Medical Terminology for Health Professionals	1
FSHN 4110	Food Ingredient Interactions and Formulations	2
FSHN 4300	U.S. Health Systems and Policy	2
FSHN 4450	Strategies for Personal Food Waste Reduction	1
FSHN 4610	Medical Nutrition and Disease I	4
FSHN 4630	Community Nutrition and Health	3
FSHN 4640	Medical Nutrition and Disease II	4
FSHN 4660	Nutrition Counseling and Education Methods	3
Total Credits		44-45

Management: 10 cr.

HSPM 1330	Food Safety Certification	1
HSPM 3800	Food Production Management	3
HSPM 3800L	Food Production Management Experience	3
FSHN 3920	Food and Nutrition Services Management	3
Total Credits		10

Electives: 0-15 cr. Select from any university coursework to earn at least 120 total credits.

Go to FSHN courses.

Dietetics, B.S.**First Year**

Fall	Credits Spring	Credits
FSHN 1100	1 FSHN 1670	3
CHEM 1630 or 1770	4 BIOL 2120	3
CHEM 1630L or 1770L	1 BIOL 2120L	1
MATH 1400, 1430, 1600, or 1650	3-4 HSPM 1330	1
ENGL 1500	3 PSYCH 1010	3
LIB 1600	1 Humanities/Social Sci. (CHHS) or Elective (CALS) course	3
Humanities	3	
16-17		14

Second Year

Fall	Credits Spring	Credits
CHEM 2310	3 FSHN 2650	3
CHEM 2310L	1 FSHN 2420	3
BIOL 2550	3 BIOL 2560 and 2560L, or BIOL 3350	3-4
BIOL 2550L	1 BBMB 3010	3
ENGL 2500	3 MICRO 2010	2
STAT 1010 or 1040	3-4 MICRO 2010L	1
14-15		15-16

Third Year

Fall	Credits Spring	Credits
FSHN 3400	2 FSHN 3610	2
FSHN 3600	3 FSHN 3620	3
FSHN 2140	3 FSHN 3670	1
FSHN 2150 or 1150	1-2 HSPM 3800	3
SPCM 2120	3 HSPM 3800L	3
FSHN 3420	3 Humanities course (CHHS) or Elective* (CALS)	3
15-16		15

Fourth Year

Fall	Credits Spring	Credits
FSHN 4610	4 FSHN 4640	4
FSHN 4630	3 FSHN 4450	1
FSHN 4110	2 FSHN 4300	2
FSHN 4660	3 FSHN 3920	3

U.S. Cultures and Communities	3 Electives *	6

	15	16

Footnotes

* Choose elective courses to total equal to or greater than 120 credits. This sequence is only an example, and the number of credits taken each semester should be based on the individual student's situation. Factors that may affect credit hours per semester include student ability, employment, health, activities, and grade point consideration.

More information on minors offered through Food Science and Human Nutrition can be found here: <http://catalog.iastate.edu/collegeofagricultureandlifesciences/foodscienceandhumannutrition/#undergraduateminiortext>.

The Department of Food Science and Human Nutrition offers a Master of Professional Practice in Dietetics (M.P.P.D). More information on the program can be found here: <http://catalog.iastate.edu/collegeofhumansciences/professionalpracticeindieterics/>.

Entomology

Undergraduate Minors

All minors require at least 15 credits, including at least 6 credits in courses numbered 3000 or above taken at Iowa State University. The minor must include at least 9 credits that are not used to meet any other department, college, or university requirement.

Minor - Insect Science

The department offers a minor in Insect Science that may be earned by completing ENT 3700 Insect Biology and 12 credits in courses selected from an approved list supplied by the department.

Minor - Global Health

The Global Health minor is a transdisciplinary program designed for students who seek a broad and flexible set of skills for understanding contemporary health challenges and broad-based thinking in finding solutions. Humans are at the core of Global Health, which is viewed and addressed through an understanding of disease, disease transmission, health and well-being. Global health incorporates all cultures and places and integrates knowledge of health's social, anthropological, historical, biological, and ecological dimensions. The program cultivates capacities to deal with complex problems across disciplines and social constructs: how to identify the critical issues, ask the right questions, and create solutions that are meaningful, lasting and effective.

Requirements of the Global Health minor

The Global Health minor will consist of selecting courses that have at their core a focus on health, disease transmission, and social aspects that pertain to health. The minor will require a minimum of 15 credit hours with all students required to take Global Health (V MPM/MICRO/GLOBE 3600) and Insects and Our Health (ENT/MICRO 3740). The remaining credits to fulfill the minor will come from courses listed in two tracks:

- 1. Biological sciences of health
- 2. Social sciences aspects of health

Students must select a minimum of three credits from each of the two tracks, and an additional three credits from either track. Students may petition to take courses not on the approved list, providing these courses can be shown to include substantial study related to global health.

Required for Global Health minor:

VMPM 3600	Global Health (F)	3
ENT 3740	Insects and Our Health (S)	3
Biological Science track:		
BIOL 3280	Molecular and Cellular Biology of Human Diseases (F)	3
ENT 3740L	Insects and Our Health Laboratory (Alt. S)	1
FSHN 4600	Global Nutrition, Health and Sustainability	3
HS 3500	Human Diseases (F, S, SS)	3
MICRO 3100	Medical Microbiology (F)	3
MICRO 4080	Virology	3
MICRO 3530	Introductory Parasitology (S)	3
VDPAM 4280	Principles of Epidemiology and Population Health (S)	3
Social Science track:		
AGRON 3420	World Food Issues: Past and Present	3
ECON 3850	Economic Development	3
FSHN 4420	Food, Culture, and Sustainability	3
GLOBE 3300	Global Health Disparities	3
HS 3100	Community and Public Health	3
SOC 3450	Population and Society	3
SOC 3480	Global Poverty, Resources and Sustainable Development	3
SOC 4110	Social Change in Developing Countries (S)	3

Graduate Study

The department offers work for the master of science and doctor of philosophy degrees with a major in entomology. Studies at the Ecosystem, Organismal, and Subcellular levels occur in the following areas: aquatic entomology, biological control, chemical ecology, ecology, host plant resistance, insecticide toxicology, medical/veterinary entomology,

pathology, pest management, physiology, population genetics, or systematics.

Graduates have a broad understanding of entomology and related disciplines, and an in-depth command of their area of concentration. They are able to communicate effectively with scientific colleagues and the general public in both formal and informal settings. Graduates are able to address complex problems facing entomology or toxicology professionals, taking into account related ethical, social, legal, economic, and environmental issues. They are skilled in research methods, data analyses, and interpretation of results. They also are skilled in working effectively with their colleagues, and writing concise and persuasive grant proposals. They have an understanding of and can critically evaluate current entomological literature.

Prerequisite to the entomology major and to minor graduate work in the department is completion of at least two years of zoological courses, for part of which credit in other closely allied biological sciences may be substituted. Specific course requirements for advanced degrees depend partly upon previous training and experience in the major field of specialization.

Any student receiving the M.S. in entomology shall have at least one course in insect physiology, one course in insect systematics, two courses of ENT 5900 (selected from topics A through D, F through I, M and N, inclusive), and at least 1 credit of ENT 6000 Seminar.

Any student receiving the Ph.D. in entomology shall have at least one course in insect physiology, one course in insect systematics, four additional courses of ENT 5900 (selected from topics A through D and F through I, M through N inclusive), and at least 1 credit of ENT 6000 Seminar. At least one 5900 must be taken from each of these subgroups: Population (C, D, N); Organismal (A, B, F, M); and Suborganismal (G, I).

In addition, Ph.D. students majoring either in Entomology or Toxicology shall have two semesters of teaching experience, taken as ENT 5900K Special Topics: Teaching Experience both semesters or ENT 5900K Special Topics: Teaching Experience one semester and ENT 5900L Special Topics: Extension Internship the other semester.

A student can receive a Ph.D. minor in Entomology by taking 3 Entomology courses (5000 level and above) for a total of 9 credits to be determined by the student's POS committee and approved by the Entomology Director of Graduate Education.

An option for an emphasis in molecular Entomology is available. Any student receiving the M.S. in entomology with an emphasis in molecular entomology is required to take:

ENT 5550	Insect Physiology	4
ENT 5900G	Special Topics: Molecular Entomology	1-3

Plus one other course of 5900 selected from topics A-D, F, H, I, M, N

Plus one additional course in molecular entomology

ENT 6000	Seminar	1
BBMB 4040	Biochemistry I	3
BBMB 5420A	Introduction to Molecular Biology Techniques: DNA Techniques	1
And one course from the following:		
ENT 5760	Systematic Entomology	
ENT 5250	Aquatic Insects	
ENT 5680	Advanced Systematics	

Any student receiving the Ph.D. in entomology with an emphasis in molecular entomology is required to take:

ENT 5550	Insect Physiology	4
ENT 5900G	Special Topics: Molecular Entomology	1-3
Plus three other courses of 5900 selected from topics A-D, F, H, I, M, N		9
One additional course in molecular entomology		3
ENT 6000	Seminar	1
BBMB 5420A	Introduction to Molecular Biology Techniques: DNA Techniques	1
Plus two other workshops selected from:		6
BBMB 5420C	Introduction to Molecular Biology Techniques: Cell Techniques	1
BBMB 5420D	Introduction to Molecular Biology Techniques: Plant Transformation	1
BBMB 5420E	Introduction to Molecular Biology Techniques: Proteomics	1
An additional course with a molecular component		3
Plus one from each of the following:		
Systematics		3
ENT 5760	Systematic Entomology	
ENT 5250	Aquatic Insects	
ENT 5680	Advanced Systematics	
Biochemistry		3
BBMB 4040	Biochemistry I	
BBMB 4050	Biochemistry II	
BBMB 5040	Amino Acids and Proteins	
BBMB 5050	Bioenergetics and Metabolism	

Entomology faculty participate in the interdepartmental majors in ecology and evolutionary biology; genetics; microbiology; molecular, cellular and developmental biology; sustainable agriculture; and in the interdepartmental major and minor in toxicology (see Index).

The Federal Corn Insects and Crop Genetics Research Unit is available for advanced study in certain phases of entomological research.

More information about the department, such as current research, faculty resumes, physical facilities, and graduate students can be viewed on the department's website at www.ppem.iastate.edu (<http://www.ent.iastate.edu>).

Courses primarily for undergraduates:

ENT 2010: Introduction to Insects

Credits: 1. Contact Hours: Lecture 2.7.

Biological and ecological aspects of insects. Offered online only. 5 weeks. (Typically Offered: Fall, Spring)

ENT 2110: Insects and Society

Credits: 2. Contact Hours: Lecture 2.7.

The importance of insects in human well-being. Insect-human interactions. Primarily for non-science and non-agriculture majors. Offered online only. 11 weeks. (Typically Offered: Fall, Spring)

ENT 2140: Insects in Forensic Science

Credits: 3. Contact Hours: Lecture 3.

Introduction to the use of insects as evidence in court and how they can assist in solving crimes. Topics covered include basic insect biology, systematics, behavior, with emphasis on applications of forensic entomology. Offered even-numbered years. (Typically Offered: Fall)

ENT 2200: Introduction to Forensic Science

(Cross-listed with CJ 2200).

Credits: 3. Contact Hours: Lecture 3.

Study of fundamental forensic science techniques and procedures covering types of physical, chemical, and biological evidence and how this information is used in the legal system. Assessment of crime scenes and various forensic specialties will be introduced. (Typically Offered: Spring)

ENT 2400: Hemp: Potential and Constraints for a New Crop

(Cross-listed with AGRON 2400).

Credits: 2. Contact Hours: Lecture 2.

Repeatable.

History, biology, and agronomy of hemp as it is allowed to be grown in Iowa. (Typically Offered: Spring)

ENT 2830: Pesticide Application Certification

(Cross-listed with AGRON 2830/ FOR 2830/ HORT 2830).

Credits: 2. Contact Hours: Lecture 2.

Core background and specialty topics in agricultural, and horticultural pesticide applicator certification. Students can select certification categories and have the opportunity to obtain pesticide applicator certification at the completion of the course. Commercial pesticide applicator certification is emphasized. (Typically Offered: Spring)

ENT 3580: Bee Biology, Management, and Beekeeping

(Cross-listed with BIOL 3580).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Introductory (2000-level) biology coursework or permission of an instructor

Bee diversity and evolution, ecology, role as pollinators, behavior, anatomy, and development. Management of bees as agricultural pollinators and honey producers, focusing on honey bees. Working with live bee hives and demonstration of practical beekeeping skills will occur during several field trips to local hives. (Typically Offered: Fall)

ENT 3700: Insect Biology

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: BIOL 1010 or BIOL 2110

Structure, physiology, evolution, behavior, life histories, and recognition of insects. Collection required. (Typically Offered: Fall)

ENT 3720: Livestock Entomology

Credits: 2. Contact Hours: Lecture 2.

Classroom and off-campus videotape sections. 12 weeks. Recognition, biology, behavior, economic importance, and management of insects and other arthropods affecting livestock and poultry production. Offered odd-numbered years. (Typically Offered: Spring)

ENT 3740: Insects and Our Health

(Cross-listed with MICRO 3740).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 3 credits in Biological Sciences

Identification, biology, and significance of insects and arthropods that affect the health of humans and animals, particularly those that are vectors of disease. Meets International Perspectives Requirement. (Typically Offered: Spring)

ENT 3740L: Insects and Our Health Laboratory

(Cross-listed with MICRO 3740L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Credit or concurrent enrollment in ENT 3740 or MICRO 3740

Laboratory and field techniques for studying medical or public health entomology, including: collection, identification and maintenance of medically significant arthropods and experimental design and execution related to the biology of arthropods or arthropod-pathogen interactions. Offered even-numbered years. (Typically Offered: Spring)

ENT 3750: Plant Protection Using Natural Enemies

(Dual-listed with ENT 5750).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENT 3700 or ENT 3760

Overview of the biology, ecology, and classification of insect pathogens, predators, and parasitoids. Discussion of the use of these organisms in plant protection, including an emphasis on genetic alteration of natural enemies. Offered even-numbered years. (Typically Offered: Spring)

ENT 3760: Fundamentals of Entomology and Pest Management

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: BIOL 1010 or BIOL 2110

Introduction to entomology and insect-pest management, including life processes, ecology, economics, tactics of population suppression, and ecological backlash. (Typically Offered: Spring)

ENT 4250: Aquatic Insects

(Dual-listed with ENT 5250/ AECL 5250). (Cross-listed with AECL 4250).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: BIOL 3120

Morphology, ecology, diversity, and significance of aquatic insects, with emphasis on the collection, curation and identification of taxa in local streams and lakes. Offered odd-numbered years. (Typically Offered: Spring)

ENT 4350: Entomology Field Trip

(Cross-listed with AECL 4350).

Credits: 2. Repeatable, maximum of 2 credits.

Prereq: BIOL 3120; Permission of Instructor

Field trip to study insects of major terrestrial and aquatic ecosystems. Location and duration vary. ENT 3700 or ENT 4250 recommended. Offered irregularly. (Typically Offered: Spring, Summer)

ENT 4500: Pesticides in the Environment

(Dual-listed with ENT 5500/ TOX 5500). (Cross-listed with TOX 4500).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 6 credits of BIOL or Permission of Instructor

Fate and significance of pesticides in soil, water, plants, animals, and the atmosphere. (Typically Offered: Spring)

ENT 4520: Integrated Management of Diseases and Insect Pests of Turfgrasses

(Dual-listed with PLP 5520/ ENT 5520/ HORT 5520). (Cross-listed with PLP 4520/ HORT 4520).

Credits: 3. Contact Hours: Lecture 3.

Prereq: HORT 3510

Identification and biology of important diseases and insect pests of turfgrasses. Development of integrated pest management programs in various turfgrass environments. Offered even-numbered years. (Typically Offered: Spring)

ENT 4710: Insect Ecology

(Dual-listed with ENT 5710).

Credits: 3.

Prereq: 9 credits of BIOL

The contribution of insects to ecosystem function is staggering. This course will focus on insect population ecology, predator-prey interaction and chemical ecology. The role insects in nutrient cycling, pollination and pest management will be discussed with case studies used to highlight the applied nature of insect ecology and its relationship to agriculture. Offered even-numbered years. (Typically Offered: Fall)

ENT 4900E: Independent Study: Research or Work Experience

Credits: 1-3. Repeatable, maximum of 9 credits.

Prereq: 15 credits in biological sciences, Junior or Senior classification;

Permission of Instructor

Graduation Restriction: A maximum of 9 credits of all (university-wide) 4900 courses may be applied toward graduation. (Typically Offered: Fall, Spring, Summer)

ENT 4900U: Independent Study: Laboratory teaching experience

Credits: 1-3. Repeatable, maximum of 9 credits.

Prereq: Instructor Permission for Course

For students registering to be undergraduate laboratory assistants.

Graduation Restriction: A maximum of 9 credits of all (university-wide) 4900 courses may be applied toward graduation.

Courses primarily for graduate students, open to qualified undergraduates:

ENT 5110: Integrated Management of Tropical Crops

(Cross-listed with HORT 5110/ PLP 5110).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (ENT 3700 or ENT 3760 or HORT 2210 or PLP 4080 or PLP 4160) or Graduate Classification

Applications of Integrated Crop management principles (including plant pathology, entomology, and horticulture) to tropical cropping systems. Familiarization with a variety of tropical agroecosystems and Costa Rican culture is followed by a 10-day tour of Costa Rican agriculture during spring break, then writeup of individual projects. Offered odd-numbered years. Meets International Perspectives Requirement. (Typically Offered: Spring)

ENT 5250: Aquatic Insects

(Dual-listed with ENT 4250/ AECL 4250). (Cross-listed with AECL 5250).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: BIOL 3120 or graduate standing

Morphology, ecology, diversity, and significance of aquatic insects, with emphasis on the collection, curation and identification of taxa in local streams and lakes. Offered odd-numbered years. (Typically Offered: Spring)

ENT 5300: Ecologically Based Pest Management Strategies

(Cross-listed with AGRON 5300/ SUSAG 5300/ PLP 5300).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Durable, least-toxic strategies for managing weeds, pathogens, and insect pests, with emphasis on underlying ecological processes. Offered odd-numbered years. (Typically Offered: Fall)

ENT 5500: Pesticides in the Environment

(Dual-listed with ENT 4500/ TOX 4500). (Cross-listed with TOX 5500).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 9 credits in BIOL or Graduate Classification

Fate and significance of pesticides in soil, water, plants, animals, and the atmosphere. (Typically Offered: Spring)

ENT 5520: Integrated Management of Diseases and Insect Pests of Turfgrasses

(Dual-listed with PLP 4520/ ENT 4520/ HORT 4520). (Cross-listed with PLP 5520/ HORT 5520).

Credits: 3. Contact Hours: Lecture 3.

Prereq: HORT 3510 or Graduate Classification

Identification and biology of important diseases and insect pests of turfgrasses. Development of integrated pest management programs in various turfgrass environments. Offered even-numbered years. (Typically Offered: Spring)

ENT 5550: Insect Physiology

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: ENT 3700 or Graduate Classification

Life processes of the insects, including reviews of current problems in insect physiology. Offered even-numbered years. (Typically Offered: Spring)

ENT 5680: Advanced Systematics

(Cross-listed with EEOB 5680).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Principles and practice of systematic biology; taxonomy, nomenclature and classification of plants and animals; sources and interpretation of systematic data; speciation; fundamentals of phylogenetic systematics. (Typically Offered: Spring)

ENT 5700: Plant-Insect Interaction

Credits: 2. Contact Hours: Lecture 2.

Prereq: 9 credits in BIOL or Graduate Classification

Physiological, behavioral, ecological, and evolutionary factors that govern interactions between insects and plants, applications of this knowledge to agriculture, and important results from the study of natural systems. Additional topics covered during the semester include: tritropic interactions, biological control of plants by insects, and pollination biology. Student-led discussions and draws on both the primary and secondary literature. Offered odd-numbered years. (Typically Offered: Fall)

ENT 5710: Insect Ecology

(Dual-listed with ENT 4710).

Credits: 3.

Prereq: 9 credits in BIOL or Graduate Classification

The contribution of insects to ecosystem function is staggering. This course will focus on insect population ecology, predator-prey interaction and chemical ecology. The role insects in nutrient cycling, pollination and pest management will be discussed with case studies used to highlight the applied nature of insect ecology and its relationship to agriculture. Offered even-numbered years. (Typically Offered: Fall)

ENT 5740: Medical Entomology

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: 9 credits in BIOL or Graduate Classification

Identification, biology, and significance of insects and other arthropods that attack people and animals, particularly those that are vectors of disease. Offered even-numbered years. (Typically Offered: Spring)

ENT 5750: Plant Protection Using Natural Enemies

(Dual-listed with ENT 3750).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENT 3700 or ENT 3760 or Graduate Classification

Overview of the biology, ecology, and classification of insect pathogens, predators, and parasitoids. Discussion of the use of these organisms in plant protection, including an emphasis on genetic alteration of natural enemies. Offered even-numbered years. (Typically Offered: Spring)

ENT 5760: Systematic Entomology

Credits: 5. Contact Hours: Lecture 3, Laboratory 6.

Prereq: ENT 3700 or Graduate Classification

Classification, distribution, and natural history of insects, including fundamentals of phylogenetic systematics, biogeography, taxonomic procedures, and insect collection and curation. Offered even-numbered years. (Typically Offered: Fall)

ENT 5810: Experience in Plant Science Extension and Outreach

(Cross-listed with AGRON 5810/ PLP 5810/ HORT 5810).

Credits: 1.

Prereq: Graduate Standing or Permission of Instructor

A supervised learning experience in several extension delivery methods used in the plant sciences. Participation in Iowa State University-based extension programs that may include field crops horticulture, or Master Gardener programming. Offered odd-numbered years. (Typically Offered: Summer)

ENT 5900A: Special Topics: Biological Control and Pathology

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Special Topics: Biological Control and Pathology. (Typically Offered: Fall, Spring, Summer)

ENT 5900B: Special Topics: Chemical Ecology and Behavior

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Special Topics: Chemical Ecology and Behavior. (Typically Offered: Fall, Spring, Summer)

ENT 5900C: Special Topics: Ecology and Pest Management

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Special Topics: Ecology and Pest Management. (Typically Offered: Fall, Spring, Summer)

ENT 5900D: Special Topics: Evolution and Systematics

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Special Topics: Evolution and Systematics. (Typically Offered: Fall, Spring, Summer)

ENT 5900E: Special Topics: Special Research Topics

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Special Topics: Special Research Topics. (Typically Offered: Fall, Spring, Summer)

ENT 5900F: Special Topics: Medical and Veterinary Entomology

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Special Topics: Medical and Veterinary Entomology. (Typically Offered: Fall, Spring, Summer)

ENT 5900G: Special Topics: Molecular Entomology

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Special Topics: Molecular Entomology. (Typically Offered: Fall, Spring, Summer)

ENT 5900I: Special Topics: Toxicology

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Special Topics: Toxicology. (Typically Offered: Fall, Spring, Summer)

ENT 5900K: Special Topics: Teaching Experience

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Special Topics: Teaching Experience. (Typically Offered: Fall, Spring, Summer)

ENT 5900L: Special Topics: Extension Internship

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Independent Study. (Typically Offered: Fall, Spring, Summer)

ENT 5900M: Special Topics: Immature Insects

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Special Topics: Immature Insects. (Typically Offered: Fall, Spring, Summer)

ENT 5900N: Special Topics: Population Genetics

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Special Topics: Population Genetics. (Typically Offered: Fall, Spring, Summer)

Courses for graduate students:**ENT 6000: Seminar**

Credits: 1. Contact Hours: Lecture 1.

Presentation of research results. (Typically Offered: Fall, Spring, Summer)

ENT 6750: Insecticide Toxicology

(Cross-listed with TOX 6750).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: ENT 5550 or TOX 5010 or Graduate Classification

Principles of insecticide toxicology; classification, mode of action, metabolism, and environmental effects of insecticides. Offered even-numbered years. (Typically Offered: Fall)

ENT 6990: Research

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Research. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

Environmental Science

Interdepartmental Undergraduate Programs

Environmental Science provides an integrated, quantitative, and interdisciplinary approach to the study of environmental systems. The magnitude and complexity of environmental problems are creating a growing need for scientists with rigorous, interdisciplinary training in environmental science. The Environmental Science program is designed to prepare students for positions of leadership in this rapidly changing discipline. Environmental Science graduates have a solid foundation in biological and physical natural sciences and the specialized training necessary for integrated analysis of environmental systems.

Undergraduate Study

The Environmental Science undergraduate major is offered through both the College of Agriculture and Life Sciences and the College of Liberal Arts and Sciences. Environmental Science majors complete foundation courses in natural sciences and mathematics, plus a major consisting of an integrated core of Environmental Science courses and additional advanced course work in Environmental Science. Scientific rigor is stressed throughout the program, beginning with the foundation courses in the first two years of the curriculum. The upper level core courses emphasize a dynamic systems approach that provides a framework for integrating physical, chemical, and biological aspects of environmental systems. Beyond the required core, students select from a broad array of advanced courses to either develop greater breadth, or specialization in areas including, but not limited to, water resources, climate impacts and adaptation, environmental restoration and management, and geographic information systems (see <https://www.ensci.iastate.edu/> for additional information on areas of specialization).

Student Learning Outcomes

Environmental Science graduates should be able to:

Environmental foundations:

- explain physical and biological components, processes and interactions within ecosystems
- explain how human activities impact the environment and how societies are affected by environmental conditions

Integrated environmental analysis:

- demonstrate a broad understanding of environmental systems and issues utilizing an interdisciplinary framework
- demonstrate proficiency in data analysis and problem-solving of relevant environmental systems/problems
- use a systems approach to conduct integrated, quantitative, and interdisciplinary analyses and modeling of environmental systems and problems

Communication:

- communicate clearly and effectively to a range of audiences using appropriate written, oral, visual, and electronic techniques
- read, listen, observe and reflect effectively

Problem solving/critical thinking:

- apply a rational and objective approach to analyzing and interpreting information
- critically evaluate arguments

College of Agriculture and Life Sciences

Students seeking an Environmental Science major complete the following:

1. A foundation of approved supporting courses in science and mathematics including biology, chemistry, earth science, physics, mathematics, and statistics.

2. 33 credits of course work in the major, including a required core of 20 credits.

A combined average grade of C or higher is required in courses applied in the major.

1. Environmental Science: 33 credits

ENSCI 1100	Orientation to Environmental Science	1
ENGL 2010	Introduction to Literature	3
ENSCI 2020	Exploration of Environmental and Sustainability Issues	1
ENSCI 2030	Exploration of Environmental Science	1
ENSCI 2500	Environmental Geography	3
ENSCI 2510	Biological Processes in the Environment	3

ENSCI 3120	Ecology	4
ENSCI 3180	Introduction to Ecosystems	3
ENSCI 3190	Analysis of Environmental Systems	3
Additional ENSCI choice courses		12

Total Credits **34**

2. Mathematics & Statistics: 6-8 credits

Choose one of the following: 3-4

MATH 1040	Introduction to Probability
MATH 1500	Discrete Mathematics for Business and Social Sciences
MATH 1510	Calculus for Business and Social Sciences
MATH 1600	Survey of Calculus
MATH 1650	Calculus I
COMS 1060	Introduction to Web Programming
COMS 1070	Windows Application Programming
DS 2010	Introduction to Data Science
DS 2020	Data Acquisition and Exploratory Data Analysis

Choose one of the following: 3-4

STAT 1010	Principles of Statistics
STAT 1040	Introduction to Statistics

Total Credits **6-8**

3. Physical & Life Sciences: 21-24 credits

BIOL 2110	Principles of Biology I	3

Choose from one of the following: 5

CHEM 1630 & 1630L	College Chemistry and Laboratory in College Chemistry
CHEM 1670 & 1670L	General Chemistry for Engineering Students and Laboratory in General Chemistry for Engineering
CHEM 1770 & 1770L	General Chemistry I and Laboratory in General Chemistry I
CHEM 2010 & 2010L	Advanced General Chemistry and Laboratory in Advanced General Chemistry

Choose from one of the following: 3-4

CHEM 2310 & 2310L	Elementary Organic Chemistry and Laboratory in Elementary Organic Chemistry
CHEM 3310 & 3310L	Organic Chemistry I and Laboratory in Organic Chemistry I
BBMB 2210	Structure and Reactions in Biochemical Processes
AGRON 2590	Organic Compounds in Plants and Soils

Choose 3 of the following: 9

AGRON 1820	Introduction to Soil Science
AGRON 2820	Soil Conservation and Land Use

GEOL 1000	How the Earth Works	
or GEOL 201 Geology for Engineers and Environmental Scientists		
MTEOR 2060	Introduction to Weather and Climate	
BIOL 2120	Principles of Biology II	
CHEM 1780	General Chemistry II	
& 1780L	and Laboratory in College Chemistry II	
PHYS 1150	Physics for the Life Sciences	
or PHYS 131 General Physics I		
or PHYS 231 Introduction to Classical Physics I		
Total Credits		20-21

4. Communications: 7-10 credits

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
LIB 1600	Introduction to College Level Research (Embedded communication coursework in ENSCI 2030 and ENSCI 3120)	1
Embedded communication coursework in ENSCI 2030 and ENSCI 3120		
Total Credits		7

Additional communication courses required of majors in the College of Agriculture and Life Sciences

Choose one of the following:		3
SPCM 2120	Fundamentals of Public Speaking	
AGEDS 3110	Presentation and Sales Strategies for Agricultural Audiences	
COMST 2140	Professional Communication	
Total Credits		3

5. General Education: 15-21 credits**General Education requirements in the College of Agriculture and Life Sciences**

Humanities	3
Social Science	3
Ethics	3
International Perspectives course from university approved list	3
U.S. Cultures and Communities course from university approved list	3
Total Credits	15

General Education requirements in the College of Liberal Arts and Sciences

Arts and Humanities courses from college approved list	12
Social Science courses from college approved list	9
(Select courses to include 3 cr. of International Perspectives and 3 cr. of US Diversity)	

Students must have completed 3 years of a single world language in high school or take 4-8 credits of World Languages at the university level

Total Credits **21**

Electives (28-35 credits)

LAS students must earn a minimum of 45 credits at the 3000-/4000-level.

A minimum of 120.0 Total Credits are needed for graduation

Environmental Science (AGLS) students must meet all requirements of the College of Agriculture and Life Sciences and university-wide requirements for majors.

Environmental Science, B.S. (AGLS)

Freshman

Fall	Credits Spring	Credits
ENGL 1500	3 ENSCI 2030 ¹	1
ENSCI 1100 ¹	1 BIOL 2110	3
ENSCI 2010	2 BIOL 2110L	1
ENSCI 2020 ¹	1 Physical or Life Science Choice ³	3 or 4
CHEM 1770	4 Social Science or Humanities Choice ²	3
CHEM 1770L	1 Mathematics, Programming, or Data Science choice	3-4
LIB 1600	1	
STAT 1010 or 1040	3-4	
16-17		14-16

Sophomore

Fall	Credits Spring	Credits
ENSCI 2500 ¹	3 ENSCI 2510	3
Social Science or Humanities Choice ²	3 Organic Chemistry Choice ³	3
ENGL 2500	3 Social Science or Humanities Choice ²	3
Physical or Life Science choice ³	Physical or Life Science choice ³	
Elective	3 Communications (Speech)	3
12		12

Junior

Fall	Credits Spring	Credits
ENSCI 3120	4 ENSCI 3180	3
Environmental Science Choice ¹	3 ENSCI 3190	3
Social Science or Humanities Choice ²	3 Social Science or Humanities Choice ²	3

Elective	6 Electives	6
	16	15
Senior		
Fall	Credits Spring	Credits
Environmental Science	3 Environmental Science	6
Choice ¹	Choice ¹	
Elective	12 Elective	9
	15	15

¹ Students complete at least 32 credits in Environmental Science including ENSCI 1100, ENGL 2010, ENSCI 2020, ENSCI 2030, ENSCI 2500, ENSCI 2510, ENSCI 3120, ENSCI 3180, ENSCI 3190 and 15 additional credits of approved ENSCI coursework.

² Students complete at least 15 credits in humanities and social science including at least 3 credits each in ethics, humanities, social science, U.S. Diversity, and International Perspectives from approved lists.

³ Students choose one course from the following Physical and Life Science related courses: AGRON 1820, AGRON 2820, BIOL 2120, CHEM 1780, GEOL 1000, GEOL 2010, MTEOR 2060, PHYS 1150, PHYS 1310, PHYS 2310. Students choose from one of the following Organic Chemistry options: CHEM 2310 & CHEM 2310L, CHEM 3310 & CHEM 3310L, BBMB 2210, or AGRON 2590.

Graduate Study

Contact information for the graduate program:

Lynette Edsall

camelot@iastate.edu (mstolt@iastate.edu)

515-294-1191

<https://enscigrad.iastate.edu/>

The Environmental Science graduate program offers an interdepartmental curriculum leading to M.S. and Ph.D. degrees with a major in Environmental Science. Faculty from the colleges of Agriculture and Life Sciences, Engineering, and Liberal Arts and Sciences cooperate to offer courses and research opportunities covering a broad array of environmental topics. Cooperating departments include Agricultural and Biosystems Engineering; Agronomy; Animal Science; Civil, Construction and Environmental Engineering; Ecology, Evolution and Organismal Biology; and Earth, Atmosphere, and Climate.

Applicants should have completed an undergraduate or master's degree in one of the biological, chemical, physical, or engineering sciences or should have equivalent preparation.

The Environmental Science Graduate Program emphasizes fundamental concepts and research, which at the same time address major environmental issues. The curriculum is designed to provide the interdisciplinary approach needed in environmental science education

and research. In addition to work in their chosen area of specialization, students are afforded a broad exposure to the biological, chemical and physical aspects of environmental systems and the specialized training necessary for integrated analysis of these systems.

Information on application procedures, curriculum requirements, and faculty research areas is available on the Environmental Science Graduate Program website (<https://enscigrad.iastate.edu/>).

Food Science (AGLS)

Food science is a degree program focused on the role of the food industry in producing safe, nutritious, and acceptable foods for consumers. Food scientists apply basic science (chemistry, biology, physics) to improve processing, preservation, and safety of food and to develop new food products. The food science major is approved by the Institute of Food Technologists.

Student Learning Outcomes

Upon graduation, students should be able to:

- Communicate effectively in their field of study using written, oral, visual and/or electronic forms.
- Demonstrate proficiency in ethical data collection and interpretation, literature review and citation, critical thinking and problem solving.
- Participate effectively in a group or team.
- Integrate creativity, innovation, or entrepreneurship in ways that produce value.
- Explain how human activities impact the natural environment and how societies are affected.
- Meet program specific learning outcomes for the Food Science major.

The department also offers a food science minor.

Administered by the Department of Food Science and Human Nutrition

Courses listed below are required.

Total Degree Requirement: 120 cr.

Students must fulfill International Perspectives and U.S. Cultures and Communities requirements by selecting coursework from approved lists. These courses may also be used to fulfill other area requirements. Only 65 cr. from a two-year institution may apply to the degree which may include up to 16 technical cr.; 9 P-NP cr. of electives; 2.00 minimum GPA.

International Perspectives: 3 cr.

U.S. Cultures and Communities: 3 cr.

Communications and Library: 10 cr.

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
LIB 1600	Introduction to College Level Research	1

SPCM 2120	Fundamentals of Public Speaking	3
Total Credits		10

Humanities and Social Sciences: 6-12 cr.

Select Humanities course from approved list	3
ECON 1010 Principles of Microeconomics	3
If HSCI student, select:	6
Additional Humanities course	
Additional Humanities or Social Science course	

Ethics: 3 cr.

FSHN 3420	World Food Issues: Past and Present	3

Mathematical Sciences: 7-8 cr.

Select 4 credits from:

MATH 1600	Survey of Calculus	4
or MATH 1650	Calculus I	

Select at least 3 credits from:

STAT 1010	Principles of Statistics	3-4
or STAT 1040	Introduction to Statistics	

Total Credits		7-8

Physical Sciences: 17-19 cr.

CHEM 1770	General Chemistry I	5
& 1770L	and Laboratory in General Chemistry I	
CHEM 1780	General Chemistry II	3
CHEM 2310	Elementary Organic Chemistry	4-6
& 2310L	and Laboratory in Elementary Organic Chemistry	
or CHEM 3310	Organic Chemistry I	
& CHEM 3320	and Organic Chemistry II	
PHYS 1150	Physics for the Life Sciences	5
& 1150L	and Laboratory in Physics for the Life Sciences	
or PHYS 1310	General Physics I	
& 1310L	and General Physics I Laboratory	

Total Credits		17-19

Biological Sciences: 10-11 cr.

BBMB 3010	Survey of Biochemistry	3
or BBMB 3030	General Biochemistry	
or BBMB 3160	Principles of Biochemistry	
BIOL 2120	Principles of Biology II	3
BIOL 2120L	Principles of Biology Laboratory II	1
MICRO 2010	Introduction to Microbiology	2-3
or MICRO 3020	Biology of Microorganisms	
MICRO 2010L	Introductory Microbiology Laboratory	1

or MICRO 3020 Microbiology Laboratory

Total Credits		10-11

Food Science and Human Nutrition: 49 cr.

FSHN 1010	Food and the Consumer	3
FSHN 1100	Professional and Educational Preparation	1
FSHN 1670	Introductory Human Nutrition and Health	3
FSHN 2030	Contemporary Issues in Food Science and Human Nutrition	1
FSHN 2070	Processing of Foods: Basic Principles and Applications	3
FSHN 3050	Food Quality Management and Control	2
FSHN 3110	Food Chemistry	3
FSHN 3110L	Food Chemistry Laboratory	1
FSHN 3140	Professional Development for Culinary Food Science and Food Science Majors	1
FSHN 3150	Professional Skills for Culinary Food Science and Food Science Majors	1
FSHN 3510	Introduction to Food Engineering Concepts	3
FSHN 4030	Food Laws and Regulations	2
FSHN 4060	Sensory Evaluation of Food	3
FSHN 4070	Microbiological Safety of Foods of Animal Origins	3
FSHN 4100	Food Analysis	3
FSHN 4110	Food Ingredient Interactions and Formulations	2
FSHN 4120	Food Product Development	3
FSHN 4200	Food Microbiology	3
FSHN 4210	Food Microbiology Laboratory	3
FSHN 4710	Food Processing	3
FSHN 4720	Food Processing Laboratory	2

Total Credits		49

Select 5-6 credits from the following Professional Electives: 5-6

ABE 3250	Biorenewable Systems
ACCT 2150	Legal Environment of Business
ACCT 2840	Financial Accounting
ACCT 2850	Managerial Accounting
AESHM 4740	Entrepreneurship in Human Sciences
AGRON 4500	Issues in Sustainable Agriculture
ANS 2700	Foods of Animal Origin
ANS 2700L	Foods of Animal Origin Laboratory
ANS 3600	Fresh Meat Science and Applied Muscle Biology
ANS 4600	Science and Technology of Value Added Meat Products
CHEM 2110	Quantitative and Environmental Analysis

CHEM 2110L	Quantitative and Environmental Analysis Laboratory
CHEM 3160	Instrumental Methods of Chemical Analysis
CHEM 3160L	Instrumental Analysis Laboratory
ECON 2350	Introduction to Agricultural Markets
ECON 3010	Intermediate Microeconomics
ECON 3200	Labor Economics
ECON 3350	The Economics of Global Agricultural Food and Bio-energy
ECON 3370	Agricultural Marketing
ECON 3620	Applied Ethics in Agricultural Business
ECON 4600	Agricultural, Food, and Trade Policy
ENTSP 3100	Entrepreneurship and Innovation
FSHN 1150	Food Preparation Laboratory
FSHN 1200	The Biochemistry of Beer
FSHN 1200L	Biochemistry of Beer Laboratory
FSHN 2140	Scientific Study of Food
FSHN 2150	Advanced Food Preparation Laboratory
FSHN 2200	American Food and Culture
FSHN 2410	Introduction to Manufacturing Processes for Plastics
FSHN 2420	The US Food System
FSHN 2650	Metabolism, Nutrition and Health
FSHN 2760	Grape and Wine Science
FSHN 4350	Analysis of Food Markets
FSHN 4420	Food, Culture, and Sustainability
FSHN 4600	Global Nutrition, Health and Sustainability
FSHN 4900B	Independent Study: Food Science
FSHN 4910B	Supervised Work Experience: Food Science
FSHN 4910D	Supervised Work Experience: Culinary Science
FSHN 4990	Undergraduate Research
FSHN 4960A	Food Science and Human Nutrition Travel Course: International travel
FSHN 5090	Sensory Evaluation of Wines
GLOBE 2010	Introduction to Global Resource Systems
GLOBE 2200	Globalization and Sustainability
GLOBE 3030	Agricultural, Food and Natural Global Resource Systems
HORT 2210	Principles of Horticulture Science
HORT 4610	Fruit Crop Production and Management
HORT 4710	Vegetable Production and Management
HORT 4710L	Vegetable Production and Management Lab
HSPM 1330	Food Safety Certification

MGMT 3710	Organizational Behavior
MGMT 4140	International Management
MGMT 4720	Diversity, Equity, and Inclusion in Organizations
MIS 3010	Management Information Systems
MKT 3400	Principles of Marketing
MKT 4470	Consumer Behavior
MKT 4480	Global Marketing

Total Credits **5-6**

Electives: 2-13 cr. Select from any university coursework to earn at least 120 total credits. Food science internship experience is strongly recommended during the summers, and students can earn elective credits for the internship experience by enrolling in FSHN 4910B.

Go to FSHN courses.

Food Science, B.S.

First Year

Fall	Credits Spring	Credits
FSHN 1010	3 FSHN 1670	3
FSHN 1100	1 CHEM 1780	3
CHEM 1770	4 BIOL 2120	3
CHEM 1770L	1 BIOL 2120L	1
ENGL 1500	3 ECON 1010	3
LIB 1600	1 Humanities	3
Humanities or Elective	3	
	16	16

Second Year

Fall	Credits Spring	Credits
CHEM 2310 and CHEM 2310L or CHEM 3310	3-4 BBMB 3010, 3030, or 3160	3
FSHN 2030	1 CHEM 3320 (if CHEM 3310 taken) or Elective	3
ENGL 2500	3 MICRO 2010 or 3020	2-3
PHYS 1150 or 1310	4 MICRO 2010L or 3020L	1
PHYS 1150L or 1310L	1 STAT 1010 or 1040	3-4
MATH 1600 or 1650	4 FSHN 2070	3
	16-17	15-17

Third Year

Fall	Credits Spring	Credits
FSHN 3110	3 FSHN 3050	2
FSHN 3110L	1 FSHN 3510	3
FSHN 3140	1 FSHN 4030	2
FSHN 3150	1 FSHN 4110	2
FSHN 4200	3 FSHN 4210	3
SPCM 2120	3 Professional Elective	3

Professional Elective	3	
	15	15
Fourth Year		
Fall	Credits Spring	Credits
FSHN 4060	3 FSHN 3420	3
FSHN 4100	3 FSHN 4120	3
FSHN 4710	3 FSHN 4720	2
FSHN 4070	3 U.S. Cultures and Communities (if not already taken) or elective	3
Elective *	2 Humanities/social science (CHHS) or elective (CALS)	3
	14	14

* Choose elective courses to total equal to or greater than 120 credits.

This sequence is only an example. The number of credits taken each semester should be based on the individual student's situation. Factors that may affect credit hours per semester include student ability, employment, health, activities, and grade point considerations.

More information on the Food Science, Food Safety, and Food and Society minors can be found here: <http://catalog.iastate.edu/collegeofagricultureandlifesciences/foodscienceandhumannutrition/#undergraduateminortext>.

The Department of Food Science and Human Nutrition offers a Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) in Food Science and Technology. More information can be found here: <https://www.grad-college.iastate.edu/academics/programs/apresults.php?id=50>.

Food Science and Human Nutrition

The Department of Food Science and Human Nutrition is jointly administered by the College of Agriculture and Life Sciences and the College of Health and Human Sciences. All curricula offered by the department are available to students in either college. These majors include:

- Culinary food science
- Dietetics
- Diet and exercise
- Food science
- Nutritional science
- Nursing

Visit the department web site at: www.fshn.hs.iastate.edu (<http://www.fshn.hs.iastate.edu>).

Undergraduate Study

Culinary Food Science

Culinary food science is an interdisciplinary degree combining a strong food science foundation with culinary skills development. Culinary Food Scientists apply principles of chemistry, biology, and microbiology to understand ingredient interactions and how cooking techniques can effect flavor, texture, and the nutritional value of food products. Internship experience in the food industry is required. Culinary food science graduates are qualified to work as food product developers, food innovation managers product development chefs, culinary application specialists, and food marketing and sales managers. The Culinary Food Science major is an approved Culinology® program through the Research Chefs Association.

Dietetics

The Didactic Program in Dietetics (DPD) is accredited by the Accreditation Council for Education in Nutrition and Dietetics, the accrediting agency of the Academy of Nutrition and Dietetics. The dietetics undergraduate curriculum meets the academic requirements as the DPD. Additionally, the curriculum for concurrent bachelor's and master's degrees in diet and exercise meets the academic requirements of the DPD. Graduates of the program are eligible to apply for admission to accredited dietetics internships/supervised practice programs. Upon successful completion of the experience program and a master's degree, graduates are eligible to take the national examination administered by the Commission on Dietetic Registration to become a Registered Dietitian Nutritionist (RDN) and to practice in the field of dietetics. There is a \$30 fee for a statement of verification of completion of the DPD.

The dietetics program includes study in basic sciences, nutrition, and food science with applications to medical dietetics, nutrition counseling and education, and community nutrition. Foodservice management is also an important aspect of the program. Graduates work in clinical settings, consulting, food companies, food services, sports or athletic programs, corporate wellness programs, care facilities for patients from neonatal to geriatric, and community or school health programs.

Diet and Exercise

A program for concurrent Bachelor of Science and Master of Science (B.S./M.S.) degrees in diet and exercise (<https://fshn.hs.iastate.edu/find-your-major/diet-and-exercise/>) is available. The program is jointly administered by the Department of Food Science and Human Nutrition (FSHN), within the College of Agriculture and Life Sciences and College of Health and Human Sciences, and the Department of Kinesiology within the College of Health and Human Sciences. Students interested in this program enroll as pre-diet and exercise students. In the fall of the third year, students apply for admission to the BS/MS program. Students not accepted into the program can continue toward completion of the BS degree in dietetics or kinesiology and health. Coursework has been designed to facilitate a 4-year graduation date for those

students not accepted into the program and electing to complete a single undergraduate degree. Students accepted into the program will progress toward completion of B.S./M.S. degrees in diet and exercise.

Food Science

Food science is a discipline in which the principles of biological and physical sciences are used to study the nature of foods, the causes of their deterioration, and the principles underlying the processing and preparation of food. It is the application of science and technology to the provision of a safe, wholesome, and nutritious food supply. Biotechnology and toxicology interrelate with food science in the area of food safety. In the food industry, food scientists work in research and development of products or processes, production supervision, quality control, marketing and sales, test kitchens and recipe development, product promotion and communication. Food scientists also work in government regulatory agencies and academic institutions.

The food science major is approved by the Institute of Food Technologists, the national professional organization of food science. Career options include quality control/assurance; production supervision; management and sales; research careers in the food industry, government, or academia; business; journalism; food product formulation and recipe development; food promotion and communication; and consumer services in government and industry.

Students in food science have the opportunity to pursue a Master of Business Administration (<http://www.fshn.hs.iastate.edu/undergraduate-programs/food-science/>) (MBA) concurrently with the Bachelor of Science (B.S.) degree in food science. The program is designed so students can earn both the B.S. in food science and MBA in five years, to meet the needs of students who are interested in management careers in the food industry. Students apply for admission to the MBA program in the spring of the third year. The program for concurrent B.S. in food science/MBA degrees is a rigorous 5-year program, and admission is very selective.

Nutritional Science

Nutritional science looks at the connection between diet and health. Students learn how diet can play a crucial role in the cause, treatment, and prevention of many diseases. The pre-health and research focus of the coursework prepares students for work in research laboratories, graduate study in nutrition or biological sciences, or entrance into health professional programs, such as medical, dental, physician assistant, and pharmacy schools. Students gain a strong science education along with human nutrition expertise.

Nursing

The Bachelor of Science in Nursing (BSN) program at Iowa State University is a RN-to-BSN program, designed for those who have obtained an associate degree in nursing or are eligible for NCLEX, and desire to further their nursing career and education to the next level. Iowa

State's RN-to-BSN program provides interactive learning opportunities where students can apply their real-world experiences and education to inspire innovation in their places of care. RN-to-BSN students will acquire knowledge, skills, and experience in four essential areas: research, leadership, population health, and self-care/health promotion. The program emphasizes providing professional, cultural, and ethically congruent care that respects the dignity and uniqueness of individuals and groups in diverse populations and locations.

The baccalaureate nursing program at Iowa State University of Science and Technology located in Ames, Iowa is approved by the:

Iowa Board of Nursing (IBON)

6200 Park Ave #100
Des Moines, IA 50321

The baccalaureate nursing program at Iowa State University of Science and Technology located in Ames, Iowa is accredited by the:

Accreditation Commission for Education in Nursing (ACEN)

3390 Peachtree Road NE, Suite 1400
Atlanta, GA 30326
(404) 975-5000

The most recent accreditation decision made by the ACEN Board of Commissioners for the baccalaureate nursing program is initial accreditation.

View the public information disclosed by the ACEN regarding this program at <https://www.acenursing.org/acen-programs-05202024/iowa-state-university-of-science-and-technology>.

For more information and RN-to-BSN student learning outcomes: <https://nursing.iastate.edu/rn-bsn-program>

FSHN Departmental Learning Outcomes

Upon graduation, students should be able to:

- Communicate effectively in their field of study using written, oral, visual and/or electronic forms.
- Demonstrate proficiency in ethical data collection and interpretation, literature review and citation, critical thinking and problem solving.
- Participate effectively in a group or team.
- Integrate creativity, innovation, or entrepreneurship in ways that produce value.
- Explain how human activities impact the natural environment and how societies are affected.
- Meet program specific learning outcomes.

For more information: <https://fshn.hs.iastate.edu/staff-and-faculty/resources/outcomes-assessment/learning-outcomes/>.

Communication Proficiency is certified by a grade of C or better in 6 credits of coursework in composition (ENGL 1500 Critical Thinking and Communication and ENGL 2500 Written, Oral, Visual, and Electronic Composition or other communication-intensive courses) and a grade of C or better in 3 credits of coursework in oral communication.

Minors - Undergraduate

The department offers minors in:

- culinary food science
- food and society
- food safety (interdepartmental minor)
- food science
- nutrition

All minors require at least 15 credits, including at least 9 credits in courses numbered 2000 or above, of which at least 6 credits in courses numbered 3000 or above, with at least 3 credits taken at Iowa State University. The minor must include at least 3 credits that are not used to meet any other department, college, or university requirement.

Prerequisites: Students must complete prerequisite requirements for courses included in the minor.

Minor in Culinary Food Science

FSHN 1010	Food and the Consumer	3
FSHN 1150	Food Preparation Laboratory	1-2
or FSHN 2150	Advanced Food Preparation Laboratory	
FSHN 2140	Scientific Study of Food	3
Select additional credits from the following list for a minimum of 15 credits for the minor:		
FSHN 2200	American Food and Culture	3
FSHN 4110	Food Ingredient Interactions and Formulations	2
FSHN 4910D	Supervised Work Experience: Culinary Science	1-4
ANS 2700 & 2700L	Foods of Animal Origin and Foods of Animal Origin Laboratory	3
ANS 4600	Science and Technology of Value Added Meat Products	3
HSPM 1330	Food Safety Certification	1
HSPM 3800 & 3800L	Food Production Management and Food Production Management Experience	6
HSPM 3830	Wine and Spirits in Hospitality Management	2
HSPM 4870	Fine Dining Management	3

Minor in Food and Society

FSHN 1670	Introductory Human Nutrition and Health	3
FSHN 2420	The US Food System	3

FSHN 5700	Sustainable and Healthy Eating Patterns	3
Select 6 additional credits from:		6
FSHN 2200	American Food and Culture	
FSHN 3420	World Food Issues: Past and Present	
FSHN 3650	Obesity and Health	
FSHN 4420	Food, Culture, and Sustainability	
FSHN 4600	Global Nutrition, Health and Sustainability	
FSHN 4630	Community Nutrition and Health	
SOC 2200	Globalization and Sustainability	
SOC 4440	Sociology of Food and Agricultural Systems	

Interdepartmental Minor in Food Safety (Students majoring in Food Science or Culinary Food Science cannot declare a minor in Food Safety.)

FSHN 1010	Food and the Consumer	3
HSPM 1330	Food Safety Certification	1
or HSPM 2330	Hospitality Sanitation and Safety	
FSHN 4030	Food Laws and Regulations	2
FSHN 4200	Food Microbiology	3

Select 3 credits from the Food Microbiology area

FSHN/MICRO 4070	Microbiological Safety of Foods of Animal Origins	
FSHN/MICRO 4210	Food Microbiology Laboratory	

Select 3 credits from the Food Processing area:

FSHN 2070	Processing of Foods: Basic Principles and Applications	
FSHN 3050	Food Quality Management and Control	
ANS 2700 & 2700L	Foods of Animal Origin and Foods of Animal Origin Laboratory	
ANS 3600	Fresh Meat Science and Applied Muscle Biology	
FSHN 4710	Food Processing	
FSHN 4720	Food Processing Laboratory	

Minor in Food Science (Students majoring in Culinary Food Science cannot declare a minor in Food Science.)

FSHN 1010	Food and the Consumer	3
FSHN 2070	Processing of Foods: Basic Principles and Applications	3

Select 9 additional credits:

Food chemistry:		
FSHN 3110	Food Chemistry (lab optional: FSHN 3110L)	3
FSHN 4100	Food Analysis	3
FSHN 4110	Food Ingredient Interactions and Formulations	2

Food microbiology:

FSHN 4070	Microbiological Safety of Foods of Animal Origins	3
FSHN 4200	Food Microbiology	3
FSHN 4210	Food Microbiology Laboratory	3

Food processing/engineering:

FSHN 3510	Introduction to Food Engineering Concepts	3
FSHN 4710	Food Processing	3
FSHN 4720	Food Processing Laboratory	2

General food science:

FSHN 3050	Food Quality Management and Control	2
FSHN 4030	Food Laws and Regulations	2
FSHN 4060	Sensory Evaluation of Food	3

Minor in Nutrition (Students majoring in Diet and Exercise, Dietetics, and Nutritional Science cannot declare a minor in Nutrition.)

FSHN 1670	Introductory Human Nutrition and Health	3
FSHN 2650	Metabolism, Nutrition and Health	3
FSHN 3600	Advanced Nutrition and the Regulation of Metabolism in Health and Disease	3

Select at least 6 credits from:

FSHN 2420	The US Food System	3
FSHN 2670	Clinical Perspectives on Nutrition	1
FSHN 3010	Nutrigenomics: From Basic Science to Translational Impact	1
FSHN 3610	Nutrition and Health Assessment	2
FSHN 3620	Nutrition and Health Throughout the Lifecycle	3
FSHN 3650	Obesity and Health	3
FSHN 4630	Community Nutrition and Health	3
FSHN 4670	Molecular Basis of Nutrition in Disease Etiology and Health Promotion	3
FSHN 4920	Research Concepts in Human Nutrition	2

Graduate Study

The Food Science and Human Nutrition (FSHN) Department offers coursework for the degrees Master of Science and Doctor of Philosophy. Degree options include:

- food science and technology (<https://fshn.hs.iastate.edu/graduate-students/graduate-programs/food-science-and-technology/>) (M.S. and Ph.D.)
- meat science (<https://www.meatscience.ag.iastate.edu/>) (M.S. and Ph.D.; co-major in animal science)
- nutritional sciences ([https://fshn.hs.iastate.edu/graduate-students/graduate-programs/interdepartmental-graduate-program-in-](https://fshn.hs.iastate.edu/graduate-students/graduate-programs/interdepartmental-graduate-program-in-nutritional-sciences/)

<https://fshn.hs.iastate.edu/graduate-students/graduate-programs/diet-and-exercise/>) (M.S. and Ph.D.; interdepartmental graduate program)

- diet and exercise (<https://fshn.hs.iastate.edu/graduate-students/graduate-programs/diet-and-exercise/>) (B.S./M.S.)

Prerequisite to major work is a baccalaureate degree in food science, nutrition, other physical/biological sciences or engineering that is substantially equivalent to those at Iowa State University.

Students taking major work for the degree Doctor of Philosophy either in food science and technology or in nutritional sciences may choose minors from other fields including anthropology, biorenewable resources and technology, chemistry, biochemistry, economics, education, journalism, microbiology, psychology, physiology, statistics, toxicology, or other related fields.

The interdepartmental graduate program in nutritional sciences, administered through the Graduate College, under the auspices of the Chairs of FSHN and Animal Science, will provide the structure for coordinating and enhancing interdisciplinary nutrition research and graduate education. Graduate students will be able to select from three specializations: animal nutrition, human nutrition, or molecular/biochemical nutrition. The three main departments are FSHN, Animal Science, and Kinesiology, whereas other departments (such as; Biochemistry, Biophysics, and Molecular Biology; Agronomy; and Statistics) may also be involved. (See Nutritional Sciences interdepartmental graduate major).

The department offers work for concurrent B.S. and M.S. degree programs that allow students to obtain both the B.S. and M.S. degrees in 5 years. The programs are available to students majoring in nutritional science or pre-diet and exercise, and students' progress toward M.S. degrees in nutritional sciences or diet and exercise, respectively. Students interested in these programs should contact the department for details. Application for admission to the Graduate College should be made during the junior year. Students begin research for the M.S. thesis or creative component during the summer after their junior year and are eligible for research assistantships.

Students graduating with advanced degrees in nutritional sciences and in food science and technology will demonstrate competency in their chosen discipline. Measurable outcomes will include the ability to: 1) design, conduct, and interpret research; 2) apply theoretical information to solve practical problems; 3) prepare and communicate discipline-specific information in written and oral forms to scientific and lay audiences; 4) facilitate learning in the classroom; 5) submit a paper for publication in a peer-reviewed journal; and 6) secure professional-level positions in academia, industry, government, or health care.

Minors - Graduate

The department offers coursework for graduate minors in:

- food science/technology (<https://fshn.hs.iastate.edu/graduate-students/graduate-programs/food-science-and-technology/>)
- nutritional sciences (<https://fshn.hs.iastate.edu/graduate-students/graduate-programs/interdepartmental-graduate-program-in-nutritional-sciences/>)

Food Science and Technology Graduate Minor students must complete the following:

- 9 to 12 credits. Students without a background in food chemistry, food engineering/processing, and/or food microbiology are required to take FSHN 5110 and two 6000-level courses in two different competency areas.
- 9 credits of graduate level food science coursework as approved by the POS committee.
- Maximum of 3 credits at the 4000 level.

Nutritional Sciences Graduate Minor students must complete the following:

- 9 to 12 credits are required. Students who have not taken FSHN 3600 or its equivalent (advanced nutrition with a biochemistry prerequisite) will need to take FSHN 3600, in which case the Nutrition Graduate minor will constitute 12 credits.
- 9 credits of graduate level nutrition courses as approved by the POS Committee.
- NUTRS 5100 and NUTRS 5110

Certificate - Undergraduate

Health Coach (<https://kin.hs.iastate.edu/current-students/academics/health-coach-certificate/>)

The undergraduate health coach certificate provides a rigorous academic and theoretical background in three components of health (nutrition, exercise and motivational coaching) required to prepare workers for the challenges of being a health coach.

Certificates - Graduate

Food Safety and Defense (<http://www.fshn.hs.iastate.edu/graduate-program/food-safety-defense/>)

The department offers an online 12-13 credit Graduate Certificate in Food Safety and Defense, in conjunction with the University of Nebraska, Lincoln, Kansas State University and the University of Missouri through the Great Plains Interactive Distance Education Alliance. Students may be admitted if qualified for admission to the food science master's degree program.

Forestry

Administered by the Department of Natural Resource Ecology and Management.

The forestry curriculum offers courses dealing with the management of forest ecosystems for multiple benefits including biodiversity, recreation, water, wilderness, wildlife, and wood and fiber. Conservation and preservation of natural resources are emphasized. The department offers work for the Bachelor of Science degree with a major in forestry and options in forest ecosystem management, interpretation of natural resources, urban and community forestry, or natural resource conservation and restoration. Students select at least one of these options, all of which lead to a professional degree in forestry (Bachelor of Science). The forestry major has been accredited by the Society of American Foresters (SAF) since 1935. The Council for Higher Education Accreditation recognizes SAF as the specialized accrediting body for forestry education in the United States. The primary goal of the undergraduate curriculum in forestry is to educate foresters to be capable of scientifically managing the nation's forest lands and related ecosystems - private and public.

Graduates understand and can apply scientific principles associated with forests, forest ecosystem management, and wood and non-wood products. Graduates are able to communicate effectively and work well in teams. They are capable of preparing and delivering effective oral and written communication of scientific and technical decisions to professional and lay audiences. They are proficient in technical skills such as measurements, computer usage, inventory, economic analysis, data and situation analysis, and ecosystem assessment. They recognize the importance of ethics in forestry and are sensitive to cultural diversity and broad environmental concerns.

Graduates of the forest ecosystem management option are skilled at understanding how forests function and how forests can be managed to produce desired goods (wood, fiber, recreation, wildlife habitat) and services (clean water, carbon sequestration, wilderness) in the long run. They are skilled at interpretation of interactions and effects of abiotic and biotic factors in forests and quantification of bio-physical, social, and economic outputs from forest ecosystems. They are skilled at complex decision-making involving private and public forest resources where ethical, legal, social, economic, and ecological dimensions are explicitly considered.

Graduates of the interpretation of natural resources option are skilled at communicating with the public about the values associated with forest ecosystems and providing educational programs for all ages.

Graduates of the urban and community forestry option are able to combine biological, social, legal, and economic expertise to effectively manage trees or forests in an urban setting. They are skilled at decision-

making related to site assessment, and long-term management of urban trees and forests to achieve multiple goals.

Graduates of the natural resource conservation and restoration option are skilled at assessing the natural functions of the environment and human impacts. They are skilled at interpretation of forest and other natural environments and making decisions relating to their conservation and preservation.

In consultation with their advisor, students can select elective courses related to the forest ecosystem management option to emphasize forest ecology; wildlife, wilderness, and recreation management; water quality and erosion protection; quantitative-analytical techniques; business and marketing; and other areas related to natural resource management. Elective courses in the urban and community forestry option can be selected to emphasize plant health, policy and planning, ecology, hydrology, sociology, business administration, or horticulture/design. Elective courses related to the natural resource conservation and restoration option can be selected to emphasize, ecology, wildlife, recreation, nature interpretation, landscape design, sociology and ethics of conservation and preservation. Elective courses in the interpretation of natural resources option can be selected to emphasize natural history, animal ecology, and environmental education.

Many private firms as well as national, regional, state, and local agencies seek forestry graduates to fill positions in management of natural resources for commodity and non-commodity multiple benefits.

Graduates in forestry are prepared to be involved with evolving forestry systems, such as agroforestry and urban forestry. Wood processing industries, such as composite products, plywood, particle board, lumber, and pulp and paper offer professional opportunities in fiber procurement and marketing.

With advanced graduate study, the range of professional job opportunities for a person with a B.S. in forestry is expanded. Opportunities include research and education as well as more specialized managerial and administrative positions with private firms and public agencies.

During fall semester of the second year of study (sophomore year, typically), forestry students are required to enroll in the department's integrated forestry modules consisting of:

FOR 2010	Forest Biology	2
FOR 2020	Sustainable Materials: Wood Utilization	2
FOR 2030	Resource Measurements/Evaluation	2
FOR 2040	Forest Ecosystem Decision-Making	2
FOR 2050	Integrated Forestry Laboratory	3
FOR 2060	Fall Forestry Camp	4

That semester, consisting entirely of forestry coursework, is designed to give students an early understanding of the many aspects of forestry and how they are interrelated. In addition to work in the classroom, students will spend time in laboratory and field work each week. A 3-week off-campus fall camp during the semester will reinforce concepts learned both in the classroom and during laboratory/field sessions. Transfer students should check with the department for counsel on timing their completion of the integrated forestry modules.

Student Learning Outcomes

Upon graduation, students should be able to:

1. Identify, explain and critically evaluate their own beliefs, values and actions in relation to professional and societal standards of ethics.

For any given situation, graduates identify, critically evaluate, and state their own beliefs and values as they relate to professional and societal ethical standards, for any given situation. They elaborate on how those values and beliefs impact their actions, and they explain which specific canons or principles of a professional code of ethics are applicable to a particular situation.

2. Anticipate, analyze and evaluate natural resource issues and opportunities, explaining the ecological, economic, and social consequences of natural resource actions at various scales and over time.

In the case of existing natural resource issues, graduates explain the ecological, economic, and social consequences that reasonably could be expected to occur as the result of actions taken to address the issue. The explanation includes considerations of the geographic area influenced by the issue as well as the time frame over which the consequences can be expected to occur. In the case of evolving circumstances, graduates predict natural resource issues that may arise as a result of the circumstances and explain the ecological, economic and social consequences of those issues.

3. Actively seek the input and perspectives of diverse stakeholders regarding natural resource problems and issues.

Graduates identify the comprehensive list of individuals or groups who may be impacted by particular natural resource problems and issues. They are well versed in techniques for seeking and incorporating input and perspectives from those people, and they incorporate those inputs and perspectives into the decision-making process.

4. Assess, analyze, synthesize, and evaluate information fairly and objectively.

Not all information is equally sound or applicable in a particular situation. Graduates evaluate the validity and importance of information obtained

from any source. Once evaluated, they use the information appropriately in the solution of natural resource problems.

5. Work effectively, both individually and with others, on complex, value-laden natural resource problems that require holistic problem-solving approaches.

Effective solution of natural resource problems often involves input from diverse constituencies with diverse value scales. When working individually, graduates incorporate those values into the solution of problems. Graduates work effectively with diverse individuals and groups to reach consensus on problem solutions.

6. Formulate and evaluate alternative solutions to complex problems and recommend and defend best alternatives.

The natural resource base with which we deal is capable of providing numerous goods and services to numerous publics. Graduates formulate multiple alternatives, as well as action plans, to achieve stakeholder objectives. They evaluate each of the feasible alternatives in terms of biological possibility, economic feasibility and social acceptability. They recommend best alternatives based on the stakeholders' objectives, and they justify their recommendations on the basis of sound science.

7. Communicate clearly and effectively with all audiences using appropriate oral, visual, electronic, and written techniques.

Graduates utilize the best form, or forms, of communication for effectively conveying information to, or seeking input from, a particular audience. They are proficient in all forms of communication and adjust their style or technique of communication to suit different audiences.

8. Recognize and interpret resource problems and opportunities across spatial scales from local to global.

Graduates recognize where resource problems and opportunities can or could exist, and they evaluate and interpret these for others. They, evaluate and interpret for individual landowners at a very local scale as well as for problems that span multiple ownerships, regions and ecosystems.

9. Appreciate cultural diversity and understand the impact of the global distribution of people and wealth on natural resource use and valuation.

Different cultures, population densities, and income classes value and use natural resources in very different ways. Because natural resources often are used simultaneously by different groups, it is important for graduates to be able to account for those differing uses and valuations when making management decisions about natural resources.

10. Exercise leadership skills as professionals and engaged citizens

Graduates organize, facilitate, and participate effectively in groups, teams, or organizations. They define problems or opportunities,

implement action planning processes, work toward goals and justify actions taken.

11. Demonstrate creativity and innovation in identifying and pursuing opportunities that produce environmental, social, or economic value.

Graduates display creativity in a variety of situations and identify opportunities to promote understanding of natural resource issues. They demonstrate persistence when working with individuals who have diverse interests in order to build consensus and facilitate accomplishing stated objectives.

12. Exercise life-long learning skills developed before graduation.

Graduates articulate why life-long learning is important. Graduates find answers to their questions as they arise throughout life. They are capable of determining what they need to know to effectively deal with an issue or situation, and they know how to obtain the necessary knowledge. They have learned how to learn in the absence of teachers.

Curriculum in Forestry

Total Degree Requirement: 128 cr.

Only 65 cr. from a two-year institution may apply which may include up to 16 technical cr.; 9 P-NP cr. of free electives; 2.00 minimum GPA.

International Perspective: 3 cr.
U.S. Cultures and Communities: 3 cr.
Communications Proficiency (with a C or better):

English composition	6
Speech fundamentals	3
Total Credits	9

Communication/Library: 13 cr.

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
LIB 1600	Introduction to College Level Research	1
SPCM 2120	Fundamentals of Public Speaking	3
One course from:		3
ENGL 3020	Business Communication	
ENGL 3090	Proposal and Report Writing	
ENGL 3120	Communicating Science and Public Engagement	
ENGL 3140	Technical Communication	

Total Credits	13

Humanities and Social Sciences: 6 cr.

6 cr. from approved list.

Ethics: 3 cr.

3 cr. from approved list.

Mathematics, Physical and Life Sciences: 21-23 cr.

MATH 1400	College Algebra	3
CHEM 1630	College Chemistry	4
CHEM 1630L	Laboratory in College Chemistry	1
AGRON 1820	Introduction to Soil Science	3
BIOL 2110	Principles of Biology I	3
BIOL 2110L	Principles of Biology Laboratory I	1
One course from:		3-4
STAT 1010	Principles of Statistics	
STAT 1040	Introduction to Statistics	
One course from:		3-4
MATH 1510	Calculus for Business and Social Sciences	
MATH 1600	Survey of Calculus	
MATH 1650	Calculus I	
NREM 2400	Quantitative Problem Solving in Natural Resources	
STAT 3010	Intermediate Statistical Concepts and Methods	

Total Credits 21-23**Forestry: 31 cr.**

NREM 1040	Practical Work Experience	
NREM 1100	Orientation in Natural Resource Ecology and Management	1
NREM 1200	Introduction to Renewable Resources	3
NREM 2110	Careers in Natural Resources	1
FOR 2010	Forest Biology	2
FOR 2020	Sustainable Materials: Wood Utilization	2
FOR 2030	Resource Measurements/Evaluation	2
FOR 2040	Forest Ecosystem Decision-Making	2
FOR 2050	Integrated Forestry Laboratory	3
FOR 2060	Fall Forestry Camp	4
FOR 3020	Silviculture	4
FOR 4510	Forest Resource Economics and Quantitative Methods	4
FOR 4540	Forestry Practicum	3

Total Credits 31

Electives: Students majoring in forestry are required to choose one of the following options at the end of their sophomore year: forest ecosystem management; sustainable material science and technology; urban and community forestry; natural resource conservation and restoration; or interpretation of natural resources.

Forest Ecosystem Management

FOR 2800	Wood Properties and Identification	4
FOR 3560	Dendrology	3

PLP 4160	Forest Insects and Diseases	3
FOR 4420	Dynamics of Forest Stands	3
FOR 4520	Ecosystem Management: Integrating Ecology, Society, and Policy	3
NREM 3010	Natural Resource Ecology and Soils	4
NREM 3450	Natural Resource Photogrammetry and Geographic Information Systems	3
One course from:		3-4
AECL 3660	Natural History of Iowa Vertebrates	
AECL 4180	Stream Ecology	
ECON 3800	Energy, Environmental and Resource Economics	
NREM 3900	Fire Ecology and Management	
NREM 4070	Watershed Management	
NREM 4460	Integrating GPS and GIS for Natural Resource Management	
NREM 4550	Stream Restoration	
NREM 4710	Agroforestry Systems	

One course from: 3

NREM 3850	Natural Resource Policy	
or NREM 4600 Controversies in Natural Resource Management		

Total Credits 29-30**Interpretation of Natural Resources**

AECL 3650	Vertebrate Biology	4
AECL 3660	Natural History of Iowa Vertebrates	3
BIOL 3660	Plant Systematics	4
ENT 3700	Insect Biology	3
FOR 4520	Ecosystem Management: Integrating Ecology, Society, and Policy	3
NREM 3030	Internship	1-3
NREM 3300	Principles of Interpretation	3
One course from:		3
BIOL 4740	Plant Ecology	
FOR 3560	Dendrology	

One course from: 3-4

AGRON 2060	Introduction to Weather and Climate	
ASTRO 1200	The Sky and the Solar System	
GEOL 1000	How the Earth Works	
GEOL 1010	Environmental Geology: Earth in Crisis	
GEOL 1080	Introduction to Oceanography	3
One course from:		3
NREM 3850	Natural Resource Policy	

NREM 4600	Controversies in Natural Resource Management	
Total Credits		33-36
Natural Resource Conservation and Restoration		
AECL 3660	Natural History of Iowa Vertebrates	3
FOR 3560	Dendrology	3
FOR 4520	Ecosystem Management: Integrating Ecology, Society, and Policy	3
NREM 3010	Natural Resource Ecology and Soils	4
NREM 3900	Fire Ecology and Management	3
NREM 4070	Watershed Management	4
PLP 4160	Forest Insects and Diseases	3
One course from:		3
NREM 3450	Natural Resource Photogrammetry and Geographic Information Systems	
NREM 4460	Integrating GPS and GIS for Natural Resource Management	
One course from:		3
NREM 3850	Natural Resource Policy	
NREM 4600	Controversies in Natural Resource Management	
Three credit hours from approved list of electives		3
Total Credits		32
Urban and Community Forestry		
CRP 2010	The North American Metropolis	3-4
or CRP 3010	Urban Analytical Methods	
FOR 2800	Wood Properties and Identification	4
FOR 3560	Dendrology	3
FOR 4520	Ecosystem Management: Integrating Ecology, Society, and Policy	3
FOR 4750	Urban Forestry	3
HORT 3420	Landscape Plant Installation, Establishment, and Management	3
PLP 4160	Forest Insects and Diseases	3
SOC 3100	Community	3
or SOC 3820	Environmental Sociology	
One course from:		3
NREM 3850	Natural Resource Policy	
NREM 4600	Controversies in Natural Resource Management	
Total Credits		28-29

Freshman		
Fall	Credits Spring	Credits
NREM 1100	1 CHEM 1630	4
BIOL 2110L	1 CHEM 1630L	1
BIOL 2110	3 STAT 1010	4
ENGL 1500	3 NREM 1200	3
MATH 1400**	3 Free Elective	3
LIB 1600	1	
Approved Social Science course	3	
	15	15
Sophomore		
Fall	Credits Spring	Credits
FOR 2010	2 SPCM 2120	3
FOR 2020	2 ENGL 2500	3
FOR 2030	2 FOR 2800	4
FOR 2040	2 NREM 2110	1
FOR 2050	3 FOR 3020	4
FOR 2060	4 Required Elective	3
	15	18
Junior		
Fall	Credits Spring	Credits
MATH 1510, NREM 2400, STAT 3010, MATH 1600, or MATH 1650	3-4 FOR 4510	4
FOR 3560	3 Required Electives	6
NREM 3010	4 NREM 3450	3
NREM 3450 or FOR 4420	3 AGRON 1820	3
Required Elective	3	
	16-17	16
Senior		
Fall	Credits Spring	Credits
FOR 4420 or NREM 3450	3 FOR 4540	3
FOR 4160	3 FOR 4520	3
Communications Elective	3 Policy Elective	3
Free Elective	3 Required Elective	3
Free Elective	3 Free Elective	4
	15	16

Forestry, B.S. - Forest Ecosystem Management option

* To complete degree program in 4 years students must maintain an average of 16 credits per semester.

** Initial math course is determined on the basis of high school math and placement test scores. A non-credit math course may be required at additional course.

******In scheduling coursework, students should pay particular attention to courses with limited offerings (e.g., offered only on alternate years) and to course sequences (i.e., where a course serves as a prerequisite for another course).

Ndte In addition to coursework listed above, students must complete departmental requirements for Practical Work Experience requirement (NREM 1040). See <https://www.nrem.iastate.edu/workexperience> (<https://www.nrem.iastate.edu/workexperience/>)

Forestry Minor

The department offers a minor in forestry which can be earned by completion of a minimum of 15 credits in forestry courses. The minor must include at least 3 credits that are not used to meet any other department, college, or university requirement. Students wishing to emphasize management and environmental aspects of forestry must select at least 15 credits from the following courses:

FOR 3020	Silviculture	4
FOR 3560	Dendrology	3
FOR 4160	Forest Insects and Diseases	3
FOR 4420	Dynamics of Forest Stands	3
FOR 4510	Forest Resource Economics and Quantitative Methods	4
FOR 4520	Ecosystem Management: Integrating Ecology, Society, and Policy	3
FOR 4750	Urban Forestry	3
NREM 1200	Introduction to Renewable Resources	3
NREM 3010	Natural Resource Ecology and Soils	4
NREM 3450	Natural Resource Photogrammetry and Geographic Information Systems	3
NREM 3900	Fire Ecology and Management	3
NREM 4070	Watershed Management	4
NREM 4460	Integrating GPS and GIS for Natural Resource Management	3

Genetics

Genetics is the scientific study of heredity. Understanding the basis of heredity is fundamental to all aspects of the life sciences, from the most basic molecular study to applied studies of agricultural species. At Iowa State University the study of the life sciences is interdepartmental, involving faculty in the basic, agricultural, and veterinary sciences.

Faculty in 20 different departments are involved in genetics research. This large group of faculty presents a broad range of possibilities for students to learn from faculty who are at the forefront of research in many areas of genetics.

UNDERGRADUATE STUDY

Undergraduate study in genetics is jointly administered by three departments: the Roy J. Carver Department of Biochemistry, Biophysics, and Molecular Biology; the Department of Genetics, Development, and Cell Biology; and the Department of Ecology, Evolution, and Organismal Biology. Undergraduate degrees are offered through both the College of Agriculture and Life Sciences and the College of Liberal Arts and Science. Programs of study for genetics majors leading to a B.S. degree are available.

Training in genetics may lead to employment in teaching, research, or a variety of health-related professions. Although some students find employment directly after their baccalaureate training, many students continue their education in graduate or professional programs. Students with the B.S. degree may find employment in the biotechnology, health, or food industries. Recent graduates have also developed careers in conservation biology, technical writing, science journalism, technical sales, and business.

The required course work and associated electives provide students with the foundation in basic life sciences, mathematics, chemistry, and physics that is essential for professions involving modern biological/ biomedical sciences. As part of these courses, students develop skills in problem solving, critical thinking, writing, and research-related activities in the biological sciences.

Specific entrance requirements for medical and health-related professions are established by the professional schools. Students interested in fulfilling pre-professional requirements for such professions as dentistry, human medicine, genetic counseling, optometry, pharmacy, physical therapy, physician assistant, and veterinary medicine can major in genetics while fulfilling the pre-professional requirements.

Student Learning Outcomes:

Upon graduation, students earning the B.S. degree in Genetics are expected to have achieved the following skills and capabilities:

- Comprehensive, detailed understanding of the chemical basis of heredity.
- Comprehensive and detailed understanding of genetic methodology and how quantification of heritable traits in families and populations provides insight into cellular and molecular mechanisms.
- Understanding of how genetic concepts affect broad societal issues including health and disease, food and natural resources, environmental sustainability, etc.
- Understanding the role of genetic mechanisms in evolution.
- The knowledge required to design, execute, and analyze the results of genetic experimentation in animal and plant model systems.

- The ability to recognize the experimental rationale of genetic studies as they are described in peer-reviewed research articles and grant proposals to federal and other funding agencies.
- The ability to evaluate conclusions that are based on genetic data.
- Insight into the mathematical, statistical, and computational basis of genetic analyses that use genome-scale data sets in systems biology settings.
- Understanding the role of genetic technologies in industries related to biotechnology, pharmaceuticals, energy, and other fields.
- Communication skills required in the discipline including oral presentations of research data, published research articles, grant proposals, and poster presentations at conferences.
- Teamwork and leadership skills including group analysis of data, working together in the research laboratory, joint compositions of written reports, substantive participation in research group meetings, etc.

CURRICULUM IN GENETICS - REQUIREMENTS

Total Degree Requirement: 120 cr.

A maximum of 65 cr. from a two-year institution can be applied that may include up to 16 technical cr.; up to 9 Pass-Not Pass cr. of free electives can be applied; a cumulative GPA of at least 2.0 is required for graduation. Program-approved lists can be found on the Genetics website.

1. Genetics and Life Sciences

A grade of C– or better is required in all Genetics and Life Science courses.

A. Courses required of all Genetics majors

GEN 1100	Genetics Orientation	1
BIOL 2110	Principles of Biology I	3
BIOL 2110L	Principles of Biology Laboratory I	1
BIOL 2120	Principles of Biology II	3
BIOL 2120L	Principles of Biology Laboratory II	1
GEN 3130	Principles of Genetics	3
GEN 3130L	Genetics Laboratory	1
BIOL 3140	Principles of Molecular Cell Biology	3
BIOL 3150	Biological Evolution	3
One of the following:		3-4
GEN 3220	Introduction to Bioinformatics and Computational Biology	
GEN 3490	The Genome Perspective in Biology	
BCBIO 4060	Bioinformatics of OMICS	
GEN 4090	Molecular Genetics	3

GEN 4100	Analytical Genetics	3
One of the following:		3
GEN 4620	Evolutionary Genetics	
EEOB 5610	Evolutionary and Ecological Genomics	
EEOB 5630	Molecular Phylogenetics	
GEN 4910	Undergraduate Seminar, Professional Practice in Genetics Disciplines	1
MICRO 3020	Biology of Microorganisms	3
Total Credits		35-36

B. Course required of majors in the College of Agriculture and Life Sciences only

A minimum of 3 cr. of coursework in the area of environmental science from program approved list	3

Total Credits	3

2. Advanced Sciences Electives: 6 cr. from program approved list

A grade of C– or better is required in each course. No more than 3 cr. of GEN 4900, 4900R, 4900H, 4920, 4960, 4990, or 4990H may be used to meet this requirement.

3. Mathematical Sciences

Complete at least one calculus course from MATH, minimum of 4 credits.	4

MATH 1600	Survey of Calculus	
MATH 1650	Calculus I	
Complete at least one course from STAT, minimum of 3 credits.		3-4
STAT 1010	Principles of Statistics	
STAT 1040	Introduction to Statistics	
Complete at least one additional course from MATH or STAT, minimum of 4 credits.		4
MATH 1660	Calculus II	
STAT 3010	Intermediate Statistical Concepts and Methods	
Total Credits		11-12

4. Supporting Sciences

CHEM 1770	General Chemistry I	4
CHEM 1770L	Laboratory in General Chemistry I	1
CHEM 1780	General Chemistry II	3
CHEM 1780L	Laboratory in College Chemistry II	1
CHEM 3310	Organic Chemistry I	3
CHEM 3310L	Laboratory in Organic Chemistry I	1
CHEM 3320	Organic Chemistry II	3
CHEM 3320L	Laboratory in Organic Chemistry II	1

PHYS 1310	General Physics I	4
PHYS 1310L	General Physics I Laboratory	1
PHYS 1320	General Physics II	4
PHYS 1320L	General Physics II Laboratory	1

Choose one of the following options 6-7

Option 1

BBMB 4040 Biochemistry I

And one of the following:

BBMB 4050 Biochemistry II

BBMB 4110 Techniques in Biochemical Research

CHEM 2110 Quantitative and Environmental Analysis
& 2110L and Quantitative and Environmental Analysis
Laboratory

CHEM 3250 Chemical Thermodynamics

Option 2

BBMB 4200 Mammalian Biochemistry

And one of the following:

BBMB 4110 Techniques in Biochemical Research

CHEM 2110 Quantitative and Environmental Analysis
& 2110L and Quantitative and Environmental Analysis
Laboratory

CHEM 3250 Chemical Thermodynamics

Total Credits 33-34

5. International Perspectives: 3 cr. from university approved list

This course can satisfy **both** the university requirement for International Perspectives and the college requirement for a General Education elective (item 8) if the selection appears on both lists of approved courses.

6. U.S. Cultures and Communities: 3 cr. from university approved list

This course can satisfy **both** the university requirement for U.S. Cultures and Communities and the college requirement for a General Education elective (item 8) if the selection appears on both lists of approved courses.

7. Communications/Information Literacy

A. Courses required of all Genetics majors

Grades of C or better are required in ENGL 2500 and advanced writing. (The College of Agriculture and Life Sciences requires a C or better in ENGL 1500, as well.)

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
	or ENGL 2500H Written, Oral, Visual, and Electronic Composition: Honors	

LIB 1600	Introduction to College Level Research	1
	One advanced English writing course from program approved list	3
Total Credits		10

B. Course required of majors in the College of Agriculture and Life Sciences only.

A grade of C or better is required by the college.

SPCM 2120	Fundamentals of Public Speaking	3
	or AGEDS 3110 Presentation and Sales Strategies for Agricultural Audiences	

Total Credits 3

C. Course required of majors in the College of Liberal Arts and Sciences only.

LAS 2030	Professional Career Preparation	1

8. General Education electives

Courses from college approved lists that also appear on university approved lists of U.S. Cultures and Communities or International Perspectives courses can be used to satisfy both requirements.

A. College of Agriculture and Life Sciences

Humanities course from college approved list	3
Social Science course from college approved list	3
Ethics course from college approved list	3
Total Credits	9

B. College of Liberal Arts and Sciences

Humanities courses from college approved list; one of these should be a Science/Humanities bridge course from program approved list	12
Social Science courses from college approved list	9

Students must have completed 3 years of a single world language in high school or take 4-8 credits of World Languages at the university level.

Total Credits 21

Genetics, B.S.

Freshman

Fall	Credits	Spring	Credits
GEN 1100		1 ENGL 2500 or Social Sciences Choice	3
BIOL 2110		3 BIOL 2120	3
BIOL 2110L		1 BIOL 2120L	1
CHEM 1770		4 CHEM 1780	3

CHEM 1770L	1	CHEM 1780L	1
ENGL 1500 or 2500	3	MATH/ STAT choice or Humanities Choice	3-4
LIB 1600	1	Consider Research (HON 2900 or GEN 4990)	0-2
MATH/ STAT choice or Humanities Choice	3-4		

17-18			14-17		
Sophomore					
Fall	Credits	Spring	Credits	Summer	Credits
BIOL 3130		3 BIOL 3140		3 Consider Internship, Study Abroad	
BIOL 3130L		1 CHEM 3320		3	
CHEM 3310		3 CHEM 3320L		1	
CHEM 3310L		1 MICRO 3020		3	
SPCM 2120		3 MATH/STAT Choice or Social Sciences*		3-4	
MATH/STAT Choice or Social Sciences*		3-4 Ethics Choice		3	

14-15			16-17			0
Junior						
Fall	Credits	Spring	Credits	Summer	Credits	
GEN 4090		3 BIOL 3150		3 Consider Research with Faculty		

U.S. Cultures and Communities/ Social Sciences Choice	3 or	Bioinformatics Choice	
BIOL 3150	3	BBMB 4050	3
BBMB 4040	3	GEN 4100	3
PHYS 1310 or 2310	4	GEN 4910 (or Fall of Senior Year)	1
PHYS 1310L or 2310L	1	PHYS 1320	4
		PHYS 1320L	1

Senior			
Fall	Credits	Spring	Credits
GEN 4620		3 Advanced Science Electives	3-6
STAT 3010 (or Advanced Science Elective)		4 International Perspectives/ Humanities	3
ENGL 3120 (or other ENGL 3020-3160)		3 True Electives	3-6
Environmental Awareness Choice	3-4		
13-14		9-15	

Undergraduate Minor

The minor in Genetics may be earned by completing the following courses. At least 3 cr. must be used **only** to fulfill the requirements of the minor and not be applied to any other major, college, or university requirement.

GEN 3130	Principles of Genetics	3
GEN 3130L	Genetics Laboratory	1
BIOL 3140	Principles of Molecular Cell Biology	3
GEN 4100	Analytical Genetics	3

GEN 4090	Molecular Genetics	3
Two or more additional credits in Genetics at the 3000 level or above.		2
Total Credits		15

Global Resource Systems

The Global Resource Systems undergraduate major employs a truly interdisciplinary and systemic approach to understanding complex global resource issues. Students develop a core set of technical competencies in a resource area selected from the majors, minors and certificates offered by the College of Agriculture and Life Sciences. Students choose a world region in which to specialize, develop competency in a relevant world language, and participate in a significant cross-cultural internship experience. They carry out a senior project related to their resource specialization within the context of the world region. The undergraduate experience culminates with a senior capstone course, where students work with real-world clients to address global resource challenges.

Multidisciplinary themes are developed in the context of the physical, biological and socio-economic factors affecting global resource systems. In this context, resource systems include natural, food and agricultural, environmental, cultural and human, political and institutional, financial and built, public health and social resources. Graduates of this program have transnational leadership skills and are successful integrators of various specializations on a team. They are skilled in applying a systemic perspective and developing solutions to complex global resource systems problems using innovativeness and creativity. Future professionals communicate effectively and demonstrate environmental awareness, exhibit an ethical perspective, and display clear analysis of how cultural diversity impacts work both here and abroad.

A degree in Global Resource Systems opens the door to employment opportunities in the many businesses and organizations that require globally competent employees.

Student Learning Outcomes

Upon graduation, students should be able to:

Understand sustainable global resource systems by: summarizing factors of biological, physical, and social resources in global systems; and predicting the consequences of the utilization and distribution of global resources and their systems.

Apply global competency skills by recognizing diverse cultures, reflecting on the value of cultures on global resource systems, and employing skills needed to work in different cultures.

Design ethical and innovative solutions to global challenges by using information literacy skills to define global challenges and creating sustainable solutions to global challenges.

Use communication and leadership skills by communicating effectively with diverse audiences using written, oral, visual, and electronic skills and participating effectively as leaders in teams and organizations.

Curriculum in Global Resource Systems

Administered by a supervisory committee in the College of Agriculture and Life Sciences. Students choose a region of the world to develop an expertise; they choose a language to learn and develop proficiency through the intermediate level; they choose and possess an area of technical expertise by completing an additional major, minor or certificate program offered through the College of Agriculture and Life Sciences; they complete a required internship in an international setting; and they select and complete a senior research project with faculty mentoring.

Total Degree Requirement: 125 cr.

Only 65 cr. from a two-year institution may apply which may include up to 16 technical cr.; 9 P-NP cr. of free electives; 2.00 minimum GPA.

International Perspective: 3 cr.

3 cr. from approved list 3

U.S. Cultures and Communities: 3 cr.

3 cr. from approved list 3

Communications Proficiency:

English composition (6 credits with a grade of C or higher; see courses below.)

Speech fundamentals (3 credits with a grade of C or higher; see courses below.)

Communication/Library: 13 cr.

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
SPCM 2120	Fundamentals of Public Speaking	3
	or AGEDS 3110 Presentation and Sales Strategies for Agricultural Audiences	
ENGL 3020	Business Communication	3
	or ENGL 3090 Proposal and Report Writing	
	or ENGL 3140 Technical Communication	
LIB 1600	Introduction to College Level Research	1

Total Credits 13

Humanities and Social Sciences: 6 cr.

ECON 1010	Principles of Microeconomics	3
	or ECON 1020 Principles of Macroeconomics	

Plus three credit hours from approved humanities list 3

Total Credits 6

Ethics: 3 cr.

3 cr. from approved list

Life Sciences: 6 cr.

BIOL 1010 Introductory Biology

or BIOL 2110 Principles of Biology I

or BIOL 2120 Principles of Biology II

or BIOL 2510 Biological Processes in the Environment

Plus 3 cr. from approved life sciences list

Mathematics and Statistics from college-approved list: 6 cr.

3 credit of mathematics

3 credits of statistics

Total Credits**Global Competency: 15-31 cr.**

16 cr. of 1000 and 2000 level of a single WLC language; 15 cr. in global competency courses from an approved list with up to 3 cr. may be earned from a travel course.

Physical Sciences: 8 cr.

5 credits of physical science (e.g., chemistry, geological and atmospheric sciences, physics) from college-approved list

One course from the following:

AGRON 1820 Introduction to Soil Science

or AGRON 2060 Introduction to Weather and Climate

or AGRON 2820 Soil Conservation and Land Use

or GEOL 1010 Environmental Geology: Earth in Crisis

or GEOL 1600 Water Resources of the World

or GLOBE 1200 Geography of Global Resource Systems

Total Credits**Global Resource Systems: 23 cr.**

GLOBE 1100 Orientation

GLOBE 2010 Introduction to Global Resource Systems

3 credits of GLOBE 2110

GLOBE 2110 Issues in Global Resource Systems (Each offering is 1 cr., must be repeated for 3 cr.)

GLOBE 3030 Agricultural, Food and Natural Global Resource Systems

GLOBE 3040 Socio-Economic Global Resource Systems

GLOBE 3200 Global Resource Systems Internship Preparation

One of the following:

GLOBE 3210 Internship - Global

GLOBE 3220 Internship - United States

GLOBE 4010 Senior Project

GLOBE 4020	Responses to Global Resource System Challenges	3

Total Credits**23-26****Specialization 15-18 cr.**

Satisfied by any of the majors, minors or certificates offered at Iowa State University.

Electives:

Sufficient coursework to ensure a total of not less than 125 credits.

Global Resource Systems, B.S.

Freshman

Fall	Credits Spring	Credits
GLOBE 1100	1 GLOBE 2010	3
MATH 1400	3 ECON 1010	3
ENGL 1500	3 ENGL 2500	3
LIB 1600	1 CHEM 1630	4
BIOL 2110	3 CHEM 1630L	1
BIOL 2110L	1 STAT 1040	3
Humanities	3	
	15	17

Sophomore

Fall	Credits Spring	Credits
GLOBE 3030	3 GLOBE 3040	3
Language 1010	4 Language 1020	4
GLOBE 2110	1 GLOBE 2110	1
Global Politics or Global Culture	3 AGEDS 3110 or SPCM 2120	3
Technical Area	3 AGRON 1820, 2060, 2820, GEOL 1010, or GEOL 1600	3
	Specialization	3
	14	17

Junior

Fall	Credits Spring	Credits
GLOBE 2110	1 GLOBE 3200	1
Language 2010	4 Language 2020	4
ENGL 3090	3 Global History or Global Culture	3
Global Culture	3 AGRON 3420 (or Other CALS Approved Ethics)	3
U.S. Cultures and Communities	3 Specialization	3
General Elective	3 General Elective	3
	17	17

Senior		
Fall	Credits Spring	Credits
GLOBE 3210	3 GLOBE 4020	3
GLOBE 4010	3 Global Culture	3
International Perspectives	3 3000 Level or Higher Life Science	3
Global Competency	3 Specialization	3
Specialization	3 General Elective	2
15		14

Horticulture

To meet the educational needs of a student population with interests ranging from plant physiology to landscape design/installation to fruit and vegetable production to golf course/athletic field construction and management, considerable flexibility is built into the horticulture curriculum. The diversity of interests and need for flexibility are reflected in the impressive array of horticulture courses offered.

The Department of Horticulture offers six options within the horticulture major:

1. Greenhouse Plant Production
2. Horticultural Food Crop Production and Management
3. Landscape Design, Installation, and Management
4. Public Horticulture
5. Horticulture Research
6. Turfgrass Management

Graduates possess the technical knowledge and skills to become professional horticulturists. They understand principles of life science, plant growth and development, and are familiar with cultural and management practices for a wide assortment of horticultural crops. They are able to work and communicate effectively with fellow horticultural professionals and other citizens who share an interest in horticulture. Graduates also understand the ethical and environmental dimensions of problems and issues facing horticultural professionals.

A degree in horticulture opens the door to employment opportunities with production nurseries, seed companies, interior landscaping firms, greenhouses, garden centers, conservatories, landscape design/installation firms, public gardens and arboreta, orchards and vineyards, food processing companies, vegetable farms, fertilizer cooperatives, agricultural chemical companies, golf courses, sports fields, sod production companies, and lawn care businesses. Several allied plant-science industries also provide employment opportunities in the areas of sales, management, and communication. Opportunities exist for careers

in research, teaching, extension, and business after obtaining advanced training in graduate school.

Student Learning Outcomes

Upon graduation, students should be able to:

1. Acquire, integrate, and apply knowledge of plant science to manage systems.
2. Demonstrate interdisciplinary knowledge and competency in managing horticulture systems.
3. Synthesize knowledge and use insight and creativity to better understand and improve plant systems.
4. Appreciate and communicate the diverse impacts of horticulture on people.
5. Demonstrate professionalism and proficiency in skills that relate to horticulture.

Degree Requirements

Students majoring in horticulture will select an option in which to specialize before reaching junior standing and will fulfill the requirements described below under Options.

Total Degree Requirement: 129 credits

Only 65 credits from a two-year institution may apply which may include up to 16 technical credits; 9 P-NP credits of free electives; 2.00 minimum GPA.

Biological Sciences: 18 cr.

BIOL 2110	Principles of Biology I	3
BIOL 2110L	Principles of Biology Laboratory I	1

And complete fourteen credit hours from the following: 14

AGRON 2170	Weed Identification
AGRON 2820	Soil Conservation and Land Use
AGRON 3160	Crop Structure-Function Relationships
AGRON 3170	Principles of Weed Science
AGRON 3540 & 3540L	Soils and Plant Growth and Soils and Plant Growth Laboratory
BIOL 2120 & 2120L	Principles of Biology II and Principles of Biology Laboratory II
BIOL 3120	Ecology
BIOL 3130 & 3130L	Principles of Genetics and Genetics Laboratory
or GEN 3200 Genetics, Agriculture and Biotechnology	
BIOL 3140	Principles of Molecular Cell Biology
BIOL 3550	Plants and People
BIOL 3660	Plant Systematics
BIOL 4540	Plant Anatomy

BIOL 4740	Plant Ecology
ENT 2010	Introduction to Insects
ENT 2110	Insects and Society
ENT 3700	Insect Biology
ENT 3750	Plant Protection Using Natural Enemies
ENT 3760	Fundamentals of Entomology and Pest Management
FOR 4160	Forest Insects and Diseases
PLP 4080	Principles of Plant Path

Total Credits 18

Communications Proficiency (with a grade of C or better)

6 credits of English composition (see approved courses below)

3 credits of speech fundamentals (see approved courses below)

Communication/Library: 13 cr.

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
LIB 1600	Introduction to College Level Research	1
ENGL 3020	Business Communication	3
or ENGL 3090	Proposal and Report Writing	
or ENGL 3140	Technical Communication	

One of the following: 3

SPCM 2120	Fundamentals of Public Speaking
AGEDS 3110	Presentation and Sales Strategies for Agricultural Audiences
COMST 2140	Professional Communication

Total Credits 13

Ethics: 3 cr.

3 cr. from approved list 3

Humanities and Social Sciences: 6 cr.

Approved Humanities course 3

Approved Social Science course 3

Total Credits 6

International Perspective: 3 cr.

3 cr. from approved list 3

Total Credits 3

U.S. Cultures and Communities: 3 cr.

3 cr. from approved list 3

Total Credits 3

Life Sciences: 6 cr.

BIOL 2110 Principles of Biology I 3

Approved Life Sciences course 3

Total Credits 6

Mathematical Sciences: 6 cr.

Select one course from the following: 3

MATH 1400	College Algebra
MATH 1500	Discrete Mathematics for Business and Social Sciences
MATH 1650	Calculus I

AND select one of the following: 3

STAT 1010	Principles of Statistics
STAT 1040	Introduction to Statistics
STAT 2260	Introduction to Business Statistics I
STAT 3010	Intermediate Statistical Concepts and Methods

Total Credits 6

Physical Sciences: 11 cr.

Complete one of the following: 5

CHEM 1630	College Chemistry
& 1630L	and Laboratory in College Chemistry
or CHEM 1770	General Chemistry I
& 1770L	and Laboratory in General Chemistry I

AND complete one course from the following: 3-4

AGRON 2590	Organic Compounds in Plants and Soils
CHEM 1780	General Chemistry II
& 1780L	and Laboratory in College Chemistry II
CHEM 3310	Organic Chemistry I
& 3310L	and Laboratory in Organic Chemistry I
PHYS 1010	Physics for the Nonscientist
PHYS 1150	Physics for the Life Sciences
PHYS 1310	General Physics I
& 1310L	and General Physics I Laboratory

AND complete one course from the following: 3-5

BBMB 2210	Structure and Reactions in Biochemical Processes
CHEM 2310	Elementary Organic Chemistry
& 2310L	and Laboratory in Elementary Organic Chemistry
CHEM 3310	Organic Chemistry I
& 3310L	and Laboratory in Organic Chemistry I

Total Credits 11-14

Horticultural Sciences: Minimum of 30 cr.

HORT 1100 Professional and Educational Development in Horticulture 1

HORT 2210	Principles of Horticulture Science	3
HORT 3210	Horticulture Physiology	3
Select 23 cr. hours from courses within selected option.		23
Total Credits	Minimum	30

Soil Sciences: 3 cr.

AGRON 1820	Introduction to Soil Science	3
Total Credits		3

Electives

No more than 4 cr. of Hort 4900 may count toward graduation.

Options

Greenhouse Plant Production

The following courses are required to meet the Horticulture requirement:

HORT 2400	Trees, Shrubs, and Woody Vines for Landscaping	3
HORT 3220	Plant Propagation	3
HORT 3300	Herbaceous Ornamental Plants	3
HORT 3310	Hydroponic Crop Production	2
HORT 3320	Greenhouse and Nursery Operations and Management	4
HORT 4340	Floriculture Crop Production	3
HORT 4350	Landscape Plant Production	3

Other recommended courses are:

HORT 3910	Horticultural Management Experience	
HORT 4240	Sustainable and Environmental Horticulture Systems	
HORT 4760	Horticultural Postharvest Technology	
HORT 2330	House Plants and Interiorscaping	

Required for option:

ACCT 2840	Financial Accounting	3

And select 9 cr. hours from the following: 9

ACCT 2150	Legal Environment of Business	
ACCT 2850	Managerial Accounting	
ACCT 4160	Business Law	
AGRON 2060	Introduction to Weather and Climate	
COMS 1030	Computer Literacy and Applications	
ECON 1010	Principles of Microeconomics	
ECON 1020	Principles of Macroeconomics	
ECON 2300	Farm Business Management	
ECON 2340	Small Business Management	
ECON 3340	Entrepreneurship in Agriculture	

ENTSP 3100	Entrepreneurship and Innovation	
ENTSP 3130	Feasibility Analysis for New Ventures	
MGMT 3700	Managing Organizations	
MGMT 3710	Organizational Behavior	
MKT 3400	Principles of Marketing	
MKT 4420	Sales Management	
MKT 4470	Consumer Behavior	
TSM 2700	Principles of Injury Prevention and Safety	

Horticultural Food Crop Production and Management

The following courses are required to meet the Horticulture requirement:

HORT 2760	Grape and Wine Science	3
HORT 3760	Fundamentals of Field Production of Horticultural Food Crops	3
HORT 4610	Fruit Crop Production and Management	3
HORT 4710	Vegetable Production and Management	2
HORT 4710L	Vegetable Production and Management Lab	1
HORT 4760	Horticultural Postharvest Technology	3

Other recommended courses:

HORT 3220	Plant Propagation	
HORT 3310	Hydroponic Crop Production	
HORT 3320	Greenhouse and Nursery Operations and Management	
HORT 3380	Seed Science and Technology	
HORT 3910	Horticultural Management Experience	
HORT 4840	Organic Agricultural Theory and Practice	

Required for option:

ACCT 2840	Financial Accounting	3

And select 9 cr. hours from the following: 9

ACCT 2150	Legal Environment of Business	
ACCT 2850	Managerial Accounting	
ACCT 4160	Business Law	
COMS 1030	Computer Literacy and Applications	
ECON 1010	Principles of Microeconomics	
ECON 1020	Principles of Macroeconomics	
ECON 2300	Farm Business Management	
ECON 2340	Small Business Management	
ECON 3340	Entrepreneurship in Agriculture	
ENVS 2930	Environmental Planning	
ENVS 3240	Energy and the Environment	
ENVS 3820	Environmental Sociology	
ENVS 4910	Environmental Law and Planning	

FSHN 4030	Food Laws and Regulations
FSHN 4710	Food Processing
FSHN 4720	Food Processing Laboratory
ENTSP 3100	Entrepreneurship and Innovation
ENTSP 3130	Feasibility Analysis for New Ventures
MGMT 3700	Managing Organizations
MGMT 3710	Organizational Behavior
MKT 3400	Principles of Marketing
MKT 4420	Sales Management
MKT 4470	Consumer Behavior
TSM 2700	Principles of Injury Prevention and Safety
TSM 3240	Soil and Water Conservation Management

Horticulture Research

The following courses are required for this option:

AGEDS 3120	Science With Practice	3
HORT 3220	Plant Propagation	3

Other recommended courses:

HORT 2400	Trees, Shrubs, and Woody Vines for Landscaping
HORT 3300	Herbaceous Ornamental Plants
HORT 3310	Hydroponic Crop Production
HORT 3320	Greenhouse and Nursery Operations and Management
HORT 3420	Landscape Plant Installation, Establishment, and Management
HORT 3760	Fundamentals of Field Production of Horticultural Food Crops
HORT 3910	Horticultural Management Experience

Mathematical Sciences Requirement: 8

MATH 1650	Calculus I
MATH 1660	Calculus II

Physical Sciences Requirement:

BBMB 3010	Survey of Biochemistry
or BBMB 4040	Biochemistry I
or BBMB 3160	Principles of Biochemistry
CHEM 1770	General Chemistry I
CHEM 1770L	Laboratory in General Chemistry I
CHEM 1780	General Chemistry II
CHEM 1780L	Laboratory in College Chemistry II
CHEM 3310	Organic Chemistry I
CHEM 3310L	Laboratory in Organic Chemistry I
CHEM 3320	Organic Chemistry II
CHEM 3320L	Laboratory in Organic Chemistry II

PHYS 1310 & 1310L	General Physics I and General Physics I Laboratory
PHYS 1320 & 1320L	General Physics II and General Physics II Laboratory

And select 5 cr. hours from the following:

BBMB 4050	Biochemistry II
BBMB 4040	Biochemistry I
or BBMB 3160	Principles of Biochemistry
BBMB 4110	Techniques in Biochemical Research
BIOL 3130	Principles of Genetics
BIOL 3130L	Genetics Laboratory
BIOL 3140	Principles of Molecular Cell Biology
BIOL 3150	Biological Evolution
CHEM 2110	Quantitative and Environmental Analysis
CHEM 2110L	Quantitative and Environmental Analysis Laboratory
CHEM 3160	Instrumental Methods of Chemical Analysis
CHEM 3160L	Instrumental Analysis Laboratory
CHEM 3210L	Laboratory in Physical Chemistry
CHEM 3220L	Laboratory in Physical Chemistry
CHEM 3240	Introductory Quantum Mechanics
COMS 1070	Windows Application Programming
or COMS 2070	Fundamentals of Computer Programming
GEN 4090	Molecular Genetics
GEN 4100	Analytical Genetics

Landscape Design, Installation and Management

The following courses are required to meet the Horticulture requirement:

HORT 2400	Trees, Shrubs, and Woody Vines for Landscaping	3
HORT 2810	Landscape Graphics	2
HORT 3300	Herbaceous Ornamental Plants	3
HORT 3410	Woody Plant Cultivars: Shade Trees, Ornamental Trees and Woody Shrubs	2
HORT 3420	Landscape Plant Installation, Establishment, and Management	3
HORT 3510	Turfgrass Establishment and Management	3
HORT 3800	Principles of Garden Composition	2
HORT 3810	Beginning Garden Composition Studio	2
HORT 4440	Landscape Construction Management	3
HORT 4810	Advanced Garden Composition	2

Other recommended courses are:

HORT 3220	Plant Propagation

HORT 3320	Greenhouse and Nursery Operations and Management	
HORT 3910	Horticultural Management Experience	
Required for option:		
ACCT 2840	Financial Accounting	3
And select 9 cr. hours from the following:		
ACCT 2150	Legal Environment of Business	
ACCT 2850	Managerial Accounting	
ACCT 4160	Business Law	
COMS 1030	Computer Literacy and Applications	
ECON 2340	Small Business Management	
ECON 3340	Entrepreneurship in Agriculture	
ENTSP 3100	Entrepreneurship and Innovation	
ENTSP 3130	Feasibility Analysis for New Ventures	
MGMT 3700	Managing Organizations	
MGMT 3710	Organizational Behavior	
MKT 3400	Principles of Marketing	
MKT 4420	Sales Management	
MKT 4470	Consumer Behavior	
TSM 3240	Soil and Water Conservation Management	

Public Horticulture

The following courses are required to meet the Horticulture requirement:

HORT 2400	Trees, Shrubs, and Woody Vines for Landscaping	3
HORT 3220	Plant Propagation	3
HORT 3300	Herbaceous Ornamental Plants	3

Other recommended courses:

HORT 2330	House Plants and Interiorscaping	
HORT 2810	Landscape Graphics	
HORT 3320	Greenhouse and Nursery Operations and Management	
HORT 3410	Woody Plant Cultivars: Shade Trees, Ornamental Trees and Woody Shrubs	
HORT 3420	Landscape Plant Installation, Establishment, and Management	
HORT 3510	Turfgrass Establishment and Management	
HORT 3510L	Turfgrass Establishment and Management Laboratory	
HORT 3760	Fundamentals of Field Production of Horticultural Food Crops	
HORT 3800	Principles of Garden Composition	
HORT 3810	Beginning Garden Composition Studio	
HORT 3910	Horticultural Management Experience	

Required for option

ACCT 2840	Financial Accounting	3

And select 9 credit hours from the following:

ACCT 2150	Legal Environment of Business	
ACCT 2850	Managerial Accounting	
ACCT 4160	Business Law	
AGEDS 3100	Foundations of Agricultural Education Programs	
AGEDS 4010	Planning Agriculture and Life Sciences Education Programs	
COMST 2110	Interpersonal Communication	
COMST 2140	Professional Communication	
COMST 3170	Small Group Communication	
ECON 1010	Principles of Microeconomics	
ECON 2340	Small Business Management	
ECON 3340	Entrepreneurship in Agriculture	
ENGL 2200	Descriptive English Grammar	
ENGL 3030	Free-Lance Writing for Popular Magazines	
ENGL 3050	Creative Writing: Nonfiction	
ENGL 3090	Proposal and Report Writing	
ENGL 3130	Rhetorical Website Design	
ENGL 4150	Business and Technical Editing	
ENGL 4160	Visual Aspects of Business and Technical Communication	
ENSCI 4460	Integrating GPS and GIS for Natural Resource Management	
FIN 3010	Principles of Finance	
JLMC 2010	Reporting and Writing for the Mass Media	
JLMC 3100	Fundamentals of Photojournalism	
MGMT 3700	Managing Organizations	
MGMT 3710	Organizational Behavior	
MGMT 4710	Introduction to Human Resource Management	
PR 2200	Principles of Public Relations	
SPCM 3120	Business and Professional Speaking	

Turfgrass Management

The following courses are required to meet the Horticulture requirement:

HORT 2400	Trees, Shrubs, and Woody Vines for Landscaping	3
HORT 3510	Turfgrass Establishment and Management	3
HORT 3510L	Turfgrass Establishment and Management Laboratory	1
HORT 4510	Professional Turfgrass Management	2
HORT 4530	Sports Turf Management	3

HORT 4540	Turf & Landscape Irrigation	3
HORT 5510	Growth and Development of Perennial Grasses	2
Other recommended courses:		
HORT 3300	Herbaceous Ornamental Plants	
HORT 3220	Plant Propagation	
HORT 3910	Horticultural Management Experience	
HORT 4240	Sustainable and Environmental Horticulture Systems	
Required for option:		
ACCT 2840	Financial Accounting	3
And select 9 cr. hours from the following:		
ACCT 2850	Managerial Accounting	
ACCT 4160	Business Law	
AGRON 2060	Introduction to Weather and Climate	
AGRON 3600	Environmental Soil Science	
AGRON 4590	Soil and Water Chemistry	
COMS 1030	Computer Literacy and Applications	
ECON 2340	Small Business Management	
ECON 3340	Entrepreneurship in Agriculture	
ENVS 2010	Introduction to Environmental Issues	
ENVS 3240	Energy and the Environment	
HSPM 1010	Introduction to the Hospitality Industry	
HSPM 2890	Contemporary Club Management	
MGMT 3700	Managing Organizations	
MGMT 3710	Organizational Behavior	
TSM 2700	Principles of Injury Prevention and Safety	
TSM 3240	Soil and Water Conservation Management	

Horticulture, B.S. Greenhouse Plant Production Option

Freshman

Fall	Credits Spring	Credits
ENGL 1500	3 ENGL 2500	3
CHEM 1630	4 BIOL 2110	3
CHEM 1630L	1 BIOL 2110L	1
ECON 1010	3 STAT 1040	3
HORT 1210	3 AGRON 1820	3
LIB 1600	1 HORT 2210	3
HORT 1100	1	
	16	16

Sophomore

Fall	Credits Spring	Credits
ENT 2010	1 HORT 3320	4
ENT 2110	2 AGRON 2820	3

HORT 2400	3 PHYS 1010, 1150, BBMB 2210, or AGRON 2590	3-4
MATH 1400	3 ENT 3760	3
ACCT 2840	3 Elective	3
HORT 3310	2	
Elective	1	
	15	16-17

Junior

Fall	Credits Spring	Credits
HORT 4340	3 ENT 3750	3
HORT 3210	3 ENTSP 3100	3
HORT 3910	1 HORT 3220	3
PLP 4080	3 CHEM 2310 & 2310L or BBMB 2210	3-4
Elective	3 International Perspective	3
U.S. Cultures and Communities	3 Elective	1
	16	16-17

Senior

Fall	Credits Spring	Credits
HORT 3210	3 HORT 4350	3
HORT 3910	1 ECON 3340	3
ECON 2340	3 Humanities	3
Ethics	3 HORT 3410	2
SPCM 2120 or AGEDS 3110	3 ENGL 3020 or 3140	3
Elective	3 Elective	2
	16	16

Horticulture, B.S. - Horticulture Food Crop Production and Management Option

Freshman

Fall	Credits Spring	Credits
ENGL 1500	3 ENGL 2500	3
CHEM 1630	4 BIOL 2110	3
CHEM 1630L	1 BIOL 2110L	1
ECON 1010	3 STAT 1040	3
HORT 1210	3 AGRON 1820	3
LIB 1600	1 HORT 2210	3
HORT 1100	1	
	16	16

Sophomore

Fall	Credits Spring	Credits
ENT 2010	1 AGRON 2820	3

ENT 2110	2 HORT 2760	3	Sophomore		
HORT 3760	3 PHYS 1010, 1310, 1150, BBMB 2210, or AGRON 2590	3-4	Fall	Credits Spring	Credits
			ENT 2010	1 AGRON 2820	3
MATH 1400	3 ENT 3760	3	ENT 2110	2 HORT 3800	2
ACCT 2840	3 HORT 4710	2	HORT 3300	3 PHYS 1010, 1310, 1150, BBMB 2210, or AGRON 2590	3-4
International Perspective	3 HORT 4710L	1			
Elective	1 Elective	1	MATH 1400	3 ENT 3760	3
	16	16-17	ACCT 2840	3 HORT 3810	2
Junior			HORT 2810	2 Elective	3
Fall	Credits Spring	Credits	HORT 4440	3	
HORT 3310	2 Biological Science	3		17	16-17
HORT 3210	3 HORT 3320	4	Junior		
HORT 3910	1 HORT 3220	3	Fall	Credits Spring	Credits
Humanities	3 HORT 4610	3	HORT 2400	3 BIOL 3550	3
CHEM 2310 & 2310L or BBMB 2210	3-4 Elective	3	HORT 3210	3 CHEM 2310 & 2310L or BBMB 2210	3-4
Elective	3		HORT 3910	1 International Perspective	3
	15-16	16	HORT 4810	2 U.S. Cultures and Communities	3
Senior			SPCM 2120 or AGEDS 3110	3 HORT 3410	2
Fall	Credits Spring	Credits	ECON 2340	3 HORT 3420	3
ENTSP 3100	3 ENGL 3020 or 3140	3		15	17-18
HORT 3910	1 ECON 3340	3	Senior		
ECON 2340	3 PLP 4080	3	Fall	Credits Spring	Credits
HORT 4760	3 Ethics	3	ENTSP 3100	3 ENGL 3020 or 3140	3
HORT 3310	2 U.S. Cultures and Communities	3	HORT 3910	1 Humanities	3
SPCM 2120 or AGEDS 3110	3 Elective	1	ECON 3340	3 Ethics	3
Elective	1		Elective	3 PLP 4080	3
	16	16	MGMT 3710	3 HORT 3220	3
			HORT 3510	3 Elective	1
				16	16

Horticulture, B.S. - Landscape Design, Installation, and Management

Freshman		
Fall	Credits Spring	Credits
ENGL 1500	3 ENGL 2500	3
CHEM 1630	4 BIOL 2110	3
CHEM 1630L	1 BIOL 2110L	1
ECON 1010	3 STAT 1040	3
HORT 1210	3 AGRON 1820	3
LIB 1600	1 HORT 2210	3
HORT 1100	1	
	16	16

Horticulture, B.S. - Public Horticulture Option

Freshman		
Fall	Credits Spring	Credits
ENGL 1500	3 ENGL 2500	3
CHEM 1630	4 BIOL 2110	3
CHEM 1630L	1 BIOL 2110L	1
ECON 1010	3 STAT 1040	3
HORT 1210	3 AGRON 1820	3
LIB 1600	1 HORT 2210	3
HORT 1100	1	
	16	16

Sophomore

Fall	Credits Spring	Credits
ENT 2010	1 AGRON 2820	3
ENT 2110	2 HORT 3220	3
HORT 2400	3 PHYS 1010, 1310, 1150, BBMB 2210, or AGRON 2590	3-4
MATH 1400	3 ENT 3760	3
ACCT 2840	3 Elective	3
International Perspective	3	
Elective	1	
	16	15-16

Junior

Fall	Credits Spring	Credits
HORT 3300	3 BIOL 3550	3
HORT 3210	3 CHEM 2310 & 2310L or BBMB 2210	3-4
HORT 3910	1 HORT 4240	3
SPCM 2120 or AGEDS 3110	3 Elective	3
PR 2200	3 U.S. Cultures and Communities	3
Elective	3 Elective	1
	16	16-17

Senior

Fall	Credits Spring	Credits
ENGL 3090	3 ENGL 3020 or 3140	3
PLP 4080	3 Elective	3
HORT 3910	1 Humanities	3
JLMC 2010	3 HORT 3320	4
Ethics	3 HORT 3420	3
MGMT 3710	3	
	16	16

Horticulture, B.S. - Horticulture Research Option**Freshman**

Fall	Credits Spring	Credits
ENGL 1500	3 ENGL 2500	3
CHEM 1770	4 BIOL 2110	3
CHEM 1770L	1 BIOL 2110L	1
ECON 1010	3 STAT 1040	3
HORT 1210	3 AGRON 1820	3
LIB 1600	1 HORT 2210	3
HORT 1100	1	
	16	16

Sophomore

Fall	Credits Spring	Credits
BIOL 2120	3 US Diversity	3
BIOL 2120L	1 HORT 3320	4
HORT 2400	3 MATH 1660	4
MATH 1650	4 PHYS 1310	4
CHEM 1780	3 PHYS 1310L	1
CHEM 1780L	1	
	15	16

Junior

Fall	Credits Spring	Credits
PHYS 1320	4 ENT 3760	3
PHYS 1320L	1 BIOL 3130	3
HORT 3210	3 BIOL 3130L	1
HORT 3910	1 HORT 3220	3
PLP 4080	3 CHEM 3310	3
AGEDS 3120	3 CHEM 3310L	1
HORT 3420	3 International Perspective	3
	18	17

Senior

Fall	Credits Spring	Credits
CHEM 3320	3 BIOL 3140	3
CHEM 3320L	1 Humanities	3
HORT 3910	1 Ethics	3
BBMB 3010, 4040, or 3160	3 HORT 3300	3
ENGL 3020 or 3140	3 Elective	1
SPCM 2120 or AGEDS 3110	3	
BIOL 3660	4	
Elective	2	
	20	13

Horticulture, B.S. - Turfgrass Management Option**Freshman**

Fall	Credits Spring	Credits
ENGL 1500	3 ENGL 2500	3
CHEM 1630	4 BIOL 2110	3
CHEM 1630L	1 BIOL 2110L	1
ECON 1010	3 STAT 1040	3
HORT 1210	3 AGRON 1820	3
LIB 1600	1 HORT 2210	3
HORT 1100	1	
	16	16

Sophomore

Fall	Credits Spring	Credits
ENT 2010	1 AGRON 2820	3
ENT 2110	2 Humanities	3
HORT 2400	3 PHYS 1010, 1310, 1150, BBMB 2210, or AGRON 2590	3-4
MATH 1400	3 HORT 5510	2
ACCT 2840	3 SPCM 2120 or AGEDS 3110	3
HORT 3510	3 Elective	3
HORT 3510L	1	
	16	17-18

Junior

Fall	Credits Spring	Credits
HORT 4530	3 AGRON 3540	3
HORT 3210	3 ENT 3760	3
HORT 3910	1 HORT 4510	2
PLP 4080	3 HORT 3220	3
International Perspective	3 Elective	2
U.S. Cultures and Communities	3 CHEM 2310 & 2310L or BBMB 2210	3-4
	16	16-17

Senior

Fall	Credits Spring	Credits
AGRON 2060	3 ENGL 3020 or 3140	3
HORT 3910	1 HORT 3420	3
HORT 4540	3 HORT 4240	3
Option Class	3 Ethics	3
MGMT 3710	3 Option Class	3
Option Class	3 Elective	1
	16	16

Minors

The Department of Horticulture offers two minors: 1) Horticulture and 2) Landscape Management. Both minors are earned by taking HORT 2210 Principles of Horticulture Science plus 12 additional credits with at least 6 credits at the 3000-level or above. The minor must include at least 3 credits that are not used to meet any other department, college, or university requirement.

Horticulture minor

The Horticulture minor is a broad-based minor that does not focus within a specific area of horticulture. The 12 additional credits for this minor can be selected from the full list of Horticulture courses.

Landscape Management minor

The Landscape Management minor focuses on landscape management including plant selection, landscape installation and management, and turfgrass management. The 12 additional credits for this minor can be selected from the following courses: HORT 2400 Trees, Shrubs, and Woody Vines for Landscaping, HORT 2810 Landscape Graphics, HORT 3300 Herbaceous Ornamental Plants, HORT 3410 Woody Plant Cultivars: Shade Trees, Ornamental Trees and Woody Shrubs, HORT 3420 Landscape Plant Installation, Establishment, and Management, HORT 3510 Turfgrass Establishment and Management or HORT 4440 Landscape Construction Management.

Graduate Study

The graduate major in horticulture leads to the M.S. (thesis and non-thesis option) and Ph.D. Some faculty members of the department serve as major professors for students in interdepartmental graduate majors in plant biology; genetics and genomics; molecular, cellular, and developmental biology; ecology and evolutionary biology; sustainable agriculture; and environmental science.

Graduates possess a broad understanding of horticulture and the allied plant sciences. They are able to communicate effectively with members of the scientific community, industry groups, and other interested citizens. They are experienced in conducting research and communicating the results from that research. They are capable of addressing and solving complex problems that confront the many horticultural, agricultural, and plant science professions. They also understand the ethical, legal, social, and environmental issues associated with modern agricultural/horticultural practices.

Industrial Technology

The Department of Agricultural and Biosystems Engineering offers a Bachelor of Science degree in Industrial Technology (ITEC), as well as an undergraduate certificate in Occupational Safety. Students majoring in ITEC choose between three options: Biological and Biomanufacturing Systems Technology, Manufacturing or Occupational Safety. The department also offers a minor in Industrial Technology.

Successful ITEC graduates gain knowledge, skills, and abilities in solving technical problems, understanding the design process, excelling in authentic leadership, being aware of safety issues, having a quality orientation, effectively managing projects, and having a systems-thinking perspective. This translates to a holistic approach that uses science and engineering principles to focus on the way the constituent parts of a manufacturing system interrelate, how they work over time, and how they fit the context of larger systems. Graduates find careers within a variety of industries, businesses, and organizations in the fields of advanced manufacturing and biomanufacturing; robotics; analytical and processing laboratories; automation and controls; biofuel and

beverage fermentation systems electronics; lean manufacturing; quality and operations management; safety management, loss prevention; or industrial hygiene.

Common job duties of ITEC Biological and Biomanufacturing Systems Technology graduates include:

- Management of technical projects
- Implementation, management, and maintenance of instruments and equipment
- Management of bioprocessing and biotechnology systems

Common job duties of ITEC Manufacturing graduates include:

- Supervision of production systems
- Design of manufacturing processes and products

Common job duties of ITEC Occupational Safety graduates include:

- Development, management, and evaluation of safety programs and systems
- Hazard identification and mitigation
- Loss prevention

The certificate in occupational safety is designed to meet the needs of the students who will find themselves in management roles with responsibilities that include safety. The certificate program prepares technically oriented managers to meet their professional safety responsibilities.

For more information about the Industrial Technology degree: <http://www.abe.iastate.edu/undergraduate-students/industrial-technology/>

For more information about the occupational safety certificate: <http://www.abe.iastate.edu/home/certificate-in-occupational-safety/>

Student Learning Outcomes

Upon graduation, all ITEC students should be able to:

1. Apply knowledge of mathematics, science, computation, and applied engineering to identify and solve applied science and technology problems.
2. Develop and conduct experiments and analyze and interpret resulting data.
3. Evaluate and adapt systems, processes and programs to meet desired needs.
4. Function effectively on multi-disciplinary teams
5. Communicate effectively, ethically, and professionally in written, oral, and other formats to technical and non-technical audiences.
6. Understand the potential impacts and limitations of solutions in global and societal contexts.
7. Recognize the need for, and demonstrate an ability to, engage in life-long learning.
8. Effectively apply modern scientific and technical tools necessary for professional practice to address contemporary issues in applied engineering and technology.

Upon graduation, ITEC students in the biological and biomanufacturing systems technology (BBST) option should be able to:

1. Develop, implement, troubleshoot, and evaluate bio-based manufacturing processes, facilities, and products.
2. Calculate and interpret mass and energy balances of biological processes involving microbial growth and conversion, plants, animals, and humans to optimize processing and production systems.
3. Calculate and interpret rates of biological processes involving reaction kinetics, growth, death, heat production, and transpiration to optimize processing and production systems.

Upon graduation, ITEC students in the manufacturing (M) option should be able to:

1. Create, implement, and evaluate manufacturing processes and facility plans.
2. Integrate and apply tools in computer aided design, manufacturing, controls, robotics, and automation systems to applied engineering and technology management settings.
3. Evaluate technologies to enhance production, quality, sustainability, and profitability of manufacturing systems and facility management.

Upon graduation, ITEC students in the occupational safety (OS) option should be able to:

1. Design, implement, and evaluate occupational safety and health programs for work environments.
2. Identify, assess, and analyze hazards and loss-producing conditions in work environments.
3. Eliminate or control occupational hazards using appropriate technologies, training, and administrative interventions.

Total Degree Requirement: 120 cr.

Only 65 cr. from a two-year institution may apply which may include up to 16 technical cr.; 9 P-NP cr. of free electives; 2.00 minimum GPA.

Communications Proficiency:

6 cr. of English composition with a C or better and 3 cr. of speech fundamentals with a C or better.

Communication/Library: 13 cr.

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
LIB 1600	Introduction to College Level Research	1

One of the following: 3

ENGL 3020 Business Communication

ENGL 3090 Proposal and Report Writing

ENGL 3140 Technical Communication

AGEDS 3270 Survey of Agriculture and Life Sciences
Communication

One of the following: 3

SPCM 2120 Fundamentals of Public Speaking

COMST 2140 Professional Communication

AGEDS 3110 Presentation and Sales Strategies for Agricultural
Audiences

Total Credits 13

Mathematical, Physical, and Life Sciences: 25 cr.

STAT 1040 Introduction to Statistics 3

MATH 1450 Applied Trigonometry 3

MATH 1510 Calculus for Business and Social Sciences 3

PHYS 1310 General Physics I 4

PHYS 1310L General Physics I Laboratory 1

CHEM 1630 College Chemistry 4

CHEM 1630L Laboratory in College Chemistry 1

One of the following: 3

BIOL 1010 Introductory Biology

BIOL 2110 Principles of Biology I

BIOL 2120 Principles of Biology II

BIOL 2510 Biological Processes in the Environment

Second Biology course requirement by Option: 3

Manufacturing & Biological & Biomanufacturing Systems Technology
options

Life Sciences Elective from approved College of Agriculture and
Life Sciences list

Occupational Safety option

BIOL 2550 Fundamentals of Human Anatomy

Total Credits 25

Business, Humanities, Ethics, and Social Sciences: 18 cr.

Occupational safety option must take ACCT 2150

ACCT 2840 Financial Accounting 3

or ACCT 2150 Legal Environment of Business

ECON 1010 Principles of Microeconomics 3

TSM 3700 Occupational Safety (Ethics) 3

Humanities course from College of Agriculture and Life Sciences list 3

International Perspectives course from University list 3

U.S. Cultures and Communities course from University list 3

Total Credits 18

Technical Core: 27 cr.

TSM 1100 Introduction to Technology 1

TSM 1110 Experiencing Technology 1

TSM 1150 Solving Technology Problems 3

TSM 1160 Introduction to Design in Technology 3

TSM 2010 Preparing for Workplace Seminar 1

TSM 2100 Fundamentals of Technology 3

TSM 2140 Managing Technology Projects 1

TSM 2700 Principles of Injury Prevention and Safety 3

TSM 3100 Total Quality Improvement 3

TSM 3630 Electrical Power and Electrical Machinery Systems 3

TSM 3970 Summer Internship in Technology R

or TSM 3990 Internship in Technology

TSM 4150 Applied Project Management in Technology 2

TSM 4160 Technology Capstone 3

Total Credits 27

TSM 3970 or TSM 3990 may count toward graduation.

Manufacturing Option: 37 cr.

One of the following: 1

ABE 2710 Engineering Applications of Parametric Solid
Modeling

ABE 2720 Parametric Solid Models, Drawings, and
Assemblies Using Creo Parametric

ABE 2730 CAD for Process Facilities and Land Use Planning

TSM 2160 Advanced Technical Graphics, Interpretation, and
CAD 2

TSM 2400 Introduction to Advanced Manufacturing and
Metals Processing 3

TSM 2415 Introduction to Lean Manufacturing Systems 3

TSM 3370 Fluid Power Systems Technology 3

TSM 3400 Advanced Automated Manufacturing Processes 3

TSM 3650 Electrical Controls and Sensor Systems 3

TSM 4430 Statics and Strength of Materials for Technology 3

TSM 4440 Facility Planning 3

TSM 4650 Automation Systems 3

10 credits of free electives 10

Total Credits 37

Occupational Safety Option: 37 cr.

TSM 2400 Introduction to Advanced Manufacturing and
Metals Processing 3

TSM 3710	Occupational Safety Management	2
TSM 3720	Legal Aspects of Occupational Safety and Health	2
TSM 3760	Fire Protection and Prevention	3
TSM 4700	Industrial Hygiene: Physical, Chemical, and Biological Hazards	3
TSM 4710	Safety Laboratory	1
TSM 4770	Risk Analysis and Management	3
HS 1050	First Aid and Emergency Care	2
PSYCH 2500	Psychology of the Workplace	3
15 credits of free electives		15
Total Credits		37

Biological and Biomanufacturing Systems Technology Option: 37 cr.

BIOL 2120	Principles of Biology II	3
CHEM 2110	Quantitative and Environmental Analysis	2
CHEM 2110L	Quantitative and Environmental Analysis Laboratory	2
LDST 3220	Leadership in a Diverse Society	3
MICRO 2010	Introduction to Microbiology	2
MICRO 2010L	Introductory Microbiology Laboratory	1
TSM 3800	Fundamentals, Applications, and Modeling of Biological Systems	3
Select 15 credits from departmental list		15
6 credits of free electives		6
Total Credits		37

Industrial Technology, B.S. - Manufacturing option

First Year

Fall	Credits	Spring	Credits
TSM 1100	1	TSM 1110	1
TSM 1160	3	TSM 1150	3
ENGL 1500	3	MATH 1510	3
LIB 1600	1	PHYS 1310	4
MATH 1450	3	PHYS 1310L	1
CHEM 1630	4	TSM 2400	3
CHEM 1630L	1		
16		15	

Second Year

Fall	Credits	Spring	Credits
TSM 2010	1	TSM 2160	2
TSM 2140	1	TSM 2415	3
TSM 2100	3	STAT 1040	3

TSM 2700	3	BIOL 1010 or 2110	3		
ECON 1010	3	International Perspectives - See list*	3		
ENGL 2500	3	SPCM 2120, COMST 2140, or AGEDS 3110	3		
ABE 2710, 2720, or 2730	1				
15		17			
Third Year					
Fall	Credits	Spring	Credits	Summer	Credits
TSM 3370	3	TSM 3100	3	TSM 3970 or 3990	R
TSM 3630	3	TSM 3650	3		
TSM 3700 (Ethics requirement)	3	ACCT 2840 or 2150	3		
U.S. Cultures and Communities - See list*	3	ENGL 3020, 3090, 3140, or AGEDS 3270	3		
Humanities - See list	3	Life Science - See list*	3		
15		15		0	

* International Perspectives course list (<https://www.registrar.iastate.edu/students/div-ip-guide/IntlPerspectives-current/>)
 U.S. Cultures and Communities course list (<https://www.registrar.iastate.edu/students/div-ip-guide/usdiversity-courses/>)
 Humanities course list (<https://www.cals.iastate.edu/student-services/humanities/>)

Life Science course list (<https://www.cals.iastate.edu/student-services/life-science/>)

Industrial Technology, B.S. - Occupational Safety option

First Year

Fall	Credits	Spring	Credits
TSM 1100	1	TSM 1110	1
TSM 1160	3	TSM 1150	3
ENGL 1500	3	MATH 1510	3
LIB 1600	1	PHYS 1310	4
MATH 1450	3	PHYS 1310L	1
CHEM 1630	4	ECON 1010	3
CHEM 1630L	1		
16		15	

Second Year

Fall	Credits	Spring	Credits
TSM 2010	1	TSM 2400	3
TSM 2140	1	TSM 3710	2
TSM 2100	3	HS 1050	2
TSM 2700	3	STAT 1040	3
ENGL 2500	3	SPCM 2120, COMST 2140, or AGEDS 3110	3
BIOL 2510	3	BIOL 2550	3
14		16	

Third Year

Fall	Credits	Spring	Credits	Summer	Credits
TSM 3630	3	TSM 3100	3	TSM 3970 or 3990	R
TSM 3720	2	TSM 3700	3		
TSM 3760	3	TSM 4710	1		
ENGL 3020, 3090, 3140, or AGEDS 3270	3	TSM 4700	3		
Elective	3	ACCT 2150	3		
		International Perspectives *	3		
14		16		0	

Fourth Year

Fall	Credits	Spring	Credits
TSM 4150	2	TSM 4160	3

TSM 4770	3	U.S. Cultures and Communities*	3
PSYCH 2500	3	Humanities*	3
Elective	6	Elective	6
14		15	

* International Perspectives course list (<https://www.registrar.iastate.edu/students/div-ip-guide/IntlPerspectives-current/>)

U.S. Cultures and Communities course list (<https://www.registrar.iastate.edu/students/div-ip-guide/usdiversity-courses/>)

Humanities course list (<https://www.cals.iastate.edu/student-services/humanities/>)

Life Science course list (<https://www.cals.iastate.edu/student-services/life-science/>)

Industrial Technology, B.S. - Biological and Biomanufacturing Systems Technology option

First Year

Fall	Credits	Spring	Credits
TSM 1100	1	TSM 1110	1
TSM 1160	3	TSM 1150	3
ENGL 1500	3	MATH 1510	3
LIB 1600	1	PHYS 1310	4
MATH 1450	3	PHYS 1310L	1
CHEM 1630	4	ECON 1010	3
CHEM 1630L	1		
16		15	

Second Year

Fall	Credits	Spring	Credits
TSM 2010	1	CHEM 2110	2
TSM 2140	1	CHEM 2110L	2
TSM 2100	3	STAT 1040	3
BIOL 2110	3	BIOL 2120	3
TSM 2700	3	LDST 3220	3
ENGL 2500	3	Option core course - See list*	3
14		16	

Third Year

Fall	Credits	Spring	Credits	Summer	Credits
TSM 3100	3	TSM 3800	3	TSM 3970 or 3990	R

TSM 3630	3 MICRO 2010	2
ACCT 2840 or 2150	3 MICRO 2010L	1
Speech Communication - See list*	3 TSM 3700 (Ethics requirement)	3
Option core course - See list*	3 Humanities - See list*	3
	International Perspectives - See list*	3
	15	15
		0

Fourth Year

Fall	Credits	Spring	Credits
TSM 4150	2 TSM 4160	3	
Option core course - See list*	3 Advanced English - See list*	3	
Option core course - See list*	3 Option core course - See list*	3	
Option core course - See list*	3 Elective	4	
Elective	5		
	16	13	

* International Perspectives course list (<https://www.registrar.iastate.edu/students/div-ip-guide/IntlPerspectives-current/>)

U.S. Cultures and Communities course list (<https://www.registrar.iastate.edu/students/div-ip-guide/usdiversity-courses/>)

Humanities course list (<https://www.cals.iastate.edu/student-services/humanities/>)

Option core course list

Minor - Industrial Technology

The Department of Agricultural and Biosystems Engineering offers a minor in industrial technology which may be earned by completing a minimum of 15 credits of technology systems management (TSM) courses, which includes:

TSM 1150	Solving Technology Problems	3
TSM 2100	Fundamentals of Technology	3
9 credits from:		9

TSM 2160	Advanced Technical Graphics, Interpretation, and CAD
TSM 2400	Introduction to Advanced Manufacturing and Metals Processing
TSM 2415	Introduction to Lean Manufacturing Systems
TSM 2700	Principles of Injury Prevention and Safety
TSM 3100	Total Quality Improvement
TSM 3370	Fluid Power Systems Technology
TSM 3400	Advanced Automated Manufacturing Processes
TSM 3630	Electrical Power and Electrical Machinery Systems
TSM 3650	Electrical Controls and Sensor Systems
TSM 3700	Occupational Safety
TSM 3710	Occupational Safety Management
TSM 3720	Legal Aspects of Occupational Safety and Health
TSM 3760	Fire Protection and Prevention
TSM 4430	Statics and Strength of Materials for Technology
TSM 4415	Lean Manufacturing Systems
TSM 4440	Facility Planning
TSM 4490	Applied Nondestructive Testing and Evaluation.
TSM 4650	Automation Systems
TSM 4700	Industrial Hygiene: Physical, Chemical, and Biological Hazards
TSM 4710	Safety Laboratory
TSM 4770	Risk Analysis and Management

• At least six (6) credits of 3000-level or higher TSM classes (from the courses listed above)

• At least three (3) credits that are not used to meet any other department, college, or university requirement.

Total Credits **15**

For the undergraduate curriculum in agricultural systems technology leading to the degree of Bachelor of Science or for the undergraduate curriculum in industrial technology leading to the degree of Bachelor of Science.

The department also offers an undergraduate curricula and courses in agricultural engineering, biological systems engineering.

Certificate in Occupational Safety

The Department of Agricultural and Biosystems Engineering offers an undergraduate certificate in occupational safety (<http://www.abi.iastate.edu/undergraduate-students/industrial-technology/certificate-in-occupational-safety/>) which may be earned by completing a minimum of 20 credits of technology systems management courses, which includes:

TSM 2700	Principles of Injury Prevention and Safety	3
TSM 3700	Occupational Safety	3
TSM 3710	Occupational Safety Management	2
TSM 3720	Legal Aspects of Occupational Safety and Health	2
TSM 4700	Industrial Hygiene: Physical, Chemical, and Biological Hazards	3
6 credits from a departmentally approved list		6
TSM 4930D	Workshop in Technology: Occupational Safety (Note: This course needs to be the last course taken toward completion of the Occupational Safety Certificate)	1-4

International Agriculture Interdepartmental Undergraduate Program

The international agriculture program provides opportunities to develop knowledge and skills related to the factors that interact to impact agricultural and environmental issues, production, processes, distribution and utilization worldwide. The program puts emphasis on international experience through structured internships and study abroad.

The international agriculture program is appropriate for students seeking positions that require knowledge and experience related to global agricultural issues and their impact on local, regional, national and international policies and practices. Students preparing for careers in the following areas will benefit from the international agriculture program: governmental and non-governmental development agencies, agribusinesses, educational institutions, and non-profit assistance agencies.

Outcomes from participation in this program include developing an awareness for the role of international agriculture in the career development process, analyzing international agricultural issues and policies, acquiring skills for solving problems in international development and agribusiness and experiencing real situations and gaining perspectives about agriculture in a global setting.

International Agriculture as Secondary Major

International agriculture is an undergraduate secondary major that may be taken only in conjunction with a primary major in an agriculture and life sciences curriculum. Students choosing international agriculture will strengthen their career placement with a business or agency involved in international activities. Technical knowledge of a primary major discipline will be strengthened by a global awareness of agriculture and life sciences. A secondary major in international agriculture will give students practical insight into the role of agriculture in a world of increasing food and fiber needs. It is ideal for those who wish to

broaden their international perspective or prepare for international work in agriculture.

Student Learning Outcomes

Students pursuing International Agriculture Secondary Major will be able to:

1. Develop an awareness for the role of international agriculture in their career development process.
2. Improve knowledge of international agriculture within the context of College of Agriculture and Life Sciences degree programs.
3. Analyze international agricultural issues and policies and acquire skills for solving problems in international development and agribusiness.
4. Experience real life situations and gain perspectives about agriculture in a global setting.
5. Enhance understanding and analysis of global agricultural issues at home and abroad.

Curriculum in International Agriculture

International agriculture can be taken only as a secondary major in conjunction with a primary major in the College of Agriculture and Life Sciences. A minor is available to interested students regardless of their major.

The international agriculture secondary major requires a total of 24 credits including the following:

1. AGRON 3420
2. at least 3 credits of an international travel course(s)
3. at least 3 credits of one of the following: world language, agriculture-related courses taken abroad, international internship approved by the program supervisory committee, or additional international travel course(s)
4. one of the following: AGEDS 4610, AGRON 4500, ANS 4410, ECON 3850, or SOC 3480
5. additional courses from approved international agriculture courses, or agriculture-related courses taken abroad.
6. at least 12 credits in courses numbered 3000 or above from approved international agriculture courses
7. at least 6 credits taken at Iowa State University

Credits used to meet the international agriculture secondary major may be used to satisfy the credit requirement of graduation.

Students interested in earning a secondary major in international agriculture must contact the international agriculture program coordinator. The early indication of an interest in international

agriculture allows for effective integration of the secondary major course requirements with those of the primary major.

Students pursuing multiple majors may no longer qualify for federal financial aid once they have completed all requirements for the primary major. This means students should arrange their course schedule in such a way that they complete the requirements for all majors at the same time.

Minor

A minor in international agriculture is available to interested students regardless of their major. Students selecting the minor should have familiarity with agriculture and life sciences.

The international agriculture minor requires 15 credits including the following:

1. AGRON 3420
2. 3 to 6 credits of an international travel course and/or world language, or any combination thereof
3. at least 3 credits from the following: AGEDS4610, AGRON 4500, ANS 4410, ECON 3850, or SOC 3480
4. at least 9 credits numbered 2000 or above from approved international agriculture courses
5. at least 6 credits in courses numbered 3000 or above from approved international agriculture courses, of which at least 3 credits must be taken at Iowa State University
6. at least 3 credits not used to meet any other department, college, or university requirement

Learning and Leadership Sciences Minor

Learning and Leadership Sciences Minor

The Learning and Leadership Sciences minor provides an opportunity for students to engage in productive thinking, enabling them to lead in their professions and contribute to society and their communities.

The coursework builds on the curriculum of a student's primary discipline to enhance student leadership abilities throughout their academic career and beyond. Students will enhance their abilities to engage in productive thinking, such as critical, analytical, and creative thinking in problem-solving; discern the types of thinking required when presented with new situations; and use different types of thinking to address issues and situations as professionals and citizens. Core courses in the minor address eight competency areas that are critical for leaders: 1) understanding self and personal responsibility for learning, 2) understanding worthy team membership, 3) developing productive thinking and creative problem solving abilities, 4) developing resiliency,

5) negotiating and resolving conflict, 6) action planning for providing service, 7) communicating, and 8) recognizing and acting on the obligation to "do" leadership every day.

Students in the Learning and Leadership Sciences Minor will ultimately achieve these learning outcomes by uncovering and practicing:

- Habits of deep self-reflection about learning and application of these habits to their professional and community lives.
- Effective interaction with others in professional and community settings, including abilities to listen actively, communicate clearly, resolve conflicts, and negotiate desired outcomes.
- Habits of professional thinking, including accountability, initiative, innovation, resilience, tolerance, and profound respect for others.

LLS 1120	Foundations of Learning and Productive Team Membership	2
LLS 1140	Developing Responsible Learners and Effective Leaders	2
LLS 2120	Habits of Mind and Decision-Making in Leadership	2
LLS 3120	Problem Solving and Action Planning in Leadership	3
LLS 4120	Learning and Leadership in Practice	3
At least three additional credits from the following courses (or others) as per personal plan of study:		
AESHM 2110	Leadership Experiences and Development (LEAD)	3
AGEDS 3150	Personal, Professional, and Entrepreneurial Leadership in Agriculture	3
FSHN 3420	World Food Issues: Past and Present	3
HDFS 2700	Family Communications and Relationships	3
MGMT 3710	Organizational Behavior	3
MS 2020L	Basic Leadership Laboratory IV	1
NREM 4600	Controversies in Natural Resource Management	3
PSYCH 2300	Developmental Psychology	3
PSYCH 2800	Social Psychology	3
PSYCH 3100	Brain and Behavior	3
PSYCH 3130	Learning and Memory	3
SOC 3050	Social Psychology: A Sociological Perspective	3
SOC 3300	Ethnic and Race Relations	3
SOC 4640	Strategies for Community Engagement	3

Microbiology Undergraduate Microbiology Major

Interested in the study of small things that have a big impact? Then Microbiology may be the place for you.

Our mission in the Microbiology Program is to instill a comprehensive understanding of microbiology and its relevance to human society and global health, and to cultivate the concepts and skills necessary to succeed in microbiology-related careers.

Iowa State University's Microbiology Undergraduate Program offers:

- Extensive hands-on laboratory experiences that develop problem solving & technical skills used in a variety of professional careers.
- Application of science to issues in the modern world.
- Excellent preparation for human medicine and veterinary medicine.
- Preparation for employment in a variety of professional settings.
- Research opportunities and interaction with professors from across Iowa State University Departments of Animal Science; Plant Pathology, Entomology and Microbiology; Biochemistry & Molecular Biology; Biology; Veterinary Microbiology; Veterinary Pathology; Food Science; and Geology.
- Degrees in microbiology at both the undergraduate (B.S.) level and graduate (M.S., Ph.D., see Graduate Major) level.

Career opportunities:

Opportunities after graduation include the following:

- Biomedical research scientist
- Biotechnology firms
- Biorenewables industry
- Forensic scientist
- Pharmaceutical and vaccine development companies
- Immunologist
- Agricultural microbiology and plant pathology
- International agricultural research centers
- Government laboratories (CDC, NADC, USDA)
- Infectious disease
- Food safety and food technology
- Water quality
- Ecology and environmental microbiology
- Botanical gardens & nurseries
- Technical brewer
- Science writer
- Public health agencies
- Public policy organizations

Interested in Human medicine or Veterinary medicine? A microbiology degree prepares students for advanced study in Dentistry, Medical Laboratory Science, Optometry, Pharmacy, Physician Assistant Programs, and Physician or Veterinary education. Go to [micro.iastate.edu](https://www.micro.iastate.edu)

(<https://www.micro.iastate.edu/>) to find more information about the Microbiology Program.

Student Learning Outcomes

Upon graduation, students should be able to:

1. Research and critically evaluate topics in microbiology; understand and communicate results from primary and secondary literature to a variety of audiences.
2. Utilize appropriate quantitative and qualitative microbiological laboratory techniques and equipment, including microscopy, biochemical tests, serological assays, and genetic manipulation.
3. Explain how evolution unifies and explains the diversity of microbes in terms of microbial structure, function, metabolism, and genetics.
4. Describe common adaptations that enable organisms to survive in an ecological niche, such as how microbiota can impact plants, animals/humans, food, and soil health in beneficial, neutral, or negative ways.
5. Develop and follow lab protocols, interpret data, maintain an accurate lab notebook, and create illustrative graphs and tables.
6. Communicate and collaborate across disciplines about fundamental concepts in microbiology and discuss the relationship of science, society, and ethical issues in microbiology.

Curriculum in Microbiology

www.micro.iastate.edu (<http://www.micro.iastate.edu>)

Administered by an interdepartmental committee.

Total Degree Requirement: 128 cr.

Only 65 cr. from a two-year institution may apply which may include up to 16 technical cr.; 9 P-NP cr. of free electives; 2.00 minimum GPA.

International Perspective: 3 cr.

International Perspectives Courses (<https://www.registrar.iastate.edu/students/div-ip-guide/IntlPerspectives-current/>)

U.S. Cultures and Communities: 3 cr.

U.S. Cultures and Communities Courses (<https://www.registrar.iastate.edu/students/div-ip-guide/usdiversity-courses/>)

Electives: 7-12

Communications Proficiency:

English composition - with a C or better	6
Speech fundamentals - with a C or better	3

Communication/Library:

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
SPCM 2120	Fundamentals of Public Speaking	3
One course from the following:		3
ENGL 3020	Business Communication	
ENGL 3090	Proposal and Report Writing	
ENGL 3120	Communicating Science and Public Engagement	
ENGL 3140	Technical Communication	
LIB 1600	Introduction to College Level Research	1
Total Credits		13

Humanities and Social Sciences:

Approved Humanities list ¹	3
Approved Social Science list ²	3

¹ Humanities Course list (<https://www.cals.iastate.edu/student-services/humanities/>)

² Social Sciences Course list (<https://www.cals.iastate.edu/student-services/social-sciences/>)

Ethics: 3 cr.

3 cr. from approved Ethics Course list (<https://www.cals.iastate.edu/student-services/ethics/>)

Mathematical Sciences:

One of the following:		7-8
MATH 1430 & MATH 1600	Preparation for Calculus and Survey of Calculus	
MATH 1650 & MATH 1660	Calculus I and Calculus II	
MATH 1600 & STAT 3010	Survey of Calculus and Intermediate Statistical Concepts and Methods	
One of the following:		3-4
STAT 1010	Principles of Statistics	
STAT 1040	Introduction to Statistics	
Total Credits		10-12

Physical Sciences:

CHEM 1770	General Chemistry I	4
CHEM 1770L	Laboratory in General Chemistry I	1
CHEM 1780	General Chemistry II	3
One of the following:		5-10
PHYS 1150 & 1150L	Physics for the Life Sciences and Laboratory in Physics for the Life Sciences	

PHYS 1310 & 1310L	General Physics I and General Physics I Laboratory	
& PHYS 1320 & PHYS 1320L	and General Physics II and General Physics II Laboratory	
CHEM 3310	Organic Chemistry I	3
CHEM 3310L	Laboratory in Organic Chemistry I	1
CHEM 3320	Organic Chemistry II	3
One of the following:		3-6
BBMB 4040 & BBMB 4050	Biochemistry I and Biochemistry II	
or BBMB 3010	Survey of Biochemistry	
or BBMB 3160	Principles of Biochemistry	
Total Credits		23-31

Biological Sciences:

BIOL 2110	Principles of Biology I	3
BIOL 2110L	Principles of Biology Laboratory I	1
BIOL 2120	Principles of Biology II	3
BIOL 2120L	Principles of Biology Laboratory II	1
BIOL 3130	Principles of Genetics	3
BIOL 3130L	Genetics Laboratory	1
BIOL 3140	Principles of Molecular Cell Biology	3
Total Credits		15

Microbiology:

Core courses:

MICRO 1100	Professional and Educational Preparation in Microbiology	1
MICRO 3020	Biology of Microorganisms	3
MICRO 3020L	Microbiology Laboratory	1
MICRO 3100	Medical Microbiology	3
One of the following:		1
MICRO 3100L	Medical Microbiology Laboratory	
MICRO 4750L	Immunology Laboratory	
MICRO 3200	Molecular and Cellular Bacteriology	4
MICRO 4400	Laboratory in Microbial Physiology, Diversity, and Genetics	4
MICRO 4500	Undergraduate Capstone Colloquium	2
MICRO 4510	Survey in Microbiology	R
One of the following:		3
MICRO 4300	Prokaryotic Diversity and Ecology	
MICRO 4560	Principles of Mycology	
MICRO 4770	Bacterial-Plant Interactions	

Additional nine credit hours from the following: 9

MICRO 3530	Introductory Parasitology
MICRO 3740	Insects and Our Health
MICRO 3740L	Insects and Our Health Laboratory
MICRO 4020	Microbial Genetics and Genomics
MICRO 4070	Microbiological Safety of Foods of Animal Origins
MICRO 4080	Virology
MICRO 4200	Food Microbiology
MICRO 4210	Food Microbiology Laboratory
MICRO 4300	Prokaryotic Diversity and Ecology
MICRO 4560	Principles of Mycology
MICRO 4750	Immunology
MICRO 4750L	Immunology Laboratory
MICRO 4770	Bacterial-Plant Interactions
MICRO 4850	Soil and Environmental Microbiology
MICRO 4870	Microbial Ecology
MICRO 4900	Independent Study
Microbiology elective - only 3 cr. lab courses allowed	
Total Credits	31

Microbiology, B.S.

First Year

Fall	Credits	Spring	Credits
ENGL 1500 or 2500	3	MICRO 3020	3
MICRO 1100	1	MICRO 3020L	1
MICRO 1010	3	BIOL 2120	3
BIOL 2110	3	BIOL 2120L	1
BIOL 2110L	1	CHEM 1780	3
CHEM 1770	4	STAT 1040	3
CHEM 1770L	1	Social Science choice	3
LIB 1600	1		
	17		17

Second Year

Fall	Credits	Spring	Credits
MICRO 3100	3	MICRO Environmental or Elective	3
MICRO 3100L	1	BIOL 3130	3
CHEM 3310	3	BIOL 3130L	1
CHEM 3310L	1	CHEM 3320	3
MATH 1430, 1600, or 1650	4	MATH 1600, STAT 3010, or MATH 1660	4
ENGL 2500	3	Humanities choice	3
	15		17

Third Year

Fall	Credits	Spring	Credits
MICRO Environmental or Elective	3	MICRO 3200	4
PHYS 1310 or 1150	4	PHYS 1320 (if PHYS 1310 previously taken)	4
PHYS 1310L or 1150L	1	PHYS 1320L (if PHYS 1310L previously taken)	1
BIOL 3140 or 3280	3	Advanced English	3
SPCM 2120	3	International Perspectives	3
Gen Elective	3		
	17		15

Fourth Year

Fall	Credits	Spring	Credits
MICRO 4400	4	MICRO elective	3
MICRO elective	3	MICRO 4500	2
MICRO 4510	R	BBMB 4050	3
ETHICS choice	3	Social Science choice	3
BBMB 4040	3	Gen Electives	5
U.S. Cultures and Communities	3		
	16		16

Minor

The program offers a minor in microbiology which may be earned by accumulating a minimum of 15 credits of microbiology courses.

Students requesting a minor in Microbiology must take the following:

1) MICRO 2010 Introduction to Microbiology and MICRO 2010L Introductory Microbiology Laboratory or MICRO 3020 Biology of Microorganisms and MICRO 3020L Microbiology Laboratory

2) Additional lecture credits and no more than 3 additional lab credits to reach 15 credits. For a list of acceptable courses see https://www.micro.iastate.edu/files/inline-files/minor_in_microbiology_21-22_1.pdf

3) At least 6 credits at the 3000+ level and must include at least 3 credits that are not used to meet any other department, college, or university requirement.

Learning Objectives for the minor in Microbiology:

1) Research and critically evaluate topics in microbiology; understand and communicate results from primary and secondary literature to a variety of audiences.

2) Develop and follow lab protocols, interpret data, maintain an accurate lab notebook, and create illustrative graphs and tables.

3) Communicate and collaborate across disciplines about fundamental concepts in microbiology and discuss the relationship of science, society, and ethical issues in microbiology.

Graduate Study

The program offers work for the degrees Master of Science and Doctor of Philosophy in microbiology and for a minor for students majoring in other programs. The interdepartmental microbiology major is offered through faculty housed in twelve departments, including Agronomy; Animal Science; Biochemistry, Biophysics and Molecular Biology; Civil, Construction and Environmental Engineering; Earth, Atmosphere, and Climate; Food Science and Human Nutrition; Genetics, Developmental and Cell Biology; Plant Pathology, Entomology and Microbiology; Veterinary Diagnostic and Production Animal Medicine; Veterinary Microbiology and Preventive Medicine; and Veterinary Pathology. Faculty coordinate graduate education and research in a wide range of topics fundamental to the discipline of microbiology. Specific information about individual faculty and their research areas is available at www.micrograd.iastate.edu. (<http://www.micrograd.iastate.edu/>)

Prerequisites to graduate study include a sound undergraduate background in chemistry, mathematics and biology, including microbiology and genetics.

Graduates in the Microbiology Graduate program have a broad-based knowledge in the fundamentals of microbiology as well as advanced knowledge in specific areas as determined by their areas of research focus. Students completing the thesis have the technical, research, critical-thinking, problem-solving, and computer skills to design, implement, and conduct research using a variety of current techniques and equipment. They are also able to communicate research results effectively with scientific peer groups in both oral and written formats.

Natural Resource Ecology and Management

The department addresses a broad spectrum of natural resource and environmental issues in a holistic approach to learning, discovery and engagement. Our vision of natural resources is that informed protection and management of natural resources involves an integration of biological, economic, and social considerations. Such an integrated and comprehensive approach to the education of future generations of natural resource managers and scientists is needed in order to sustain viable landscapes, facilitate strong communities, and produce desired goods, services, and functions from our natural resources.

Our educational mission for the undergraduate and graduate programs is to provide those learning experiences and opportunities that will ensure students can learn to function effectively in their chosen fields.

Central to that effective functioning are the abilities to:

- Identify, explain and critically evaluate their own beliefs, values and actions in relation to professional and societal standards of ethics.
- Anticipate, analyze and evaluate natural resource issues and opportunities, explaining the ecological, economic, and social consequences of natural resource actions at various scales and over time.
- Actively seek the input and perspectives of diverse stakeholders regarding natural resource problems and issues.
- Assess, analyze, synthesize, and evaluate information fairly and objectively.
- Work effectively, both individually and with others, on complex, value-laden natural resource problems that require holistic problem solving approaches.
- Formulate and evaluate alternative solutions to complex problems and recommend and defend best alternatives.
- Communicate clearly and effectively with all audiences using appropriate oral, visual, electronic, and written techniques.
- Recognize and interpret resource problems and opportunities across spatial scales from local to global.
- Appreciate cultural diversity and understand the impact of the global distribution of people and wealth on natural resource use and valuation.
- Exercise leadership skills as professionals and engaged citizens.
- Demonstrate creativity and innovation in identifying and pursuing opportunities that produce environmental, social, or economic value.
- Exercise life-long learning skills developed before graduation.

Undergraduate Study

The Department of Natural Resource Ecology and Management offers work for the Bachelor of Science degree with majors in animal ecology or forestry. The department participates in interdisciplinary programs in biology, environmental studies, international studies, and pest management. By proper selection of free and restricted elective courses, students can obtain a minor or a second major in these programs or other disciplines.

Contact the department for information about minors from the Department of Natural Resource Ecology and Management.

The Department provides numerous scholarships; application information is available in the departmental Student Services Center.

Graduate Study

The Department of Natural Resource Ecology and Management offers work for the degrees Master of Science and Doctor of Philosophy with majors in fisheries biology, forestry, and wildlife ecology. A non-thesis masters degree is available for students desiring a general degree program without thesis research. Students may also major in interdepartmental graduate majors in ecology and evolutionary biology, environmental science, genetics, plant physiology, sustainable agriculture, or toxicology (see Index (<http://catalog.iastate.edu/azindex/>)). All students are required to teach and conduct research as part of their training for the Ph.D. degree.

Fisheries Biology and Wildlife Ecology

Graduates have a broad understanding of the basic principles of animal biology, ecology and management, and relevant aspects of basic mathematics and natural sciences, computing applications, and personal and professional development. They are able to execute rigorous independent research, have developed problem-solving and critical-thinking skills, and can communicate effectively with scientific colleagues and the general public in both formal and informal settings.

Personnel of the U.S. Geological Survey's Iowa Cooperative Fish and Wildlife Research Unit contribute significantly to the graduate program of the department through teaching and research. Governmental agencies such as the U.S. Fish and Wildlife Service, Natural Resources Conservation Service and the Iowa Department of Natural Resources, and non-governmental agencies such as The Nature Conservancy and the Iowa Natural Heritage Foundation also contribute to the graduate program by funding research, providing in-kind support, and providing numerous formal and informal mentoring relationships.

No more than two dual-listed animal ecology courses may be applied for major graduate credit. Additional work is expected of students taking a dual-listed course for credit at the 500 level.

Forestry

The department offers programs leading to the degrees of Master of Science and Doctor of Philosophy with a major in forestry and minor work to students taking major work in other departments.

Graduates are skilled at defining a research problem in forestry, applying scientific principles and appropriate methods, and analyzing the results. They are capable of understanding the many facets of forest and wood science and are very knowledgeable in specific areas in forestry. They are able to deal with complex forestry problems, and where appropriate, they are capable of blending ecological, social, ethical, legal, and economic factors in the research process. They are very skilled at communicating, both in written and oral form, research results to professional and lay

audiences. They are sensitive to cultural diversity and work effectively with peers, natural resource professionals, and the public.

The graduate program is open to, and suitable for, students who have majored in forestry or related natural resource fields. A non-thesis master's option is available.

The department participates in the Masters in Business Administration (M.B.A.), with specialization in the agriculture program administered by the College of Business, providing an opportunity to obtain an M.B.A. degree while taking advanced courses in forestry and maintaining contact with the profession of forestry.

Courses primarily for undergraduates:

AECL 2310: Principles of Wildlife & Fisheries Conservation

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2110, BIOL 2120, and NREM 1200

Introduction to the principles of wildlife and fisheries management. Case studies will be explored along with assessment methods used to understand management including conservation of populations, species and communities, as well as habitat preservation and restoration. (Typically Offered: Spring)

AECL 3120: Ecology

(Cross-listed with BIOL 3120/ ENSCI 3120).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: BIOL 2110; (BIOL 2120 or BIOL 2510)

Fundamental concepts and principles of ecology dealing with organisms, populations, communities, and ecosystems. Laboratory and field exercises examine ecological principles and methods as well as illustrate habitats. (Typically Offered: Fall, Summer)

AECL 3210: Ichthyology

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: AECL 3650

Biology, ecology, and evolution of fishes. Emphasis on structure, physiology, and behavior, including a focus on the conservation and management of fishes and their habitats. Laboratory focus on fish morphology, survey methods, identification, distribution, habits, and habitats of fishes. (Typically Offered: Spring)

AECL 3330: Fisheries Techniques

Credits: 2. Contact Hours: Lecture 1, Laboratory 3.

Prereq: BIOL 2120

Introduction to techniques used in the collection and interpretation of fish population data in the field and in the lab. Course objectives include an understanding of population survey methodology and improving student critical thinking and teamwork skills. Laboratory focuses on field trips and hands-on sampling experience. (Typically Offered: Fall)

AECL 3650: Vertebrate Biology

(Cross-listed with BIOL 3650).

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: BIOL 2110 and BIOL 2110L

Evolution, biology, and classification of fish, amphibians, reptiles, birds, and mammals. Emphasis on a comparative analysis of the structure and function of organ systems. Laboratory exercises concentrate on morphology and identification of orders of vertebrates. (Typically Offered: Fall)

AECL 3660: Natural History of Iowa Vertebrates

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: BIOL 2110 and BIOL 2110L

Vertebrate fauna of Iowa, including fishes, amphibians, reptiles, birds, and mammals. Species identification, habitat requirements, community structure and assessment, conservation issues that include historical population changes and value of wild animals to the region's ecological and economic health. (Typically Offered: Spring)

AECL 3710: Ecological Methods

(Cross-listed with BIOL 3710).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: AECL 3120 or NREM 3110; STAT 1010 or STAT 1040

Quantitative techniques used in management of natural resources with emphasis on inventory and manipulation of habitat and animal populations. (Typically Offered: Fall)

AECL 3720: Wildlife Population Methods

Credits: 4. Contact Hours: Lecture 1, Laboratory 8.

Prereq: BIOL 3120 or NREM 3110

Field-intensive study of population ecology. Emphasis on hands-on learning of study design and techniques to assess population trends in plants, invertebrates, and vertebrates inhabiting terrestrial and aquatic ecosystems. (Typically Offered: Summer)

AECL 3750: Marine Ecology and Ecosystems Dynamics

(Cross-listed with BIOL 3750/ ENSCI 3750).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2110

Overview of the ecological processes, ecosystems, and biodiversity in marine environments. Ever-changing dynamics caused by environmental disturbances, internal forces, or by human impacts on species and ecosystems. (Typically Offered: Spring)

AECL 4060: Wildlife Camp

Credits: 3. Contact Hours: Lecture 1, Laboratory 6.

Prereq: BIOL 2110 and Permission of Instructor; restricted to Animal Ecology majors

Introduction to methods and career options in wildlife research and management through field work. Two-week field work experience followed by on-campus reflection, analysis and presentation of field data. (Typically Offered: Fall)

AECL 4150: Ecology of Freshwater Invertebrates, Plants, and Algae

(Dual-listed with AECL 5150).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: AECL 3120

Identification, biology, and ecological requirements of freshwater invertebrates, plants and algae. Additional emphases on community sampling methods and analysis, and use of organisms as tools for aquatic ecosystem health assessment. (Typically Offered: Fall)

AECL 4180: Stream Ecology

(Dual-listed with AECL 5180/ ENSCI 5180). (Cross-listed with ENSCI 4180).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: AECL 4860

Biological, chemical, physical, and geological processes that determine the structure and function of flowing water ecosystems. Current ecological theories as well as applications to stream management for water quality and fisheries. Offered odd-numbered years. (Typically Offered: Fall)

AECL 4250: Aquatic Insects

(Dual-listed with ENT 5250/ AECL 5250). (Cross-listed with ENT 4250).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: BIOL 3120

Morphology, ecology, diversity, and significance of aquatic insects, with emphasis on the collection, curation and identification of taxa in local streams and lakes. Offered odd-numbered years. (Typically Offered: Spring)

AECL 4350: Entomology Field Trip

(Cross-listed with ENT 4350).

Credits: 2. Repeatable, maximum of 2 credits.

Prereq: BIOL 3120; Permission of Instructor

Field trip to study insects of major terrestrial and aquatic ecosystems. Location and duration vary. ENT 3700 or ENT 4250 recommended. Offered irregularly. (Typically Offered: Spring, Summer)

AECL 4400: Fishery Management

(Dual-listed with AECL 5400).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: AECL 3120, AECL 3210, AECL 3330; STAT 1010 or STAT 1040; Credit or Enrollment in AECL 4860

Biological basis of fishery management, fishery problems, and management practices for freshwater, anadromous, and marine fisheries. (Typically Offered: Fall)

AECL 4420: Aquaculture

(Dual-listed with AECL 5420).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2110 and BIOL 2120

Concepts related to the culture of aquatic organisms including culture systems, water quality, nutrition, genetics, diseases, and marketing. (Typically Offered: Spring)

AECL 4510: Wildlife Ecology and Management

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Ecological theory and practice of wildlife management, including, population ecology, habitat management, and current issues in the field. Course involves a series of case studies addressing actual wildlife issues using field and quantitative methods. (Typically Offered: Spring)

AECL 4540: Principles of Wildlife Disease

(Dual-listed with AECL 5540).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior standing and at least 10 credits in biological sciences at the 3000+ level

Ecological and epidemiological aspects of diseases as they relate to wildlife populations. Topics to be covered include: major classes of disease; detection, description, monitoring, and management of disease; characteristics and interactions between disease agents and wildlife hosts; relationships among wildlife, domestic animal, and human health. (Typically Offered: Spring)

AECL 4550: International Wildlife Issues

Credits: 3. Contact Hours: Lecture 3.

Prereq: AECL 3650, AECL 3120 or Graduate classification and NREM 1200

Biological, political, social, and economic factors affecting the management of international wildlife resources. Meets International Perspectives Requirement. (Typically Offered: Fall)

AECL 4570: Herpetology

(Cross-listed with BIOL 4570).

Credits: 2. Contact Hours: Lecture 2.

Prereq: (BIOL 3510 AND BIOL 3510L) OR AECL/BIOL 3650

Biology, ecology, and evolution of amphibians (salamanders, frogs, caecilians) and reptiles (lizards, snakes, tuatara, turtles, crocodilians). Emphasis on structure, physiological adaptation to different environments, behavior, reproduction, roles of amphibians and reptiles in ecosystems, and conservation. Laboratory focus on survey methods, identification, relationships, distribution, habits, and habitats of amphibians and reptiles. (Typically Offered: Fall)

AECL 4570L: Herpetology Laboratory

(Cross-listed with BIOL 4570L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: (BIOL 3510 AND BIOL 3510L) OR AECL/BIOL 3650; Concurrent enrollment in AECL/BIOL 4570

Laboratory to accompany Biology/Animal Ecology 4570. Focus on survey methods, identification, relationships, distribution, habits, and habitats of amphibians and reptiles. (Typically Offered: Fall)

AECL 4580: Ornithology

(Cross-listed with BIOL 4580).

Credits: 2. Contact Hours: Lecture 2.

Prereq: (BIOL 3510 AND BIOL 3510L) OR AECL/BIOL 3650

Biology, evolution, ecology and taxonomy of birds. Emphasis on structure, physiology, behavior, communication, navigation, reproduction, and conservation. (Typically Offered: Spring)

AECL 4580L: Ornithology Laboratory

(Cross-listed with BIOL 4580L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: (BIOL 3510 AND BIOL 3510L) OR AECL/BIOL 3650; Credit OR concurrent enrollment in AECL/BIOL 4580

Laboratory complements lecture topics with emphasis on external anatomy, identification and distribution of Midwest birds, and field trips. (Typically Offered: Spring)

AECL 4590: Mammalogy

(Cross-listed with BIOL 4590).

Credits: 2. Contact Hours: Lecture 2.

Prereq: (BIOL 3510 AND BIOL 3510L) OR AECL/BIOL 3650

Biology, ecology, and evolution of mammals. Emphasis on structure, physiological adaptation to different environments, behavior, reproduction, roles of mammals in ecosystems, and conservation. (Typically Offered: Spring)

AECL 4590L: Mammalogy Laboratory

(Cross-listed with BIOL 4590L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: (BIOL 3510 AND BIOL 3510L) OR AECL/ BIOL 3650; Concurrent enrollment in AECL/BIOL 4590

Laboratory focus on identification, survey methods, distribution, habits, and habitats of mammals. Several field trips. (Typically Offered: Spring)

AECL 4710: Introductory Conservation Biology

(Cross-listed with BIOL 4710).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 3120

Examination of conservation issues from a population and community perspective. The role of genetics, demography, and environment in determining population viability, habitat fragmentation, reserve design, biodiversity assessment, and restoration ecology. (Typically Offered: Spring)

AECL 4800: Studies in Marine Biology

Credits: 1-8. Contact Hours: Lecture 8.

Repeatable.

Courses taken at Gulf Coast Research Laboratory and other marine biological stations are transferred to Iowa State University under this number. (Typically Offered: Summer)

AECL 4860: Aquatic Ecology

(Dual-listed with AECL 5860/ EEOB 5860/ ENSCI 5860). (Cross-listed with BIOL 4860/ ENSCI 4860).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 3120 or ENSCI 3190 or ENSCI 4020 or NREM 3010

Structure and function of aquatic ecosystems with application to fishery and pollution problems. Emphasis on lacustrine, riverine, and wetland ecology. (Typically Offered: Fall)

AECL 4860L: Aquatic Ecology Laboratory

(Dual-listed with AECL 5860L/ EEOB 5860L/ ENSCI 5860L). (Cross-listed with BIOL 4860L/ ENSCI 4860L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Credit or concurrent enrollment in BIOL 4860

Field trips and laboratory exercises to accompany 4860. Hands-on experience with aquatic research and monitoring techniques and concepts. (Typically Offered: Fall)

AECL 4890: Population Ecology

(Dual-listed with AECL 5890/ EEOB 5890). (Cross-listed with BIOL 4890).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: BIOL 3120; (STAT 1010 or STAT 1040); (MATH 1510, 1600, 1650 or Graduate standing)

Concepts and theories of population dynamics with emphasis on models of growth, predation, competition, and regulation. Offered even-numbered years. (Typically Offered: Fall)

Courses primarily for graduate students, open to qualified undergraduates:

AECL 5150: Ecology of Freshwater Invertebrates, Plants, and Algae

(Dual-listed with AECL 4150).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: AECL 3120 or graduate standing

Identification, biology, and ecological requirements of freshwater invertebrates, plants and algae. Additional emphases on community sampling methods and analysis, and use of organisms as tools for aquatic ecosystem health assessment. (Typically Offered: Fall)

AECL 5160: Avian Ecology

Credits: 3. Contact Hours: Lecture 3.

Prereq: AECL 3650; AECL 3120; or graduate standing

Current topics and theories including avian breeding and foraging ecology, population biology, community structure, habitat selection, field methodologies, and data interpretation. Offered even-numbered years. (Typically Offered: Spring)

AECL 5180: Stream Ecology

(Dual-listed with AECL 4180/ ENSCI 4180). (Cross-listed with ENSCI 5180).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: AECL 4860; or graduate standing

Biological, chemical, physical, and geological processes that determine the structure and function of flowing water ecosystems. Current ecological theories as well as applications to stream management for water quality and fisheries. Offered odd-numbered years. (Typically Offered: Fall)

AECL 5200: Fisheries Science

Credits: 3. Contact Hours: Lecture 3.

Prereq: AECL 3120; AECL 3210; or graduate standing

Concepts, approaches, and techniques for assessment of recreational and commercial fisheries. Scope will range from individual fish to entire ecosystems, both freshwater and marine. Offered odd-numbered years. (Typically Offered: Spring)

AECL 5250: Aquatic Insects

(Dual-listed with ENT 4250/ AECL 4250). (Cross-listed with ENT 5250).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: BIOL 3120 or graduate standing

Morphology, ecology, diversity, and significance of aquatic insects, with emphasis on the collection, curation and identification of taxa in local streams and lakes. Offered odd-numbered years. (Typically Offered: Spring)

AECL 5310: Conservation Biology

(Cross-listed with EEOB 5310).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 3120, BIOL 3130; or graduate standing

Examination of conservation issues from a population and a community perspective. Population-level analysis will focus on the role of genetics, demography, and environment in determining population viability. Community perspectives will focus on topics such as habitat fragmentation, reserve design, biodiversity assessment, and restoration ecology. Offered even-numbered years. (Typically Offered: Spring)

AECL 5400: Fishery Management

(Dual-listed with AECL 4400).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: AECL 3120; AECL 3210; AECL 3330; (STAT 1010 or STAT 1040); credit or enrollment in AECL 4860 or graduate standing

Biological basis of fishery management, fishery problems, and management practices for freshwater, anadromous, and marine fisheries. (Typically Offered: Fall)

AECL 5420: Aquaculture

(Dual-listed with AECL 4420).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2110; BIOL 2120 or graduate standing

Concepts related to the culture of aquatic organisms including culture systems, water quality, nutrition, genetics, diseases, and marketing. (Typically Offered: Spring)

AECL 5510: Behavioral Ecology

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: (BIOL 3120 or NREM 3110 or BIOL 3540 or ANS 3360 or ANTHR 3170) or graduate classification

The study of how an animal's behavior affects its ability to survive and reproduce in its environment. Course topics, such as foraging behavior, sexual selection, parental care, etc., represent the interface of ecology, evolution, and behavior. Offered odd-numbered years. (Typically Offered: Fall)

AECL 5540: Principles of Wildlife Disease

(Dual-listed with AECL 4540).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Ecological and epidemiological aspects of diseases as they relate to wildlife populations. Topics to be covered include: major classes of disease; detection, description, monitoring, and management of disease; characteristics and interactions between disease agents and wildlife hosts; relationships among wildlife, domestic animal, and human health. (Typically Offered: Spring)

AECL 5860: Aquatic Ecology

(Dual-listed with AECL 4860/ BIOL 4860/ ENSCI 4860). (Cross-listed with EEOB 5860/ ENSCI 5860).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 3120 or ENSCI 3810 or ENSCI 4020 or NREM 3010 or graduate classification

Structure and function of aquatic ecosystems with application to fishery and pollution problems. Emphasis on lacustrine, riverine, and wetland ecology. (Typically Offered: Fall)

AECL 5860L: Aquatic Ecology Laboratory

(Dual-listed with AECL 4860L/ BIOL 4860L/ ENSCI 4860L). (Cross-listed with EEOB 5860L/ ENSCI 5860L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Concurrent enrollment in BIOL 4860.

Field trips and laboratory exercises to accompany 4860. Hands-on experience with aquatic research and monitoring techniques and concepts. (Typically Offered: Fall)

AECL 5890: Population Ecology

(Dual-listed with AECL 4890/ BIOL 4890). (Cross-listed with EEOB 5890).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (BIOL 3120, STAT 1010 OR STAT 1040, MATH 1510 OR 1600 OR 1650) or graduate classification

Concepts and theories of population dynamics with emphasis on models of growth, predation, competition, and regulation. Offered even-numbered years. (Typically Offered: Fall)

AECL 5990: Creative Component

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

Courses for graduate students:

AECL 6110: Analysis of Populations

Credits: 3. Contact Hours: Lecture 3.

Prereq: (BIOL 3120; STAT 5870; MATH 1510 or 1600 or 1650) or graduate classification

Quantitative techniques for analyzing vertebrate population data to estimate parameters such as density and survival. Emphasis on statistical inference and computing. Offered even-numbered years. (Typically Offered: Fall)

AECL 6980: Animal Ecology Teaching Practicum

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Graduate student experience in the animal ecology teaching program. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

AECL 6990: Research

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

Courses primarily for undergraduates:**FOR 2010: Forest Biology**

Credits: 2. Contact Hours: Lecture 2.

Prereq: Concurrent enrollment in FOR 2020, FOR 2030, FOR 2040, FOR 2050, and FOR 2060

Discussion of ecological concepts, individual tree structure and growth, variation and diversity in tree populations. Physical environment of trees and forests, ecological processes in forest communities, and introduction to different regional forest communities. (Typically Offered: Fall)

FOR 2020: Sustainable Materials: Wood Utilization

Credits: 2. Contact Hours: Lecture 2.

Prereq: Concurrent enrollment in FOR 2010, FOR 2030, FOR 2040, FOR 2050, and FOR 2060.

Basis for use of wood as an industrial raw material for lumber, composites, pulp and paper, energy and chemicals. Implications of use of alternative renewable and non-renewable materials for societal infrastructure and consumer goods. (Typically Offered: Fall)

FOR 2030: Resource Measurements/Evaluation

Credits: 2. Contact Hours: Lecture 2.

Prereq: Concurrent enrollment in FOR 2010, FOR 2020, FOR 2040, FOR 2050, and FOR 2060; MATH 1400

Survey techniques involved in quantification, valuation, and evaluation of tree and stand growth and other variables in the forest environment (e.g., recreational use, wildlife habitat value, biomass, and solid wood). (Typically Offered: Fall)

FOR 2040: Forest Ecosystem Decision-Making

Credits: 2. Contact Hours: Lecture 2.

Prereq: Concurrent enrollment in FOR 2010, FOR 2020, FOR 2030, FOR 2050, and FOR 2060

Methods of decision-making related to forest ecosystems including communications, teams and conflict resolution. Current issues relating to public, private, and urban forests; quantification of processes, services, and goods produced by the forest and expected by the public such as wildlife, water, range, recreation, wilderness, biodiversity, as well as wood and fiber products. (Typically Offered: Fall)

FOR 2050: Integrated Forestry Laboratory

Credits: 3. Contact Hours: Laboratory 8.

Prereq: Credit or concurrent enrollment in FOR 2010, FOR 2020, FOR 2030, FOR 2040, and FOR 2060

Field and laboratory exercises integrating the evaluation and management of forest goods, services, and the processing of wood products. (Typically Offered: Fall)

FOR 2060: Fall Forestry Camp

Credits: 4.

Prereq: Credit or concurrent enrollment in FOR 2010, FOR 2020, FOR 2030, FOR 2040, and FOR 2050

Three-week field camp to address topics and issues covered in 2010, 2020, 2030, 2040, and 2050. (Typically Offered: Fall)

FOR 2800: Wood Properties and Identification

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Properties of wood and how they relate to its successful use.

Comparative anatomical characteristics, scientific nomenclature, and hand lens identification of commercially important North American woods. (Typically Offered: Spring)

FOR 2830: Pesticide Application Certification

(Cross-listed with AGRON 2830/ ENT 2830/ HORT 2830).

Credits: 2. Contact Hours: Lecture 2.

Core background and specialty topics in agricultural, and horticultural pesticide applicator certification. Students can select certification categories and have the opportunity to obtain pesticide applicator certification at the completion of the course. Commercial pesticide applicator certification is emphasized. (Typically Offered: Spring)

FOR 2900A: Special Problems: Leadership in Forestry Teams (LIFT) Learning Community

Credits: 1-4. Repeatable.

Prereq: Freshman or Sophomore classification, permission of instructor

Offered on a satisfactory-fail basis only.

FOR 2900B: Special Problems: Forest Ecosystem Management

Credits: 1-4. Repeatable.

Prereq: Freshman or Sophomore classification, permission of instructor

Offered on a satisfactory-fail basis only.

FOR 2900C: Special Problems: Natural Resource Conservation

Credits: 1-4. Repeatable.

Prereq: Freshman or Sophomore classification, permission of instructor

Offered on a satisfactory-fail basis only.

FOR 2900D: Special Problems: Urban and Community Forestry

Credits: 1-4. Repeatable.

Prereq: Freshman or Sophomore classification, permission of instructor

Offered on a satisfactory-fail basis only.

FOR 2900E: Special Problems: Wood Science and Technology

Credits: 1-4. Repeatable.

Prereq: Freshman or Sophomore classification, permission of instructor

Offered on a satisfactory-fail basis only.

FOR 3020: Silviculture

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: FOR 2010 or NREM 3010 or AECL 3120

Manipulation of forest vegetation based on ecological principles for the production of goods and services. (Typically Offered: Spring)

FOR 3560: Dendrology

(Cross-listed with BIOL 3560).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: BIOL 2110

Identification and ecology of North American woody plant species. Importance of woody plants in timber production and wildlife habitat. Historical conditions of North American forest regions will also be addressed. (Typically Offered: Fall)

FOR 3580: Forest Herbaceous Layer: Ecology and Identification.

Credits: 1.

Survey of the major plant families, general, and representative species of the forest herbaceous layer. Functional ecology and restoration. (Typically Offered: Spring)

FOR 4160: Forest Insects and Diseases

(Cross-listed with PLP 4160).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Nature of insects and pathogens of forest and shade trees; their role in the dynamics of natural and managed forest ecosystems; and the management of indigenous and exotic pests. Laboratory experience working with insect and fungal pests of trees. (Typically Offered: Fall)

FOR 4420: Dynamics of Forest Stands

(Dual-listed with FOR 5420).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: FOR 3020; NREM 3010; (STAT 1010 or STAT 1040)

Change in forest species composition and structure at the stand and landscape scales resulting from site quality, tree growth, competition, succession, and disturbance. Methods for assessing tree growth and reconstructing past stand development. Applications to forest and savanna management. Offered even-numbered years. (Typically Offered: Fall)

FOR 4510: Forest Resource Economics and Quantitative Methods

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: FOR 2030

Application of economic principles to forest resource management considering both market and non-market goods and services. Methods of identifying and specifying problems in the management and use of forest resources. Application of mathematical and statistical models to the solution of managerial problems. (Typically Offered: Spring)

FOR 4520: Ecosystem Management: Integrating Ecology, Society, and Policy

(Dual-listed with FOR 5520/ NREM 5520). (Cross-listed with NREM 4520).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Junior or Senior classification; (NREM 1200 or BIOL 1730)

Principles of planning, regulating, and decision-making associated with public and private lands, with consideration of forest, grassland, wetland, and freshwater aquatic ecosystems. Integrated natural resources management within ecological, social, economic and policy constraints. (Typically Offered: Spring)

FOR 4540: Forestry Practicum

Credits: 3. Contact Hours: Lecture 1, Laboratory 4.

Prereq: Senior classification

Integrated decision-making related to the conservation, management, and preservation of private and public forests, wildlands, urban/ community forests, and/or the production and utilization of wood products. Student teams work with a client and develop management plans that incorporate ecological, social, economic, ethical, and institutional/political factors. Effective teamwork, written/oral/visual communication, and problem-solving stressed. Multiple trips to project site and client. (Typically Offered: Spring)

FOR 4750: Urban Forestry

(Cross-listed with HORT 4750).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Junior or senior classification, 3 credits in BIOL

Discussion of establishment and management of woody perennials in community-owned urban greenspaces, consideration of urban site and soil characteristics, plant physiology, plant culture, urban forest valuation, inventory methods, species selection, and urban forest maintenance (health care and pest management). (Typically Offered: Fall)

Courses primarily for graduate students, open to qualified undergraduates:

FOR 5420: Dynamics of Forest Stands

(Dual-listed with FOR 4420).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Change in forest species composition and structure at the stand and landscape scales resulting from site quality, tree growth, competition, succession, and disturbance. Methods for assessing tree growth and reconstructing past stand development. Applications to forest and savanna management. Offered even-numbered years. (Typically Offered: Fall)

FOR 5520: Ecosystem Management: Integrating Ecology, Society, and Policy

(Dual-listed with FOR 4520/ NREM 4520). (Cross-listed with NREM 5520).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Principles of planning, regulating, and decision-making associated with public and private lands, with consideration of forest, grassland, wetland, and freshwater aquatic ecosystems. Integrated natural resources management within ecological, social, economic and policy constraints. (Typically Offered: Spring)

FOR 5990A: Creative Component: Forest Biology

Credits: 1-12. Repeatable, maximum of 12 credits.

Prereq: Instructor Permission for Course

Offered on a satisfactory-fail basis only.

FOR 5990B: Creative Component: Forest Biometry

Credits: 1-12. Repeatable, maximum of 12 credits.

Prereq: Instructor Permission for Course

Offered on a satisfactory-fail basis only.

FOR 5990C: Creative Component: Forest and Recreation Economics

Credits: 1-12. Repeatable, maximum of 12 credits.

Prereq: Instructor Permission for Course

Offered on a satisfactory-fail basis only.

FOR 5990D: Creative Component: Forest Management and Administration

Credits: 1-12. Repeatable, maximum of 12 credits.

Prereq: Instructor Permission for Course

Offered on a satisfactory-fail basis only.

FOR 5990E: Creative Component: Wood Science

Credits: 1-12. Repeatable, maximum of 12 credits.

Prereq: Graduate Standing or Permission of Instructor

Offered on a satisfactory-fail basis only.

Courses for graduate students:

FOR 6960: Research Seminar

(Cross-listed with AGRON 6960/ BBMB 6960/ PLBIO 6960/ GDCB 6960/ HORT 6960).

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Research seminars by faculty and graduate students. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

FOR 6990A: Research: Forest Biology - Wood Science

Credits: 1-12. Repeatable, maximum of 12 credits.

Prereq: Instructor Permission for Course

Offered on a satisfactory-fail basis only.

FOR 6990B: Research: Forest Biometry

Credits: 1-12. Repeatable, maximum of 12 credits.

Prereq: Instructor Permission for Course

Offered on a satisfactory-fail basis only.

FOR 6990C: Research: Forest Economics

Credits: 1-12. Repeatable, maximum of 12 credits.

Prereq: Instructor Permission for Course

Offered on a satisfactory-fail basis only.

FOR 6990D: Research: Forest Management and Administration

Credits: 1-12. Repeatable, maximum of 12 credits.

Prereq: Instructor Permission for Course

Offered on a satisfactory-fail basis only.

FOR 6990E: Research: Wood Science

Credits: 1-12. Repeatable, maximum of 12 credits.

Offered on a satisfactory-fail basis only.

FOR 6990F: Research: Plant Physiology

Credits: 1-12. Repeatable, maximum of 12 credits.

Prereq: Instructor Permission for Course

Offered on a satisfactory-fail basis only.

Courses primarily for undergraduates:

NREM 1040: Practical Work Experience

Credits: Required.

Three months of relevant work experience in natural resources, animal ecology, or forestry. Study at a summer biological station may be applicable. See advisor for specific requirements and approval process.

NREM 1100: Orientation in Natural Resource Ecology and Management

Credits: 1. Contact Hours: Lecture 1.

Orientation to the University and to the Department of Natural Resource Ecology and Management. Discussion of departmental learning outcomes, strategies for academic success and academic planning.

Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

NREM 1110: NREM Transitions Learning Community Seminar

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Enrollment limited to members of the NREM Transitions Learning Community. Designed to assist new transfer students and continuing sophomore students with their transition to the academic expectations and professional development aspects of the natural resource program.

Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

NREM 1150: Explorations in Natural Resource Ecology & Management

Credits: 1. Contact Hours: Lecture 1.

Prereq: (Animal Ecology or Forestry major); Permission of Instructor

Interact with faculty in the Department of Natural Resource Ecology and Management through lectures, discussions, and field experiences.

Offered during the second half of Spring semester. (Typically Offered: Spring)

NREM 1200: Introduction to Renewable Resources

(Cross-listed with AGRON 1200/ ENVS 1200).

Credits: 3. Contact Hours: Lecture 3.

Overview of soil, water, plants, and animals as renewable natural resources in an ecosystem context. History and organization of resource management. Concepts of integrated resource management. (Typically Offered: Fall, Spring)

NREM 1300: Natural Resources and Agriculture

(Cross-listed with ENVS 1300).

Credits: 3. Contact Hours: Lecture 3.

Survey of the ecology and management of fish, forest, and wildlife resources in areas of intensive agriculture, with emphasis on Iowa. Conservation and management practices for private agricultural lands. Designed for nonmajors. (Typically Offered: Spring)

NREM 2070: Natural Resource Management under the North American Model of Conservation

Credits: 1. Contact Hours: Lecture 1.

Introduction to North American model of conservation, current funding for natural resource management, role of hunting and angling in the North American model, critique and refinement of the model for the 21st century, and introduction to natural resource leadership, and outdoor skills and recreation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

NREM 2110: Careers in Natural Resources

Credits: 1. Contact Hours: Lecture 1.

Prereq: Sophomore classification

Career planning exploration in natural resources. Discussion of the job application process, including techniques for successful interviewing and development of an effective resume. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

NREM 2400: Quantitative Problem Solving in Natural Resources

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: (STAT 1010 or STAT 1040) or Permission of Instructor

Applied quantitative problem-solving skills for natural resource management. Focus on group and individual exercises, with practical problems in geography, hydrology, forestry and ecology. Laboratory includes field data collection and computer data processing and modeling. (Typically Offered: Spring)

NREM 2500: Environmental Geography

(Cross-listed with AGRON 2500/ ENVS 2500/ ENSCI 2500).

Credits: 3. Contact Hours: Lecture 3.

The distribution, origins and functions of the earth's physical systems and the spatial relationship between human activity and the natural world. (Typically Offered: Fall)

NREM 2700: Foundations in Natural Resource Policy and History

(Cross-listed with ENVS 2700/ LA 2700).

Credits: 3. Contact Hours: Lecture 3.

The development of natural resource conservation philosophy and policy from the Colonial Era to the present. North American wildlife, forestry, and environmental policy; national parks and other protected lands; federal and state agencies. Relationship to cultural contexts, including urban reform and American planning movement. Discussion of common pool resources, public and private lands. (Typically Offered: Fall)

NREM 3010: Natural Resource Ecology and Soils

(Cross-listed with ENSCI 3010).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: BIOL 2110, BIOL 2110L; FOR 2010 or a second course in biology

Effects of environmental factors on ecosystem structure and function using forest, prairie and agricultural ecosystems as models. Special emphasis is given to soil-forming factors and the role of soil in nutrient and water cycling and ecosystem dynamics. Additional emphasis is given to human influences on natural ecosystems and the role of perennial plant communities in agricultural landscapes. (Typically Offered: Fall)

NREM 3030: Internship

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: Permission of Instructor; Sophomore classification

Placement with county conservation boards, camps, zoos, parks, etc., for experience as interpreters, rangers, and technicians. (Typically Offered: Fall, Spring, Summer)

NREM 3050: Seminar

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Current topics in natural resources or related issues. (Typically Offered: Fall, Spring)

NREM 3110: Field Ecology in Montana

Credits: 4. Contact Hours: Lecture 2, Laboratory 6.

Prereq: (BIOL 2110; BIOL 2110L; BIOL 2120; BIOL 2120L); Permission of Instructor

Fundamental concepts and principles of ecology dealing with organisms, populations, communities, and ecosystems. Taught at NREM's Rod and Connie French Conservation Education Camp in western Montana. Emphasizes hands-on learning of principles and methods in the field. (Typically Offered: Summer)

NREM 3130: Native Land, Water, and Resources

(Cross-listed with AMIN 3130).

Credits: 3. Contact Hours: Lecture 3.

Examines Native land rights, water rights, and natural resources.

Topics may include Native relations to landscapes, cultural resources and infrastructure projects, land rights, water usage agreements, and resource policies as they apply to on- and off-reservation Native communities. AMIN 2100 recommended. Offered even-numbered years. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Spring)

NREM 3150: Genetics for Natural Resource Managers

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2110 and BIOL 2120

Introduction into how genetic techniques and technologies can aid the management of the earth's biotic resources. Topics include an overview of DNA structure, function and inheritance; tools and techniques for measuring genetic diversity; genetic management of wild and captive populations: DNA forensics as management tool. The goal of this course is to prepare managers/biologists to interpret genetic data as they relate to natural resource conservation. (Typically Offered: Fall)

NREM 3180: Introduction to Ecosystems

(Cross-listed with AGRON 3180/ BIOL 3180/ ENSCI 3180).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 12 credits in AECL, AGRON, BIOL, CHEM, FOR, GEOL, NREM

Biological and physical processes affecting material and energy flows in natural and managed ecosystems. Understanding and predicting climate and management impacts on ecosystem services and sustainability. (Typically Offered: Spring)

NREM 3300: Principles of Interpretation

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: 6 credits in BIOL

History, objectives, forms, and techniques of interpretation in the settings of county, state, national parks, and zoos. Principles of effective communication as they apply to natural resource fields including wildlife management, forestry, and wildlife rehabilitation. Planning and use of effective communications and outreach campaigns to manage and conserve natural resources. (Typically Offered: Spring)

NREM 3450: Natural Resource Photogrammetry and Geographic Information Systems

(Cross-listed with ENSCI 3450).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Junior classification

Measurement and interpretation of aerial photos in resource management. Introduction to Geographic Information Systems (GIS) using ArcGIS including digitizing, development and query of attribute tables, georeferencing, and use of multiple GIS layers in simple spatial analyses. (Typically Offered: Spring)

NREM 3570: Midwestern Prairie Plants

Credits: 1.

Offered 1st half semester only. Survey of the major plant families, genera, and representative species of Midwestern prairies with emphasis on plant identification. Prairie management for multiple species of plants and wildlife. (Typically Offered: Fall)

NREM 3750X: Environmentalism in Music

Credits: 1. Contact Hours: Lecture 1.

Environmentalism (environmental or ecological activism) is a common topic in popular music. In this seminar, students choose recorded music with an environmental or ecological theme, present their piece to the class, and lead a discussion focused on interpreting lyrics and sound. Through analysis of music from diverse eras, genres, and cultures, students learn about historical events, evaluate attitudes and actions regarding natural resource stewardship and biodiversity preservation, and explore concepts of environmental justice and human dependence on healthy ecosystems for physical and emotional well-being. (Typically Offered: Spring)

NREM 3800: Field Ecology Research and Teaching

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: BIOL 2110 or Department Permission

Students work in teams to conduct ecological research projects at a local field site, and develop related teaching modules/lesson plans. Research and teaching activity objectives, methods, and results are shared with diverse audiences as presentations, written reports, and web-based documents, and used to engage K-12 students and community members via field days and visits to schools and other institutions. (Typically Offered: Fall)

NREM 3850: Natural Resource Policy

(Dual-listed with NREM 5850).

Credits: 3. Contact Hours: Lecture 3.

Development, theory and practice of natural resource policy. Integrative approach with topical policy studies in North American wildlife, forestry, and water. Policy formation, the role of science, introduction to federal law compliance. (Typically Offered: Spring)

NREM 3900: Fire Ecology and Management

Credits: 3. Contact Hours: Lecture 3.

Characteristics and role of fire in forest ecosystems. Major topics covered include fuels, fire weather, fire behavior, fire danger rating systems, fire control, prescribed burning, and fire dynamics in major ecosystem types. (Typically Offered: Fall)

NREM 4020: Watershed Hydrology

(Dual-listed with GEOL 5020/ ENSCI 5020/ MTEOR 5020/ NREM 5020).

(Cross-listed with ENSCI 4020/ MTEOR 4020/ GEOL 4020).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Examination of watersheds as systems, emphasizing the surface components of the hydrologic cycle. Combines qualitative understanding of hydrological processes and uncertainty with quantitative representation. Laboratory emphasizes field investigation and measurement of watershed processes. (Typically Offered: Fall)

NREM 4070: Watershed Management

(Dual-listed with NREM 5070/ ENSCI 5070). (Cross-listed with ENSCI 4070/ ENVS 4070).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: 1 course in BIOL

Managing human impacts on the hydrologic cycle. Field and watershed level best management practices for modifying the impacts on water quality, quantity and timing are discussed. Field project includes developing a management plan using landscape buffers. (Typically Offered: Spring)

NREM 4460: Integrating GPS and GIS for Natural Resource Management

(Dual-listed with NREM 5460/ ENSCI 5460). (Cross-listed with ENSCI 4460).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: 12 credits in student's major (AECL/FOR) at 3000 level or above

Emphasis on the use of GPS as a data collection tool for GIS. Basic theory of GPS. Use of Global Positioning System technology for spatial data collection and navigation. Post-processing and real-time correction of GPS data. GPS data transfer to GIS for mapping applications. Use of GIS to construct waypoints for use in GPS navigation. (Typically Offered: Fall)

NREM 4520: Ecosystem Management: Integrating Ecology, Society, and Policy

(Dual-listed with FOR 5520/ NREM 5520). (Cross-listed with FOR 4520).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Junior or Senior classification; (NREM 1200 or BIOL 1730)

Principles of planning, regulating, and decision-making associated with public and private lands, with consideration of forest, grassland, wetland, and freshwater aquatic ecosystems. Integrated natural resources management within ecological, social, economic and policy constraints. (Typically Offered: Spring)

NREM 4550: Stream Restoration

(Dual-listed with NREM 5550). (Cross-listed with GEOL 4550).

Credits: 3. Contact Hours: Laboratory 3, Lecture 2.

Prereq: CE 3720 or GEOL 4020 or NREM 4070 or AECL 4180 or ABE 4310

Interdisciplinary introduction to the science and practice of stream restoration, with emphasis on restoring physical and biological integrity and ecosystem services to streams and riparian corridors. Offered odd-numbered years. (Typically Offered: Fall)

NREM 4600: Controversies in Natural Resource Management

(Cross-listed with ENVS 4600).

Credits: 3. Contact Hours: Lecture 3.

Prereq: AECL 3120 or NREM 3010, NREM 1200, and Junior classification

Analysis of controversial natural resource issues using a case approach that considers uncertainty and adequacy of information and scientific understanding. Ecological, social, political, economic, and ethical implications of issues will be analyzed. (Typically Offered: Fall, Spring)

NREM 4660: Ecosystem Services

(Dual-listed with ENSCI 5660/ NREM 5660). (Cross-listed with ENSCI 4660).

Credits: 3. Contact Hours: Lecture 2, Discussion 1.

Prereq: 15 credits in AECL, AGRON, BIOL, CHEM, FOR, GEOL, NREM

Ecosystem services are the societal benefits provided by natural and managed ecosystems. Benefits such as provision of food, purification of air and water, and regulation of climate are essential to human survival and prosperity, but rely upon maintenance of healthy ecosystems. This course will cover the science, policy, and practice of ecosystem services assessment and management, with a special focus on biodiversity, water quality, food production, and climate. Offered odd-numbered years. (Typically Offered: Spring)

NREM 4710: Agroforestry Systems

(Dual-listed with NREM 5710/ SUSAG 5710).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 6 credits in biological science at 3000 level or above

Concepts of sustainable land use, agroecological dynamics, and component interactions of agroforestry systems. Agroforestry systems in temperate and tropical regions. Design and evaluation techniques for agroforestry systems. Ecological, socioeconomic and political aspects of agroforestry. Offered even-numbered years. Meets International Perspectives Requirement. (Typically Offered: Spring)

NREM 4830: Science + Design: Interpretation of Natural Resources in Montana

(Dual-listed with NREM 5830/ ARTGR 5830). (Cross-listed with ARTGR 4830).

Credits: 3. Contact Hours: Lecture 1, Studio 4.

Prereq: Enrollment in ARTGR major; ARTGR 2710 or BIOL 2110; Permission of Instructor.

Interdisciplinary service-learning. Design and production of natural resource related interpretive signs for Montana natural areas. Field-work experience followed by on-campus studio. (Typically Offered: Fall)

NREM 4850: Undergraduate Seminar

Credits: 1. Contact Hours: Lecture 1.

Repeatable, maximum of 2 times.

Prereq: Major in Animal Ecology or Forestry; Junior or Senior classification; Permission of Instructor

Weekly seminars on current research topics in natural resource ecology and management. Style and best practice in oral research communication. Skills and principles for evaluating research merit and quality of technical communication. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

NREM 4890: Survey of Remote Sensing Technologies

(Dual-listed with MTEOR 5890/ EE 5890/ ENSCI 5890/ GEOL 5890/ NREM 5890). (Cross-listed with EE 4890/ ENSCI 4890/ GEOL 4890/ MTEOR 4890).

Credits: 3. Contact Hours: Lecture 3.

Electromagnetic-radiation principles, active and passive sensors, multispectral and hyperspectral sensors, imaging radar, SAR, thermal imaging, lidar. Examples of applications. Also offered online S. (Typically Offered: Fall)

NREM 4890L: Satellite Remote Sensing Laboratory

(Dual-listed with MTEOR 5890L/ EE 5890L/ GEOL 5890L/ NREM 5890L). (Cross-listed with EE 4890L/ GEOL 4890L/ MTEOR 4890L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Completion or concurrent enrollment in MTEOR/GEOL/NREM/ EE 4890/5890

Processing and analysis of satellite sensor data (optical and radar). Provides practical applications in an environmental context. (Typically Offered: Fall)

NREM 4900A: Independent Study: Animal Ecology

Credits: 1-4. Repeatable, maximum of 4 credits.

Prereq: Restricted to Junior or Senior classifications, Instructor permission required

Offered on a satisfactory-fail basis only.

NREM 4900B: Independent Study: Forestry

Credits: 1-4. Repeatable, maximum of 4 credits.

Prereq: Restricted to Junior or Senior classifications, Instructor permission required

Offered on a satisfactory-fail basis only.

NREM 4900E: Independent Study: Entrepreneurship

Credits: 1-4. Repeatable, maximum of 4 credits.

Prereq: Restricted to Junior or Senior classifications, Instructor permission required

NREM 4900H: Independent Study

Credits: 1-4. Repeatable, maximum of 4 credits.

Prereq: Junior or Senior classification; Instructor Permission; Membership in the University Honors Program

Offered on a satisfactory-fail basis only.

NREM 4960A: Travel Course: International

(Dual-listed with NREM 5960A).

Credits: 1-5. Repeatable, maximum of 3 times.

Limited enrollment. Extended field trips to study ecological and management topics in varied environments. Location and duration of trips will vary. Pre-trip sessions arranged. Trip expenses paid by students. Meets International Perspectives Requirement.

NREM 4960B: Travel Course: Domestic

(Dual-listed with NREM 5960B).

Credits: 1-5. Repeatable, maximum of 3 times.

Prereq: Instructor Permission for Course

Limited enrollment. Extended field trips to study ecological and management topics in varied environments. Location and duration of trips will vary. Pre-trip sessions arranged. Trip expenses paid by students.

NREM 4980: Cooperative Education

Credits: 1-3. Repeatable.

Prereq: Department Chair Permission for Course

Required of all cooperative education students. Students must register prior to commencing each work period. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

NREM 5020: Watershed Hydrology

(Dual-listed with GEOL 4020/ ENSCI 4020/ MTEOR 4020/ NREM 4020).

(Cross-listed with ENSCI 5020/ MTEOR 5020/ GEOL 5020).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Examination of watersheds as systems, emphasizing the surface components of the hydrologic cycle. Combines qualitative understanding of hydrological processes and uncertainty with quantitative representation. Laboratory emphasizes field investigation and measurement of watershed processes. (Typically Offered: Fall)

NREM 5040: Forest Landscapes, Wildlife, and Silviculture

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Desired forest habitat conditions for fish and wildlife. Silvicultural approaches to protecting/improving such habitats. Focus on key forest elements related to animal species, groups and overall diversity. The lab focuses on team observations and discussions of diverse habitats including one weekend field trip. Offered odd-numbered years. (Typically Offered: Fall)

NREM 5050: Seminar

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable, maximum of 3 times.

Prereq: Graduate Standing or Permission of Instructor

Current topics in natural resources research and management. (Typically Offered: Fall, Spring)

NREM 5070: Watershed Management

(Dual-listed with ENVS 4070/ NREM 4070/ ENSCI 4070). (Cross-listed with ENSCI 5070).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Managing human impacts on the hydrologic cycle. Field and watershed level best management practices for modifying the impacts on water quality, quantity and timing are discussed. Field project includes developing a management plan using landscape buffers. (Typically Offered: Spring)

NREM 5330: Erosion and Sediment Transport

(Cross-listed with ABE 5330/ ENSCI 5330/ GEOL 5330).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Soil erosion processes, soil loss equations and their application to conservation planning, sediment properties, initiation of sediment motion and over land flow, flow in alluvial channels and theory of sediment transport, channel stability, reservoir sedimentation, wind erosion, BMPs for controlling erosion. Offered even-numbered years. (Typically Offered: Fall)

NREM 5350: Restoration Ecology

(Cross-listed with EEOB 5350/ ENSCI 5350).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Theory and practice of restoring animal and plant diversity, structure and function of disturbed ecosystems. Restored freshwater wetlands, forests, prairies and reintroduced species populations will be used as case studies. Offered even-numbered years. (Typically Offered: Fall)

NREM 5420A: Introduction to Molecular Biology Techniques: DNA Techniques

(Cross-listed with BMS 5420A/ EEOB 5420A/ FSHN 5420A/ GDCB 5420A/ HORT 5420A/ BBMB 5420A/ NUTRS 5420A/ VDPAM 5420A/ VMPM 5420A).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes genetic engineering procedures, sequencing, PCR, and genotyping. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

NREM 5420B: Introduction to Molecular Biology Techniques: Protein

(Cross-listed with BMS 5420B/ EEOB 5420B/ FSHN 5420B/ GDCB 5420B/ HORT 5420B/ BBMB 5420B/ NUTRS 5420B/ VDPAM 5420B).

Credits: 1. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. Offered on a satisfactory-fail basis only. (Typically Offered: Spring, Summer)

NREM 5420C: Introduction to Molecular Biology Techniques: Cell Techniques

(Cross-listed with BMS 5420C/ EEOB 5420C/ FSHN 5420C/ GDCB 5420C/ HORT 5420C/ BBMB 5420C/ NUTRS 5420C/ VMPM 5420C/ VDPAM 5420C).

Credits: 1. Contact Hours: Laboratory 2.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. ular biology techniques and related procedures. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

NREM 5420D: Introduction to Molecular Biology Techniques: Plant Transformation

(Cross-listed with BMS 5420D/ EEOB 5420D/ FSHN 5420D/ GDCB 5420D/ HORT 5420D/ BBMB 5420D/ NUTRS 5420D/ VMPM 5420D/ VDPAM 5420D).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: Agrobacterium and particle gun-mediated transformation of tobacco, Arabidopsis, and maize, and analysis of tranformants. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

NREM 5420E: Introduction to Molecular Biology Techniques: Proteomics

(Cross-listed with BMS 5420E/ EEOB 5420E/ FSHN 5420E/ GDCB 5420E/ HORT 5420E/ BBMB 5420E/ NUTRS 5420E/ VMPM 5420E/ VDPAM 5420E).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: two-dimensional electrophoresis, laser scanning, mass spectrometry, and database searching. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

NREM 5420F: Introduction to Molecular Biology Techniques:**Metabolomics**

(Cross-listed with BMS 5420F/ EEOB 5420F/ FSHN 5420F/ GDCB 5420F/ HORT 5420F/ BBMB 5420F/ NUTRS 5420F/ VMPM 5420F/ VDPAM 5420F).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: metabolomics and the techniques involved in metabolite profiling. For non-chemistry majoring students who are seeking analytical aspects into their biological research projects. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

NREM 5420G: Introduction to Molecular Biology Techniques: Genomic

(Cross-listed with BMS 5420G/ EEOB 5420G/ FSHN 5420G/ GDCB 5420G/ HORT 5420G/ BBMB 5420G/ NUTRS 5420G/ VMPM 5420G/ VDPAM 5420G).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

NREM 5460: Integrating GPS and GIS for Natural Resource Management

(Dual-listed with NREM 4460/ ENSCI 4460). (Cross-listed with ENSCI 5460).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Emphasis on the use of GPS as a data collection tool for GIS. Basic theory of GPS. Use of Global Positioning System technology for spatial data collection and navigation. Post-processing and real-time correction of GPS data. GPS data transfer to GIS for mapping applications. Use of GIS to construct waypoints for use in GPS navigation. (Typically Offered: Fall)

NREM 5520: Ecosystem Management: Integrating Ecology, Society, and Policy

(Dual-listed with FOR 4520/ NREM 4520). (Cross-listed with FOR 5520).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Principles of planning, regulating, and decision-making associated with public and private lands, with consideration of forest, grassland, wetland, and freshwater aquatic ecosystems. Integrated natural resources management within ecological, social, economic and policy constraints. (Typically Offered: Spring)

NREM 5550: Stream Restoration

(Dual-listed with NREM 4550). (Cross-listed with GEOL 5550).

Credits: 3. Contact Hours: Laboratory 3, Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Interdisciplinary introduction to the science and practice of stream restoration, with emphasis on restoring physical and biological integrity and ecosystem services to streams and riparian corridors. Offered odd-numbered years. (Typically Offered: Fall)

NREM 5550L: Stream Restoration Lab

(Dual-listed with NREM 4550L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to measurement and analysis of stream form and function for restoration and rehabilitation. Includes field data collection, map and image analysis, and computation for assessment of channel stability, biotic integrity, and recovery potential. Offered odd-numbered years. (Typically Offered: Fall)

NREM 5660: Ecosystem Services

(Dual-listed with ENSCI 4660/ NREM 4660). (Cross-listed with ENSCI 5660).

Credits: 3. Contact Hours: Lecture 2, Discussion 1.

Prereq: Graduate Standing or Permission of Instructor

Ecosystem services are the societal benefits provided by natural and managed ecosystems. Benefits such as provision of food, purification of air and water, and regulation of climate are essential to human survival and prosperity, but rely upon maintenance of healthy ecosystems. This course will cover the science, policy, and practice of ecosystem services assessment and management, with a special focus on biodiversity, water quality, food production, and climate. Offered odd-numbered years. (Typically Offered: Spring)

NREM 5700: Advanced Decision-making in Natural Resource Allocation

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Analytical approach to economic aspects of forest resource management problems. Theory and application of economic decision-making criteria to traditional and modern forest resource management issues. Current problems in the allocation of forest resources. Offered even-numbered years. (Typically Offered: Spring)

NREM 5710: Agroforestry Systems

(Dual-listed with NREM 4710/ SUSAG 4710). (Cross-listed with SUSAG 5710).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Concepts of sustainable land use, agroecological dynamics, and component interactions of agroforestry systems. Agroforestry systems in temperate and tropical regions. Design and evaluation techniques for agroforestry systems. Ecological, socioeconomic and political aspects of agroforestry. Offered even-numbered years. Meets International Perspectives Requirement. (Typically Offered: Spring)

NREM 5830: Science + Design: Interpretation of Natural Resources in Montana

(Dual-listed with NREM 4830/ ARTGR 4830). (Cross-listed with ARTGR 5830).

Credits: 3. Contact Hours: Lecture 1, Studio 4.

Prereq: Graduate Standing or Permission of Instructor

Interdisciplinary service-learning. Design and production of natural resource related interpretive signs for Montana natural areas. Field-work experience followed by on-campus studio. (Typically Offered: Fall)

NREM 5850: Natural Resource Policy

(Dual-listed with NREM 3850).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Development, theory and practice of natural resource policy. Integrative approach with topical policy studies in North American wildlife, forestry, and water. Policy formation, the role of science, introduction to federal law compliance. (Typically Offered: Spring)

NREM 5890: Survey of Remote Sensing Technologies

(Dual-listed with MTEOR 4890/ EE 4890/ ENSCI 4890/ GEOL 4890/ NREM 4890). (Cross-listed with EE 5890/ ENSCI 5890/ GEOL 5890/ MTEOR 5890).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Electromagnetic-radiation principles, active and passive sensors, multispectral and hyperspectral sensors, imaging radar, SAR, thermal imaging, lidar. Examples of applications. Also offered online S. (Typically Offered: Fall)

NREM 5890L: Satellite Remote Sensing Laboratory

(Dual-listed with MTEOR 4890L/ EE 4890L/ GEOL 4890L/ NREM 4890L).

(Cross-listed with EE 5890L/ GEOL 5890L/ MTEOR 5890L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Processing and analysis of satellite sensor data (optical and radar).

Provides practical applications in an environmental context. (Typically

Offered: Fall)

NREM 5900A: Special Topics: Animal Ecology

Credits: 1-4. Repeatable, maximum of 4 credits.

Prereq: Instructor Permission for Course

Offered on a satisfactory-fail basis only.

NREM 5900B: Special Topics: Forestry

Credits: 1-4. Repeatable, maximum of 4 credits.

Prereq: Instructor Permission for Course

Offered on a satisfactory-fail basis only.

NREM 5930: Workshop

Credits: 1-3. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

NREM 5960A: Travel Course: International

(Dual-listed with NREM 4960A).

Credits: 1-5. Repeatable, maximum of 3 times.

Prereq: Graduate Standing or Permission of Instructor

Limited enrollment. Extended field trips to study ecological and management topics in varied environments. Location and duration of trips will vary. Pre-trip sessions arranged. Trip expenses paid by students.

NREM 5960B: Travel Course: Domestic

(Dual-listed with NREM 4960B).

Credits: 1-5. Repeatable, maximum of 3 times.

Prereq: Graduate Standing or Permission of Instructor

Limited enrollment. Extended field trips to study ecological and management topics in varied environments. Location and duration of trips will vary. Pre-trip sessions arranged. Trip expenses paid by students.

NREM 5980: Natural Resource Ecology and Management Teaching**Practicum**

Credits: 1.

Prereq: Graduate classification and Permission of Instructor

Graduate student experience in teaching. Student must plan and present at least one unit of subject matter in a course or extension workshop.

Teaching practicum must be documented by the student and approved by the student's POS committee. Offered on a satisfactory-fail basis only.

(Typically Offered: Fall, Spring, Summer)

NREM 5990: Creative Component

Credits: 1-30. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Offered on a satisfactory-fail basis only.

Courses for graduate students:**NREM 6000: Seminar**

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Current topics in natural resources research and management. (Typically

Offered: Fall, Spring)

NREM 6980: Natural Resource Ecology and Management Teaching**Practicum**

Credits: 1.

Prereq: Graduate classification and Permission of Instructor

Graduate student experience in teaching. Student must plan and present substantive subject matter for a minimum of three weeks in lecture and/or laboratory formats, or a series of extension seminars/workshops.

Teaching practicum must be documented by the student and approved by the student's POS committee. Offered on a satisfactory-fail basis only.

(Typically Offered: Fall, Spring)

NREM 6990: Research

Credits: 1-12. Repeatable, maximum of 12 credits.

Offered on a satisfactory-fail basis only.

Nursing

OVERVIEW

The Bachelor of Science in Nursing (BSN) program at Iowa State University is a RN-to-BSN program, designed for those who have obtained an associate degree in nursing or are eligible for NCLEX, and desire to further their nursing career and education to the next level. Iowa State's RN-to-BSN program provides interactive learning opportunities where students can apply their real-world experiences and education to inspire innovation in their places of care. RN-to-BSN students will acquire knowledge, skills, and experience in four essential areas: research, leadership, population health, and self-care/health promotion. The program emphasizes providing professional, cultural, and ethically congruent care that respects the dignity and uniqueness of individuals and groups in diverse populations and locations.

The Nursing program of study is not offered as an additional major, it is only offered as a full degree program. Students pursuing the Nursing degree program are allowed to pursue additional majors in other eligible programs of study if desired.

The baccalaureate nursing program at Iowa State University of Science and Technology located in Ames, Iowa is approved by the:

Iowa Board of Nursing (IBON)

6200 Park Ave. #100
Des Moines, IA 50321

The baccalaureate nursing program at Iowa State University of Science and Technology located in Ames, Iowa is accredited by the:

Accreditation Commission for Education in Nursing (ACEN)

3390 Peachtree Road NE, Suite 1400
Atlanta, GA 30326
(404) 975-5000

The most recent accreditation decision made by the ACEN Board of Commissioners for the baccalaureate nursing program is initial accreditation.

View the public information disclosed by the ACEN regarding this program at <http://www.acenursing.com/accreditedprograms/programSearch.htm>

Student Learning Outcomes

Upon graduation, students should be able to:

1. Synthesize theory and concepts from the arts and humanities, natural and social sciences, and nursing as a professional holistic practice and scientific discipline.
2. Engage in professional, culturally sensitive, compassionate, and ethically congruent care that reflects the dignity and uniqueness of individuals and groups in diverse populations and settings that seek to understand their lived experiences and connections to others.
3. Utilize information processes and technology to improve communication, address health literacy, manage knowledge, reduce errors, and support decision-making that assists in delivering optimal care for diverse individuals, families, and communities.
4. Translate research findings to support evidence-based, competent, safe, and effective nursing care to individuals, families, and communities in diverse settings across the lifespan.
5. Demonstrate a commitment to professionalism and professional identity that embodies the values and characteristics of nursing while incorporating the concepts of self-reflection, well-being, and continuous learning.
6. Examine the interconnection amongst the healthcare delivery continuum, including collaborative activities among stakeholders that impact equitable health outcomes through systems thinking, health promotion, and ethical response initiatives.
7. Develop personal, professional, and leadership skills with a commitment to personal growth, expansion of professional knowledge

and expertise, and emboldens leadership practice in the healthcare industry.

8. Analyze how social, cultural, and environmental determinants of health and social structure interact to affect access, provision of care, and health outcomes at local, regional, national, and global levels to improve population health while instilling a sense of global citizenship and ethical responsibility.

RN-to-BSN Admissions Criteria

Applications for the RN-to-BSN program are individually reviewed.

Minimum requirements for admission to the BSN program include:

- Licensed as registered nurse or NCLEX eligible
- Meet all Iowa State University admission criteria for transfer students
- Official college transcripts from all colleges and universities attended
- Minimum of 2.5 cumulative GPA for all college coursework
- Achievement of minimum "C" (not C-) for all prerequisite courses listed below

English Composition I and II (ENGL 1500 and ENGL 2500 equivalent)

Introduction to Chemistry (CHEM 1630 or CHEM 1T equivalent)

Statistics (STAT 1010 or STAT 1040 equivalent)

Introduction to Human Nutrition (FSHN 1670 equivalent)

Introduction to Sociology (SOC 1340 equivalent)

RN-to-BSN Progression Criteria

- Must earn a "C" grade or better in all NRS courses and meet the university's academic standards for progress toward a degree

RN-to-BSN Graduation Requirements

- At least 32 credits earned in residence at Iowa State University, and the final 32 credits taken through Iowa State University prior to graduation.
- All general education requirements at Iowa State University must be met.
- The BSN curriculum consists of 24 credits of NRS courses, 5 credits of FSHN courses, and 3 elective credits for a total of 32 credits in addition to prerequisite coursework.
- Electives are selected by students to meet identified career interests, and total elective credits needed will vary based on individual transfer credits.
- Minimum credits for graduation is 120 credits.

International Perspectives: 3 cr.
U.S. Cultures and Communities: 3 cr.
Communications and Library: 10 cr.

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3

LIB 1600	Introduction to College Level Research	1
Oral Communication course, select from:		3
COMST 2140 Professional Communication		
SPCM 2120 Fundamentals of Public Speaking		

Humanities and Social Sciences: 3 cr.

SOC 1340	Introduction to Sociology	3

College of Health and Human Sciences Students Only:**Additional Humanities and Social Sciences: 9 cr.**

Humanities courses from approve list ¹		6
Humanities or social science course		3

College of Agriculture & Life Science Students Only:**Additional Humanities and Social Sciences: 6 cr.**

Humanities course from approved list ¹		3
Ethics course from approved list ²		3

¹ Approved Humanities course list (<https://www.cals.iastate.edu/student-services/humanities/>)

² Approved Ethics course list (<https://www.cals.iastate.edu/student-services/ethics/>)

Math, Physical, & Biological Sciences: 7-8 cr.

Statistics course, select from:		3-4
STAT 1010	Principles of Statistics	
STAT 1040	Introduction to Statistics	
CHEM 1630	College Chemistry	4
Total Credits		7-8

College of Agriculture & Life Sciences students only:**Additional Math, Physical & Biological Sciences: 7-8 crs.**

Select math course: MATH 1400, MATH 1430, MATH 1450, MATH 1500, MATH 1510, MATH 1600, or MATH 1650		3-4
Select biology course: BIOL 1010, BIOL 2110, or BIOL 2120		3
CHEM 1630L	Laboratory in College Chemistry	1
Total Credits		7-8

Nursing Courses: 24 cr.

NRS 2500	Introduction to BSN Nursing	1
NRS 3200	Essential Concepts for Professional Nursing Practice	3
NRS 3400	Nursing Research and Evidence-Based Practice	4
NRS 3600	Nursing Leadership and Management	3
NRS 4200	Promoting a Culture of Health and Wellness	3
NRS 4400	Population Health Nursing [†]	3
NRS 4420	Population Health Nursing Practicum	1
NRS 4700	Global Health Nursing [‡]	3

NRS 4800	Advanced Concepts of Professional Nursing	3
Total Credits		24

[†] May fulfill the U.S. Cultures and Communities requirement - check current list

[‡] May fulfill the International Perspectives requirement - check current list

Select at least 3.0 credits of elective: 3 cr.**Nutrition: 5 cr.**

FSHN 3650	Obesity and Health	3
FSHN 4300	U.S. Health Systems and Policy	2
Total Credits		5

Electives: Select from any university coursework to earn at least ≥ 120 total credits prior to graduation.

Total credits for Nursing major = 32

Full-Time Enrollment Option

First Year			
Fall	Credits Spring		Credits
NRS 2500	1	NRS 4400	3
NRS 3200	3	NRS 4420 (Select from:)*	1
NRS 3400	4	A - Local	
NRS 3600	3	B - Pine Ridge	
NRS 4200	3	C - Norway	
FSHN 4300**	2	D - Cambodia	
		NRS 4700	3
		NRS 4800	3
		FSHN 3650**	3
		Elective as needed**	3
16			16

Total Credits: 32

Part-Time Enrollment Option

First Year			
Fall	Credits Spring		Credits
NRS 2500	1	NRS 4700	3
NRS 3400	4	FSHN 3650**	3
NRS 4200	3	Elective as needed	3
8			9
Second Year			
Fall	Credits Spring		Credits
NRS 3200	3	NRS 4400	3
NRS 3600	3	NRS 4420 (Select from:)*	1
FSHN 4300	2	A - Local	
		B - Pine Ridge	

C - Norway	
D - Cambodia	
NRS 4800	3
8	7

Total Credits: 32

* Denotes Practicum Courses.

** Denotes courses that may be taken before starting the nursing program.

Note: Plan of study does not include any unmet ISU general education requirements.

Nutritional Science (AGLS)

Nutritional science looks at the connection between diet and health. Students learn how diet can play a crucial role in the cause, treatment, and prevention of many diseases. The pre-health and research coursework in the degree program prepares students for work in research laboratories, graduate study in nutrition or biological sciences, or entrance into health professional programs, such as medical, dental, physician assistant, and pharmacy schools. Students gain a strong science education along with human nutrition expertise.

The department also offers a nutrition minor.

Student Learning Outcomes

Upon graduation, students should be able to:

- Communicate effectively in their field of study using written, oral, visual and/or electronic forms.
- Demonstrate proficiency in ethical data collection and interpretation, literature review and citation, critical thinking and problem solving.
- Participate effectively in a group or team.
- Integrate creativity, innovation, or entrepreneurship in ways that produce value.
- Explain how human activities impact the natural environment and how societies are affected.
- Meet program specific learning outcomes for the Nutritional Science major.

Degree Requirements

Administered by the Department of Food Science and Human Nutrition

Total Degree Requirement: 120 cr.

Students must fulfill International Perspectives and U.S. Cultures and Communities requirements by selecting coursework from approved lists. These courses may also be used to fulfill other area requirements. Only 65 cr. from a two-year institution may apply to the degree which may include up to 16 technical cr.; 9 P-NP cr. of electives; 2.00 minimum GPA.

International Perspectives: 3 cr.
U.S. Cultures and Communities: 3 cr.
Communications and Library: 13 cr.

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
Select from:		3

ENGL 3020	Business Communication	
ENGL 3090	Proposal and Report Writing	
ENGL 3140	Technical Communication	
LIB 1600	Introduction to College Level Research	1
SPCM 2120	Fundamentals of Public Speaking	3

Total Credits 13

Humanities and Social Sciences: 6-12 cr.

Select Humanities courses from approved list	3
Select Social Science course from approved list	3
If CHHS student, select:	6

Additional Humanities course	
Additional Humanities or Social Science course	

Ethics: 3 cr.

FSHN 3420	World Food Issues: Past and Present	3

Mathematical Sciences: 6-12 cr.

Select at least 3 credits from: 3-8

MATH 1400	College Algebra	
MATH 1430	Preparation for Calculus	
MATH 1600	Survey of Calculus	
MATH 1650	Calculus I	
MATH 1650 & MATH 1660	Calculus I and Calculus II	

Select at least 3 credits from: 3-4

STAT 1010	Principles of Statistics	
STAT 1040	Introduction to Statistics	

Total Credits 6-12

Physical Sciences: 13 cr.

CHEM 1770	General Chemistry I	4
CHEM 1770L	Laboratory in General Chemistry I	1
CHEM 1780	General Chemistry II	3
CHEM 1780L	Laboratory in College Chemistry II	1
CHEM 2310	Elementary Organic Chemistry	3
or CHEM 3310	Organic Chemistry I	
CHEM 2310L	Laboratory in Elementary Organic Chemistry	1
or CHEM 3310L	Laboratory in Organic Chemistry I	

Total Credits 13

Biological Sciences: 24-29 cr.

BIOL 2110	Principles of Biology I	3
BIOL 2110L	Principles of Biology Laboratory I	1
BIOL 2120	Principles of Biology II	3
BIOL 2120L	Principles of Biology Laboratory II	1
BIOL 2550	Fundamentals of Human Anatomy	3
BIOL 2550L	Fundamentals of Human Anatomy Laboratory	1
Select at least 3 credits from:		3-4
BIOL 2560 & 2560L	Fundamentals of Human Physiology and Fundamentals of Human Physiology Laboratory	3
or BIOL 335C	Principles of Human and Other Animal Physiology	
BIOL 3130	Principles of Genetics	3
Select at least 3 credits from:		3-6
BBMB 3010	Survey of Biochemistry	3
BBMB 3160	Principles of Biochemistry	
BBMB 4040 & BBMB 4050	Biochemistry I and Biochemistry II	
MICRO 2010	Introduction to Microbiology	
or MICRO 3020	Biology of Microorganisms	2-3
MICRO 2010L	Introductory Microbiology Laboratory	1
or MICRO 3020L	Microbiology Laboratory	
Total Credits		24-29

Food Science and Human Nutrition: 31 cr.

FSHN 1100	Professional and Educational Preparation	1
FSHN 1670	Introductory Human Nutrition and Health	3
FSHN 2650	Metabolism, Nutrition and Health	3
FSHN 2670	Clinical Perspectives on Nutrition	1
FSHN 3600	Advanced Nutrition and the Regulation of Metabolism in Health and Disease	3
FSHN 3610	Nutrition and Health Assessment	2
FSHN 3620	Nutrition and Health Throughout the Lifecycle	3
FSHN 4670	Molecular Basis of Nutrition in Disease Etiology and Health Promotion	3
FSHN 4920	Research Concepts in Human Nutrition	2
Select at least 10 additional credits from:		10
FSHN 2030	Contemporary Issues in Food Science and Human Nutrition	3
FSHN 2140 & FSHN 2150	Scientific Study of Food and Advanced Food Preparation Laboratory (or FSHN 1150 lab)	
FSHN 2420	The US Food System	3
FSHN 3010	Nutrigenomics: From Basic Science to Translational Impact	

FSHN 3640	Nutrition and Prevention of Chronic Disease	3
FSHN 3650	Obesity and Health	
FSHN 3670	Medical Terminology for Health Professionals	3
FSHN 4300	U.S. Health Systems and Policy	
FSHN 4600	Global Nutrition, Health and Sustainability	3
FSHN 4610	Medical Nutrition and Disease I	
FSHN 4630	Community Nutrition and Health	3
FSHN 4640	Medical Nutrition and Disease II	
FSHN 4660	Nutrition Counseling and Education Methods	3
FSHN 4900C	Independent Study: Nutrition	
FSHN 4990	Undergraduate Research	3
NUTRS 5040	Nutrition and Epigenetic Regulation of Gene Expression	
BIOL 3140	Principles of Molecular Cell Biology	3
CHEM 3320	Organic Chemistry II	
CHEM 3320L	Laboratory in Organic Chemistry II	3
PHYS 1310 & 1310L	General Physics I and General Physics I Laboratory	
or PHYS 231	Introduction to Classical Physics I and Introduction to Classical Physics I Laboratory	3
& 2310L		
PHYS 1320 & 1320L	General Physics II and General Physics II Laboratory	3
or PHYS 2320	Introduction to Classical Physics II and Introduction to Classical Physics II Laboratory	
& 2320L		
Total Credits		31

Electives: 2-24 cr. Select from any university coursework to earn at least 120 total credits. Students planning to apply to health professional programs should review entrance requirements and select appropriate courses as electives.

Go to FSHN courses.

Nutritional Science, B.S.**First Year**

Fall	Credits Spring	Credits
FSHN 1100	1 FSHN 1670	3
CHEM 1770	4 CHEM 1780	3
CHEM 1770L	1 CHEM 1780L	1
BIOL 2110	3 BIOL 2120	3
BIOL 2110L	1 BIOL 2120L	1
ENGL 1500	3 MATH 1400, 1430, 1600, or 1650	3-4
LIB 1600	1	

Humanities	3	
	17	14-15
Second Year		
Fall	Credits Spring	Credits
CHEM 2310 or 3310	3 FSHN 2650	3
CHEM 2310L or 3310L	1 FSHN 2670	1
BIOL 3130	3 BBMB 3010 or 3160, or BBMB 4040 and 4050 the next year	3
STAT 1010 or 1040	3-4 Social Science	3
ENGL 2500	3 Humanities (CHHS) or elective	3
SPCM 2120	3 Elective *	2
	16-17	15
Third Year		
Fall	Credits Spring	Credits
BIOL 2550	3 BIOL 2560 and 2560L, or 3350	3-4
BIOL 2550L	1 FSHN 3610	2
FSHN 3600	3 FSHN 3620	3
FSHN 3420	3 Humanities/Social Sci. (CHHS) or elective (CALS) *	3
MICRO 2010 or 3020	2-3 Additional course from approved list **	3
MICRO 2010L or 3020L	1	
Elective *	3	
	16-17	14-15
Fourth Year		
Fall	Credits Spring	Credits
FSHN 4920	2 FSHN 4670	3
Additional course from approved list **	3 ENGL 3020, 3090, or 3140	3
Additional course from approved list **	3 U.S. Cultures and Communities (if not already taken) or elective *	3
Additional course from approved list **	1 Elective *	3-4
Elective *	3 Elective *	3
Elective *	3	
	15	15-16

FSHN 2030, FSHN 2420, FSHN 2670X, FSHN 3010, FSHN 3640, FSHN 3650, FSHN 3670, FSHN 4300, FSHN 4600, FSHN 4610, FSHN 4630, FSHN 4640, FSHN 4660, FSHN 4900C, FSHN 4990; NUTRS 5040; PHYS 1310 or PHYS 2310/PHYS 2310L; PHYS 1320 or PHYS 2320/PHYS 2320L.

Note: This sequence is only an example. The number of credits taken each semester should be based on the individual student's situation. Factors that may affect credit hours per semester include student ability, employment, health, activities, and grade point consideration.

More information on the Nutrition minor can be found here: <http://catalog.iastate.edu/collegeofagricultureandlifesciences/foodscienceandhumannutrition/#undergraduateminor>.

The Department of Food Science and Human Nutrition offers a Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) in Nutritional Sciences. More information can be found here: <https://www.grad-college.iastate.edu/academics/programs/apresults.php?id=84>.

Occupational Safety Certificate Undergraduate Certificate in Occupational Safety

The undergraduate certificate in Occupational Safety is designed to meet the needs of undergraduate students who are planning a career with management responsibilities (including safety), but are not planning on careers as safety professionals. This Certificate provides them with desired professional development and recognition of their increased professional knowledge and skills in the field of Occupational Safety.

Working professionals who have discovered that their career path has resulted in an increased focus on occupational safety, but do not have formal educational training in safety will also benefit from this structured safety curriculum. This certificate program prepares professionals, regardless of discipline, to effectively meet expected occupational safety responsibilities.

A professional with an Iowa State University Occupational Safety certificate will strengthen a company's ability to protect their workers from injuries and illnesses. This undergraduate certificate provides a way to give formal recognition of focused study in occupational safety that is less comprehensive than what is required for an undergraduate major.

The Department of Agricultural and Biosystems Engineering, with its nationally ranked education programs, is pleased to offer this Occupational Safety Certificate program to undergraduate students, graduate students, and working professionals. This certificate program is available on campus or entirely online via web-based interactions and streaming media.

20 Credits required.

* Choose elective courses to total equal to or greater than 120 credits.

** Select at least 10 additional credits from: BIOL 3140; CHEM 3320, CHEM 3320L; FSHN 2140 with lab (FSHN 1150 or FSHN 2150);

Students complete the following 14 credits of core courses:

TSM 2700	Principles of Injury Prevention and Safety	3
TSM 3700	Occupational Safety	3
TSM 3710	Occupational Safety Management	2
TSM 3720	Legal Aspects of Occupational Safety and Health	2
TSM 4700	Industrial Hygiene: Physical, Chemical, and Biological Hazards	3
TSM 4930D	Workshop in Technology: Occupational Safety	1-4

The remaining six credits will be selected from the following:

TSM 3760	Fire Protection and Prevention	3
TSM 4710	Safety Laboratory	1
TSM 4770	Risk Analysis and Management	3
TSM 3930F	Topics in Technology: Agricultural Safety and Health	1-4
HS 1050	First Aid and Emergency Care	2
HS 1100	Personal and Consumer Health	3
HS 3050	Instructor's First Aid and Cardiopulmonary Resuscitation	2
IE 2710	Applied Ergonomics and Work Design	3

A minimum of 9 credits applied towards the certificate cannot be used to meet any other departmental, college, or university requirement.

Courses taken for the certificate cannot be taken pass or not pass.

A grade of a 2.0 or better is required in each individual course applied towards the certificate.

Plant Pathology and Microbiology Undergraduate Study

The department participates in the interdepartmental undergraduate Microbiology major. See www.catalog.iastate.edu/collegeofagricultureandlifesciences/microbiology/ for more information.

Graduate Study

The department offers studies for the degrees master of science and doctor of philosophy with a major in plant pathology, and minor work for students majoring in other departments or programs. A master of science nonthesis option is available. The department also participates in the interdepartmental majors in microbiology; toxicology; genetics; plant biology; molecular, cellular, and developmental biology; ecology and evolutionary biology; and sustainable agriculture.

Students entering graduate programs in the department need a sound background in the physical, biological, and mathematical sciences as well as adequate preparation in English.

Graduates have a broad understanding of the biology and management of plant pathogenic microorganisms and the interactions of pathogens with their host plants. They understand the relationship between plant pathology and allied disciplines and are able to communicate effectively with scientific colleagues and the general public in both formal and informal settings. Graduates are able to address complex plant disease problems facing agricultural and bioscience professionals, taking into account the related ethical, social, legal, and environmental issues. They are skilled in research procedures, communicating research results, and writing concise and persuasive grant proposals.

Courses primarily for undergraduates:

MICRO 1010: Microbial World

Credits: 3. Contact Hours: Lecture 3.

Introduction to the importance of viruses, bacteria, fungi, archaea and parasites both to humans and to the biosphere. Topics include past and present microbial impact on humans and society, ecology and diversity of microbes, biotechnology and microbial impact on the biosphere.

Recommended: High School Biology. (Typically Offered: Fall)

MICRO 1100: Professional and Educational Preparation in Microbiology

Credits: 1. Contact Hours: Lecture 1.

An introduction to curriculum and research opportunities in microbiology at Iowa State. Topics include: easing the transition to life as a university student, development of specific goals, strengthening interpersonal communication, professional portfolio creation and resume building. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

MICRO 1150: Phage Discovery Lab

Credits: 2.

An exploratory laboratory where students will purify phage from soil, visualize phage using electron microscopy and isolate genomic material for nucleic acid sequencing. (Typically Offered: Fall)

MICRO 1160: Phage Genome Annotation Lab

Credits: 2. Contact Hours: Laboratory 4.

An experiential microbiology laboratory where students learn to annotate and submit a complete phage genome. MICRO 1150 recommended.

(Typically Offered: Spring)

MICRO 2010: Introduction to Microbiology

Credits: 2. Contact Hours: Lecture 2.

Prereq: One BIOL course except BIOL 1100, BIOL 1110, BIOL 1120, BIOL 1730, BIOL 2010, BIOL 3070

Selected topics in microbiology with emphasis on the relationship of microorganisms to human and animal health, agricultural technology, and the environment. With written petition to the chair of the supervisory committee, students who obtain a grade of B or better may substitute 2010 for MICRO 3020 in advanced courses. (Typically Offered: Fall, Spring)

MICRO 2010L: Introductory Microbiology Laboratory

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Credit or concurrent enrollment in MICRO 2010 or MICRO 3020

Basic microbiology laboratory techniques for non-microbiology majors.

Graduation Restriction: Credit for either MICRO 2010L or 3020L, but not both, may be applied toward graduation. (Typically Offered: Fall, Spring)

MICRO 2650: Predicting the Next Epidemic: Living in a One Health World

Credits: 2. Contact Hours: Lecture 2, Discussion 2.

8 week course. "One Health" concept as a relatively new approach to disease control, sustainability, and the consequences of environmental disruption. Interconnectedness of human, animal, and environmental health. Importance of scientists communicating with the general public about One Health topics, such as habitat loss, agricultural practices, and the spread of antibiotic resistant organisms. Recommended: High School Biology or Environmental Science. (Typically Offered: Fall, Spring)

MICRO 3020: Biology of Microorganisms

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or concurrent enrollment in BIOL 2110 or BIOL 2120; 3 credits of CHEM

Basic cell biology, physiology, metabolism, genetics and ecology of microorganisms, with an emphasis on prokaryotes and viruses, as well as the roles of microorganisms in the environment, disease, agriculture, and industry. (Typically Offered: Fall, Spring, Summer)

MICRO 3020L: Microbiology Laboratory

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Credit or concurrent enrollment in MICRO 2010 or MICRO 3020

Basic microbiology laboratory techniques for majors in microbiology, biological sciences and related fields. Graduation Restriction: Credit for either MICRO 2010L or 3020L, but not both, may be applied toward graduation. (Typically Offered: Fall, Spring)

MICRO 3100: Medical Microbiology

Credits: 3. Contact Hours: Lecture 3.

Prereq: MICRO 3020 (or MICRO 2010 if a B or better was obtained)

Study of infection by bacterial and viral pathogenic agents of humans with an overview of immune responses in controlling disease. (Typically Offered: Fall)

MICRO 3100L: Medical Microbiology Laboratory

Credits: 1. Contact Hours: Laboratory 3.

Prereq: (MICRO 2010 or MICRO 3020) AND (MICRO 2010L or MICRO 3020L) AND credit or concurrent enrollment in MICRO 3100

Microbiological tools and techniques to isolate, identify, and characterize medically significant microorganisms in relation to human diseases. Emphasis on the virulence factors of pathogenic organisms as compared to the normal flora. (Typically Offered: Fall)

MICRO 3200: Molecular and Cellular Bacteriology

Credits: 4. Contact Hours: Lecture 4.

Prereq: BIOL 3130; MICRO 3020; CHEM 3320

A systems perspective of bacterial growth, survival, and cellular differentiation by integrating physiological and genetic principles. Emphasis is on prokaryotes although unicellular eukaryotes are also discussed. Topics include the structure, function, and assembly of cell components, molecular and genomic techniques, bioenergetics and metabolism, regulation of gene expression, genetic adaptation, stress tolerance, biofilms, and cell-cell interactions and communications. (Typically Offered: Spring)

MICRO 3530: Introductory Parasitology

(Cross-listed with BIOL 3530/ VPTH 3530).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2120

Biology and host-parasite relationships of major groups of animal parasites, and techniques of diagnosing and studying parasites. (Typically Offered: Spring)

MICRO 3600: Global Health

(Cross-listed with GLOBE 3600/ VMPM 3600).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2110

Explores human health across the world with particular emphasis on low- and lower-middle-income countries. Attention is given to the interconnectedness of health determinants, problems, and solutions found in global health, including the role of animals and the environment. Broad in scope, highlighting different cultures and the historical foundations of global health. Topics include colonialism, poverty, emerging diseases, climate change, biodiversity, one health, maternal and child health, HIV, malaria, urbanization, noncommunicable diseases and more. Current events will be a feature of all class meetings. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

MICRO 3740: Insects and Our Health

(Cross-listed with ENT 3740).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 3 credits in Biological Sciences

Identification, biology, and significance of insects and arthropods that affect the health of humans and animals, particularly those that are vectors of disease. Meets International Perspectives Requirement. (Typically Offered: Spring)

MICRO 3740L: Insects and Our Health Laboratory

(Cross-listed with ENT 3740L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Credit or concurrent enrollment in ENT 3740 or MICRO 3740

Laboratory and field techniques for studying medical or public health entomology, including: collection, identification and maintenance of medically significant arthropods and experimental design and execution related to the biology of arthropods or arthropod-pathogen interactions. Offered even-numbered years. (Typically Offered: Spring)

MICRO 4020: Microbial Genetics and Genomics

(Dual-listed with MICRO 5020/ VMPM 5020). (Cross-listed with GEN 4020).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 3130; MICRO 3020

The fundamental concepts of bacterial and bacteriophage genetics including mutagenesis, mechanisms of vertical and horizontal genetic information transfer and gene regulation are covered, along with genetic and genomic-based approaches to study these and other cellular processes of microorganisms. Review and discussion of research literature to examine experimental design, methodology, and interpretation of both historical and contemporary relevance to microbial genetics and genomics. Offered even-numbered years. (Typically Offered: Fall)

MICRO 4070: Microbiological Safety of Foods of Animal Origins

(Dual-listed with FSHN 5070/ MICRO 5070). (Cross-listed with FSHN 4070).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MICRO 2010 or MICRO 3020

Examination of the various factors in the production of foods, from production through processing, distribution and final consumption which contribute to the overall microbiological safety of the food. Upon successful completion of this class, the student will receive both the Preventive Controls for Human Foods certificate (FDA program) and the International HACCP Alliance certificate (USDA-FSIS program). Recommended: FSHN 4200 or MICRO 4200 and one semester of Microbiology Laboratory. (Typically Offered: Fall, Spring)

MICRO 4080: Virology

Credits: 3. Contact Hours: Lecture 3.

Prereq: BBMB 3010 or BIOL 3130

The molecular virology and epidemiology of human, animal, plant and insect viruses. BIOL 3140 recommended. (Typically Offered: Fall)

MICRO 4190: Foodborne Hazards

(Cross-listed with FSHN 4190/ TOX 4190).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MICRO 2010 or MICRO 3020; 3 credits in BBMB

Pathogenesis of human microbiological foodborne infections and intoxications, principles of toxicology, major classes of toxicants in the food supply, governmental regulation of foodborne hazards. Assessed service-learning component. Offered even-numbered years. Graduation Restriction: Only one of FSHN 4190 and FSHN 5190 may count toward graduation. (Typically Offered: Spring)

MICRO 4200: Food Microbiology

(Cross-listed with FSHN 4200/ TOX 4200).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MICRO 2010 or MICRO 3020

Effects of microbial growth in foods. Methods to control, detect, and enumerate microorganisms in food and water. Foodborne infections and intoxications. (Typically Offered: Fall)

MICRO 4210: Food Microbiology Laboratory

(Cross-listed with FSHN 4210).

Credits: 3. Contact Hours: Lecture 1, Laboratory 5.

Prereq: MICRO 2010 or MICRO 3020; MICRO 2010L or MICRO 3020L. Credit or enrollment in FSHN/MICRO 4200

Standard techniques used for the microbiological examination of foods. Independent and group projects on student-generated questions in food microbiology. Emphasis on oral and written communication and group interaction. (Typically Offered: Spring)

MICRO 4280: Principles of Epidemiology and Population Health

(Dual-listed with VDPAM 5280/ VMPM 5280). (Cross-listed with VDPAM 4280/ VMPM 4280).

Credits: 3. Contact Hours: Lecture 3.

Epidemiology of disease in populations. Disease causality, observational study design and approaches to epidemiologic investigations. This course is available on campus and by distance. (Typically Offered: Spring)

MICRO 4300: Prokaryotic Diversity and Ecology

(Dual-listed with MICRO 5300). (Cross-listed with BBMB 4300).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MICRO 3020; MICRO 3020L

Survey of the diverse groups of prokaryotes emphasizing important and distinguishing metabolic, phylogenetic, morphological, and ecological features of members of those groups. Offered odd-numbered years.

(Typically Offered: Spring)

MICRO 4400: Laboratory in Microbial Physiology, Diversity, and Genetics

Credits: 4.

Prereq: MICRO 3020, MICRO 3020L, CHEM 3320, and BIOL 3130L

Fundamental techniques and theory for studying the cellular mechanisms, genetic processes and diversity of microbial life.

Experimental techniques will include isolation and physiological characterization of bacteria that inhabit different environments as well as an emphasis on genetic and molecular techniques to understand antibiotic resistance processes and mechanisms. Also included are techniques for phylogenetic characterization, measuring gene expression, and genetic manipulation of bacteria. Essential components for the effective communication of scientific results are also emphasized.

(Typically Offered: Fall, Spring)

MICRO 4500: Undergraduate Capstone Colloquium

Credits: 2. Contact Hours: Lecture 2.

Prereq: SPCM 2120; 20 credits in MICRO

Required of all undergraduate majors in microbiology. Students demonstrate mastery of core courses in microbiology through discussion of current literature in microbiology and immunology, issues in scientific conduct, and bioethics in microbiology. Students present current papers in a journal club format and gain experience in writing and reviewing grant proposals. This course is a capstone course and should be taken within the last two semesters. (Typically Offered: Spring)

MICRO 4510: Survey in Microbiology

Credits: Required. Contact Hours: Lecture 1.

Prereq: 12 credits in MICRO

Preparations for graduation. Topics include job search strategies, career information, mock interviews, graduate and professional school application processes and guidelines as well as outcomes assessment activities. (Typically Offered: Fall)

MICRO 4560: Principles of Mycology

(Cross-listed with BIOL 4560).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: 10 credits BIOL or MICRO

Morphology, diversity, and ecology of fungi; their relation to agriculture, industry, and human health. (Typically Offered: Fall)

MICRO 4750: Immunology

(Dual-listed with MICRO 5750/ VMPM 5750).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MICRO 3100

An examination of humoral and cellular immune function as well as the interaction of the cells and factors of the immune system that result in health and disease. MICRO 4750L optional. Graduation Restriction: Credit for either MICRO 4750 or VMPM 5200, but not both, may be applied to graduation. (Typically Offered: Spring)

MICRO 4750L: Immunology Laboratory

Credits: 2.

Prereq: Credits or concurrent enrollment in MICRO 3100 or MICRO 4750 or MICRO 5750

Techniques in primary culture and tumor cell growth, measures of lymphocyte function, serological techniques and flow cytometry. Half semester course. (Typically Offered: Spring)

MICRO 4770: Bacterial-Plant Interactions

(Dual-listed with MICRO 5770/ PLP 5770). (Cross-listed with PLP 4770).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 3 credits in MICRO or PLP

Overview of plant-associated bacteria including their ecology, diversity, and the physiological and molecular mechanisms involved with their interactions with plants. The course covers bacterial plant pathogens and pathogenesis, nitrogen fixation and plant symbioses, biological control and plant growth promotion, bacterial disease diagnosis and management, and approaches to the study of microbial communities in the rhizosphere and on leaves. Offered even-numbered years. (Typically Offered: Spring)

MICRO 4850: Soil and Environmental Microbiology

(Dual-listed with AGRON 5850/ ENSCI 5850/ MICRO 5850). (Cross-listed with ENSCI 4850/ AGRON 4850).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: AGRON 1820

The living organisms in the soil and what they do. Emphasis on soil biota composition, the carbon cycle and bioremediation, soil-plant-microbial relationships, and environmental issues. MICRO 2010; MICRO 2010L recommended. (Typically Offered: Fall)

MICRO 4870: Microbial Ecology

(Dual-listed with EEOB 5870/ ENSCI 5870/ GEOL 5870/ MICRO 5870).

(Cross-listed with ENSCI 4870/ GEOL 4870/ BIOL 4870).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 6 credits in Biology and 6 credits in Chemistry

Introduction to major functional groups of autotrophic and heterotrophic microorganisms and their roles in natural and environmental systems.

Consequences of microbial activity on water chemistry, weathering, and precipitation/dissolution reactions will be emphasized. (Typically Offered: Fall)

MICRO 4900A: Independent Study: Laboratory Research

Credits: 1-3. Repeatable.

Prereq: 6 credits of 3000-level credit MICRO; Permission of Instructor

Graduation Restriction: A maximum of 6 credits of MICRO 4900 may be used toward the total of 128 credits required for graduation. (Typically Offered: Fall, Summer)

MICRO 4900B: Independent Study: Literature Review

Credits: 1-3. Repeatable.

Prereq: 6 credits of 3000-level credit MICRO; Permission of Instructor

Graduation Restriction: A maximum of 6 credits of MICRO 4900 may be used toward the total of 128 credits required for graduation. (Typically Offered: Fall, Summer)

MICRO 4900C: Independent Study: Instructional Assistant

Credits: 1-3. Repeatable.

Prereq: 6 credits of 3000-level credit MICRO; Permission of Instructor

Graduation Restriction: A maximum of 6 credits of MICRO 4900 may be used toward the total of 128 credits required for graduation. (Typically Offered: Fall, Summer)

MICRO 4900G: Independent Study: General

Credits: 1-3. Repeatable.

Prereq: 6 credits of 3000-level credit MICRO; Permission of Instructor

Graduation Restriction: A maximum of 6 credits of MICRO 4900 may be used toward the total of 128 credits required for graduation. (Typically Offered: Fall, Summer)

MICRO 4900H: Independent Study: Honors

Credits: 1-5. Repeatable, maximum of 6 credits.

Prereq: 6 credits of 3000-level credit MICRO; Permission of Instructor;

Membership in the University Honors Program

Graduation Restriction: A maximum of 6 credits of MICRO 4900 may be used toward the total of 128 credits required for graduation. (Typically Offered: Fall, Spring, Summer)

MICRO 4950: Internship

Credits: 1-2. Repeatable.

Prereq: 6 credits of 3000-level credit MICRO; Permission of Instructor

Participation in the Cooperative Extension Intern Program or an equivalent work experience. Written report of activities required. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

Courses primarily for graduate students, open to qualified undergraduates:**MICRO 5020: Microbial Genetics and Genomics**

(Dual-listed with MICRO 4020/ GEN 4020). (Cross-listed with VMPM 5020).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (BIOL 3130 and MICRO 3020) or Graduate Classification

The fundamental concepts of bacterial and bacteriophage genetics including mutagenesis, mechanisms of vertical and horizontal genetic information transfer and gene regulation are covered, along with genetic and genomic-based approaches to study these and other cellular processes of microorganisms. Review and discussion of research literature to examine experimental design, methodology, and interpretation of both historical and contemporary relevance to microbial genetics and genomics. Offered even-numbered years. (Typically Offered: Fall)

MICRO 5070: Microbiological Safety of Foods of Animal Origins

(Dual-listed with FSHN 4070/ MICRO 4070). (Cross-listed with FSHN 5070).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MICRO 4200 or Graduate Classification

Examination of the various factors in the production of foods, from production through processing, distribution and final consumption which contribute to the overall microbiological safety of the food. Upon successful completion of this class, the student will receive both the Preventive Controls for Human Foods certificate (FDA program) and the International HACCP Alliance certificate (USDA-FSIS program). Recommended: FSHN 4200 or MICRO 4200 and one semester of Microbiology Laboratory. (Typically Offered: Fall, Spring)

MICRO 5090: Plant Virology

(Cross-listed with PLP 5090).

Credits: 2. Contact Hours: Lecture 1, Discussion 1.

Prereq: (BBMB 3010 or BIOL 3130) or Graduate Classification

Taxonomy, molecular mechanisms, host-interactions, vector transmission, epidemiology, detection, control and exploitation of plant viruses. Course will consist of a mixture of lectures, and student-led presentations using primary literature. Offered odd-numbered years. (Typically Offered: Spring)

MICRO 5170: Gut Microbiome: Implications for Health and Diseases

(Cross-listed with ANS 5170/ FSHN 5170/ VMPM 5170).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 2-3 credits in microbiology and/or immunology.

Explore current research on gut microbiome including modern tools used to study the gut microbiome. Examine the linkages between gut microbiome and health status, diseases, and manipulation of gut microbiome to improve health. (Typically Offered: Fall)

MICRO 5250: Intestinal Microbiology

(Cross-listed with VMPM 5250).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Overview of commensal microbiota in the health and well-being of vertebrates. Topics include diversity of intestinal structure, microbial diversity/function, innate immune development, community interactions and metabolic diseases associated with alterations of the intestinal microbiome. Offered even-numbered years. (Typically Offered: Spring)

MICRO 5300: Prokaryotic Diversity and Ecology

(Dual-listed with MICRO 4300). (Cross-listed with BBMB 5300).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (MICRO 3020 and MICRO 3020L) or Graduate Classification

Survey of the diverse groups of prokaryotes emphasizing important and distinguishing metabolic, phylogenetic, morphological, and ecological features of members of those groups. Offered odd-numbered years. (Typically Offered: Spring)

MICRO 5400: Livestock Immunogenetics

(Cross-listed with ANS 5400/ VMPM 5400).

Credits: 2. Contact Hours: Lecture 2.

Prereq: ANS 5610 or MICRO 5750 or VMPM 5200 or Graduate Classification

Basic concepts and contemporary topics in genetic regulation of livestock immune response and disease resistance. Offered odd-numbered years. (Typically Offered: Spring)

MICRO 5510: Microbial Diversity and Phylogeny

Credits: 1. Contact Hours: Lecture 1.

Prereq: (BIOL 3130 and MICRO 3020) or Graduate Classification

Comparisons among the three kingdoms of life (Bacteria, Archaea, and Eukarya). Topics will include metabolism, adaptation, methods of phylogenetic analysis, and comparative genomics. (Typically Offered: Fall)

MICRO 5520: Bacterial Molecular Genetics and Physiology

Credits: 1. Contact Hours: Lecture 1.

Prereq: (BIOL 3130 and MICRO 3020) or Graduate Classification

Review of genetics and selected physiological topics of model bacteria. (Typically Offered: Fall)

MICRO 5530: Pathogenic Microorganisms

Credits: 1. Contact Hours: Lecture 1.

Prereq: (BIOL 3130 and MICRO 3020) or Graduate Classification

Review and contrast/comparison of common bacterial pathogens of plants and animals and their mechanisms of virulence, including toxins, protein secretion, host invasion and iron acquisition strategies. An overview of eukaryotic cell biology that is relevant to pathogenesis will also be included. (Typically Offered: Fall)

MICRO 5540: Virology

Credits: 1. Contact Hours: Lecture 1.

Prereq: (BIOL 3130 and MICRO 3020) or Graduate Classification

Introduction to virus life cycles including entry, gene expression strategies, replication, and mechanisms to modify and overcome host defenses. The roles of specific viruses and sub-viral agents in animal and plant disease will also be included. (Typically Offered: Spring)

MICRO 5550: Fungal Biology

Credits: 1. Contact Hours: Lecture 1.

Prereq: (GEN 3130 or GEN 3200) or Graduate Classification

Ecology, genetics, physiology and diversity of fungi, from yeasts to mushrooms, and their importance in human affairs. (Typically Offered: Spring)

MICRO 5560: Ecology of Microorganisms

Credits: 1. Contact Hours: Lecture 1.

Prereq: (BIOL 3130 and MICRO 3020) or Graduate Classification

The study of microorganisms in their natural environments, with a focus on terrestrial and aquatic ecosystems, including eukaryotic hosts; interactions within biofilms and communities, including intercellular communication and symbioses; microbial adaptations to extreme environments; and metagenomic, genomic, molecular and microscopy techniques for the study of microbes in natural systems. (Typically Offered: Spring)

MICRO 5750: Immunology

(Dual-listed with MICRO 4750). (Cross-listed with VMPM 5750).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MICRO 3100 or Graduate Classification

An examination of humoral and cellular immune function as well as the interaction of the cells and factors of the immune system that result in health and disease. MICRO 4750L optional. Graduation Restriction: Credit for either MICRO 4750 or VMPM 5200, but not both, may be applied to graduation. (Typically Offered: Spring)

MICRO 5770: Bacterial-Plant Interactions

(Dual-listed with MICRO 4770/ PLP 4770). (Cross-listed with PLP 5770).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (3 credits in MICRO or PLP) or Graduate Classification

Overview of plant-associated bacteria including their ecology, diversity, and the physiological and molecular mechanisms involved with their interactions with plants. The course covers bacterial plant pathogens and pathogenesis, nitrogen fixation and plant symbioses, biological control and plant growth promotion, bacterial disease diagnosis and management, and approaches to the study of microbial communities in the rhizosphere and on leaves. Offered even-numbered years. (Typically Offered: Spring)

MICRO 5850: Soil and Environmental Microbiology

(Dual-listed with AGRON 4850/ ENSCI 4850/ MICRO 4850). (Cross-listed with ENSCI 5850/ AGRON 5850).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: AGRON 1820 or graduate standing

The living organisms in the soil and what they do. Emphasis on soil biota composition, the carbon cycle and bioremediation, soil-plant-microbial relationships, and environmental issues. MICRO 2010; MICRO 2010L recommended. (Typically Offered: Fall)

MICRO 5860: Medical Bacteriology

(Cross-listed with VMPP 5860).

Credits: 4. Contact Hours: Lecture 4.

Prereq: MICRO 3100 or Graduate Classification

Bacteria associated with diseases of vertebrates, including virulence factors and interaction of host responses. Concurrent students need to register for 5860L. (Typically Offered: Fall)

MICRO 5870: Microbial Ecology

(Dual-listed with BIOL 4870/ ENSCI 4870/ GEOL 4870/ MICRO 4870).

(Cross-listed with ENSCI 5870/ GEOL 5870/ EEOB 5870).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to major functional groups of autotrophic and heterotrophic microorganisms and their roles in natural and environmental systems. Consequences of microbial activity on water chemistry, weathering, and precipitation/dissolution reactions will be emphasized. (Typically Offered: Fall)

MICRO 5900: Special Topics

Credits: 1-5. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

Courses for graduate students:

MICRO 6040: Seminar

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Course will expose students to the breadth of subdisciplines within microbiology, offer opportunities for direct interaction between the students and the faculty members within the Interdepartmental Microbiology Graduate Program, and promote interactions among the students within the program. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

MICRO 6080: Molecular Virology

(Cross-listed with VMPP 6080/ PLP 6080).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BBMB 4050 or GDCB 5110

Advanced study of virus host-cell interactions. Molecular mechanisms of viral replication and pathogenesis. Offered even-numbered years. (Typically Offered: Fall)

MICRO 6150: Molecular Immunology

(Cross-listed with BBMB 6150/ VMPP 6150).

Credits: 3. Contact Hours: Lecture 3.

Current topics in molecular aspects of immunology: T and B cell receptors; major histocompatibility complex; antibody structure; immunosuppressive drugs and viruses; and intracellular signaling pathways leading to expression of genes that control and activate immune function. Offered odd-numbered years. (Typically Offered: Fall)

MICRO 6250: Mechanisms of Bacterial Pathogenesis

(Cross-listed with VMPP 6250).

Credits: 3. Contact Hours: Lecture 3.

Review of current concepts in specific areas of microbial pathogenesis including the genetic basis for bacterial disease, genetic regulation and control of virulence factors and their mechanisms of action, and host-pathogen interactions at the cellular and molecular levels. The application of microbial genetics to understanding pathogenesis will be included. Offered odd-numbered years. (Typically Offered: Spring)

MICRO 6260: Advanced Food Microbiology

(Cross-listed with FSHN 6260/ TOX 6260).

Credits: 3. Contact Hours: Lecture 3.

Prereq: FSHN 4200 or FSHN 4210 or FSHN 5040

Topics of current interest in food microbiology, including new foodborne pathogens, rapid identification methods, effect of food properties and new preservation techniques on microbial growth, and mode of action of antimicrobials. Offered odd-numbered years. (Typically Offered: Spring)

MICRO 6900A: Current Topics: Microbiology

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Instructor Permission for Course

Colloquia or advanced study of specific topics in a specialized field.

(Typically Offered: Fall, Spring, Summer)

MICRO 6900B: Current Topics: Immunology

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Colloquia or advanced study of specific topics in a specialized field.

(Typically Offered: Fall, Spring, Summer)

MICRO 6900C: Current Topics: Infectious Diseases

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Colloquia or advanced study of specific topics in a specialized field.

(Typically Offered: Fall, Spring, Summer)

MICRO 6920: Molecular Biology of Plant-Pathogen Interactions

(Cross-listed with PLP 6920).

Credits: 3. Contact Hours: Lecture 3.

Seminar and current research in molecular and physiological aspects of plant interactions with pathogens, including mechanisms of pathogenesis, host-pathogen recognition and host defense, with an emphasis on critical evaluation of primary literature. Students also complete a research proposal writing and peer review exercise. Offered odd-numbered years. (Typically Offered: Spring)

MICRO 6970: Graduate Research Rotation

Credits: 1-30. Contact Hours: Laboratory 30.

Repeatable.

Graduate research projects performed under the supervision of selected faculty members in the Interdepartmental Microbiology major. (Typically Offered: Fall, Spring)

MICRO 6980: Seminar in Molecular, Cellular, and Developmental Biology

(Cross-listed with BBMB 6980/ GDCB 6980/ MCDB 6980/ VMPM 6980).

Credits: 1-2. Contact Hours: Lecture 2.

Repeatable.

Student and faculty presentations. (Typically Offered: Spring)

MICRO 6990: Research

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Courses primarily for undergraduates:

PLP 4080: Principles of Plant Path

(Dual-listed with PLP 5080).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Principles underlying the nature, diagnosis, and management of plant diseases. Laboratory complements lecture topics and provides experience in plant disease diagnosis. (Typically Offered: Fall, Spring)

PLP 4160: Forest Insects and Diseases

(Cross-listed with FOR 4160).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Nature of insects and pathogens of forest and shade trees; their role in the dynamics of natural and managed forest ecosystems; and the management of indigenous and exotic pests. Laboratory experience working with insect and fungal pests of trees. (Typically Offered: Fall)

PLP 4520: Integrated Management of Diseases and Insect Pests of Turfgrasses

(Dual-listed with PLP 5520/ ENT 5520/ HORT 5520). (Cross-listed with ENT 4520/ HORT 4520).

Credits: 3. Contact Hours: Lecture 3.

Prereq: HORT 3510

Identification and biology of important diseases and insect pests of turfgrasses. Development of integrated pest management programs in various turfgrass environments. Offered even-numbered years. (Typically Offered: Spring)

PLP 4770: Bacterial-Plant Interactions

(Dual-listed with MICRO 5770/ PLP 5770). (Cross-listed with MICRO 4770).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 3 credits in MICRO or PLP

Overview of plant-associated bacteria including their ecology, diversity, and the physiological and molecular mechanisms involved with their interactions with plants. The course covers bacterial plant pathogens and pathogenesis, nitrogen fixation and plant symbioses, biological control and plant growth promotion, bacterial disease diagnosis and management, and approaches to the study of microbial communities in the rhizosphere and on leaves. Offered even-numbered years. (Typically Offered: Spring)

PLP 4900A: Independent Study: Plant Pathology

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: 7 credits in BIOL; Junior or Senior classification; Permission of Instructor

Graduation Restriction: A maximum of 6 credits of PLP 4900 may be used toward the total of 128 credits required for graduation. (Typically Offered: Fall, Spring, Summer)

PLP 4900H: Independent Study: Honors

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: 7 credits in BIOL; Junior or Senior classification; Permission of Instructor; Membership in the University Honors Program

Graduation Restriction: A maximum of 6 credits of PLP 4900 may be used toward the total of 128 credits required for graduation. (Typically

Offered: Fall, Spring, Summer)

PLP 4940: Seed Pathology

(Dual-listed with PLP 5940). (Cross-listed with STB 4940).

Credits: 2. Contact Hours: Lecture 2.

Prereq: PLP 4080

Significance of biotic and abiotic diseases that affect the production and utilization of seeds, during each phase of the seed life cycle: growing, harvesting, conditioning, storing, and planting seed. Mechanisms of seed infection and seed-to-seedling transmission are considered for fungi, bacteria, viruses/viroids, and nematodes. Aspects of epidemiology, management, and host-pathogen relationships are discussed. Emphases include the role of seed health testing in the global seed industry for quality control and phytosanitary certification, as well as the use of seed treatments to manage seedborne and soilborne pathogens and pests.

Concurrent enrollment in PLP 4940L/5940L (Seed Pathology Laboratory) is strongly encouraged (on-campus students only). Graduation

Restriction: Credit may not be obtained for both PLP/STB 5920 and PLP 5940. Offered odd-numbered years. (Typically Offered: Fall)

PLP 4940L: Seed Pathology Laboratory

(Dual-listed with PLP 5940L). (Cross-listed with STB 4940L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: PLP 4080

Laboratory in seed pathology. Seed health testing methods; effects of seed treatments and seed conditioning on seedborne pathogens. Offered odd-numbered years. (Typically Offered: Fall)

Courses primarily for graduate students, open to qualified undergraduates:

PLP 5060: Plant-Pathogen Interactions

Credits: 2. Contact Hours: Lecture 2.

Prereq: (BIOL 3130 and PLP 4080 or PLP 4160) or Graduate Classification

Introduction to mechanisms of plant-parasite interaction. Genetics and molecular genetics of plant disease resistance and pathogenicity. Offered odd-numbered years. (Typically Offered: Spring)

PLP 5080: Principles of Plant Path

(Dual-listed with PLP 4080).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Principles underlying the nature, diagnosis, and management of plant diseases. Laboratory complements lecture topics and provides experience in plant disease diagnosis. (Typically Offered: Fall, Spring)

PLP 5090: Plant Virology

(Cross-listed with MICRO 5090).

Credits: 2. Contact Hours: Lecture 1, Discussion 1.

Prereq: (BBMB 3010 or BIOL 3130) or Graduate Classification

Taxonomy, molecular mechanisms, host-interactions, vector transmission, epidemiology, detection, control and exploitation of plant viruses. Course will consist of a mixture of lectures, and student-led presentations using primary literature. Offered odd-numbered years. (Typically Offered: Spring)

PLP 5110: Integrated Management of Tropical Crops

(Cross-listed with ENT 5110/ HORT 5110).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (ENT 3700 or ENT 3760 or HORT 2210 or PLP 4080 or PLP 4160) or Graduate Classification

Applications of Integrated Crop management principles (including plant pathology, entomology, and horticulture) to tropical cropping systems. Familiarization with a variety of tropical agroecosystems and Costa Rican culture is followed by a 10-day tour of Costa Rican agriculture during spring break, then writeup of individual projects. Offered odd-numbered years. Meets International Perspectives Requirement. (Typically Offered: Spring)

PLP 5120: Lifestyles of plant pathogenic fungi and oomycetes.

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Exploration of the major groups of plant pathogenic fungi and oomycetes, focusing on the diseases they cause as well as pathogen ecology, diagnosis, crop resistance, and fungicide resistance. Offered odd-numbered years. (Typically Offered: Spring)

PLP 5300: Ecologically Based Pest Management Strategies

(Cross-listed with AGRON 5300/ ENT 5300/ SUSAG 5300).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Durable, least-toxic strategies for managing weeds, pathogens, and insect pests, with emphasis on underlying ecological processes. Offered odd-numbered years. (Typically Offered: Fall)

PLP 5430: Ecology and Epidemiology of Plant Diseases

Credits: 3. Contact Hours: Lecture 3.

Prereq: (PLP 4080 or PLP 4160) or graduate classification

Nutter. Theory and practice related to the ecology and epidemiology of plant disease epidemics. Interactions among host and pathogen populations as affected by the environment are quantified with respect to time and space. Analysis of ecological and host and pathogen genetic factors that alter the course of plant disease epidemics. Risk assessment theory, disease forecasting, and modeling the impact of biotic plant stresses on yield and quality are also emphasized. Offered odd-numbered years. (Typically Offered: Fall)

PLP 5520: Integrated Management of Diseases and Insect Pests of Turfgrasses

(Dual-listed with PLP 4520/ ENT 4520/ HORT 4520). (Cross-listed with ENT 5520/ HORT 5520).

Credits: 3. Contact Hours: Lecture 3.

Prereq: HORT 3510 or Graduate Classification

Identification and biology of important diseases and insect pests of turfgrasses. Development of integrated pest management programs in various turfgrass environments. Offered even-numbered years. (Typically Offered: Spring)

PLP 5740: Plant Nematology

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Morphology, anatomy, identification, management, and life cycles of common plant-parasitic nematodes; host parasite interactions; recent advances in plant nematology. Offered odd-numbered years. (Typically Offered: Fall)

PLP 5740L: Laboratory Techniques in Plant Nematology

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Practical skills of sample collection, processing, extraction, and identification of plant-parasitic nematodes from soil and roots; other techniques will be discussed. Offered odd-numbered years. (Typically Offered: Fall)

PLP 5770: Bacterial-Plant Interactions

(Dual-listed with MICRO 4770/ PLP 4770). (Cross-listed with MICRO 5770).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (3 credits in MICRO or PLP) or Graduate Classification

Overview of plant-associated bacteria including their ecology, diversity, and the physiological and molecular mechanisms involved with their interactions with plants. The course covers bacterial plant pathogens and pathogenesis, nitrogen fixation and plant symbioses, biological control and plant growth promotion, bacterial disease diagnosis and management, and approaches to the study of microbial communities in the rhizosphere and on leaves. Offered even-numbered years. (Typically Offered: Spring)

PLP 5810: Experience in Plant Science Extension and Outreach

(Cross-listed with AGRON 5810/ ENT 5810/ HORT 5810).

Credits: 1.

Prereq: Graduate Standing or Permission of Instructor

A supervised learning experience in several extension delivery methods used in the plant sciences. Participation in Iowa State University-based extension programs that may include field crops horticulture, or Master Gardener programming. Offered odd-numbered years. (Typically Offered: Summer)

PLP 5900: Special Topics

Credits: 1-3. Repeatable.

Prereq: 10 credits in biological sciences, Permission of Instructor
(Typically Offered: Fall, Spring, Summer)

PLP 5920: Seed Health Management

(Cross-listed with STB 5920).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Occurrence and management of diseases during seed production, harvest, conditioning, storage, and planting. Emphasis on epidemiology, disease management in the field, seed treatment, effects of conditioning on seed health, and seed health testing. Graduation Restriction: Credit may not be obtained for both PLP/STB 5920 and PLP 5940. Offered even-numbered years. (Typically Offered: Spring)

PLP 5940: Seed Pathology

(Dual-listed with PLP 4940). (Cross-listed with STB 5940).

Credits: 2. Contact Hours: Lecture 2.

Prereq: PLP 4080 or Graduate Classification

Significance of biotic and abiotic diseases that affect the production and utilization of seeds, during each phase of the seed life cycle: growing, harvesting, conditioning, storing, and planting seed. Mechanisms of seed infection and seed-to-seedling transmission are considered for fungi, bacteria, viruses/viroids, and nematodes. Aspects of epidemiology, management, and host-pathogen relationships are discussed. Emphases include the role of seed health testing in the global seed industry for quality control and phytosanitary certification, as well as the use of seed treatments to manage seedborne and soilborne pathogens and pests. Concurrent enrollment in PLP 4940L/5940L (Seed Pathology Laboratory) is strongly encouraged (on-campus students only). Graduation Restriction: Credit may not be obtained for both PLP/STB 5920 and PLP 5940. Offered odd-numbered years. (Typically Offered: Fall)

PLP 5940L: Seed Pathology Laboratory

(Dual-listed with PLP 4940L). (Cross-listed with STB 5940L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: PLP 4080 or Graduate Classification

Laboratory in seed pathology. Seed health testing methods; effects of seed treatments and seed conditioning on seedborne pathogens. Offered odd-numbered years. (Typically Offered: Fall)

PLP 5990: Creative Component

Credits: 1-30. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Independent study related to the student's area of specialization and approved by the student's major professor. (Typically Offered: Fall, Spring, Summer)

Courses for graduate students:**PLP 6080: Molecular Virology**

(Cross-listed with MICRO 6080/ VMPM 6080).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BBMB 4050 or GDCB 5110

Advanced study of virus host-cell interactions. Molecular mechanisms of viral replication and pathogenesis. Offered even-numbered years. (Typically Offered: Fall)

PLP 6280: Improving Professional Presentation Skills

Credits: 2. Contact Hours: Lecture 2.

Skill building to improve oral presentation fundamentals for graduate students in biological sciences. Principles and guidance in both personal speaking style and maximizing impact of presentation software. In-depth lectures and class discussions on all aspects of presentation skills. Video and anonymous peer review of individual speeches. (Typically Offered: Spring)

PLP 6910: Field Plant Pathology

Credits: 2. Contact Hours: Laboratory 6.

Repeatable.

Prereq: (PLP 4080 or PLP 4160) or graduate classification

Diagnosis of plant diseases, plant disease assessment methods, and the integration of disease management into commercial crop production practices. Objectives are to familiarize students with common diseases of Midwest crops and landscape plants, and to provide experience in disease diagnosis. Field trips include commercial operations, agricultural research facilities, and ornamental plantings. Offered even-numbered years. (Typically Offered: Summer)

PLP 6920: Molecular Biology of Plant-Pathogen Interactions

(Cross-listed with MICRO 6920).

Credits: 3. Contact Hours: Lecture 3.

Seminar and current research in molecular and physiological aspects of plant interactions with pathogens, including mechanisms of pathogenesis, host-pathogen recognition and host defense, with an emphasis on critical evaluation of primary literature. Students also complete a research proposal writing and peer review exercise. Offered odd-numbered years. (Typically Offered: Spring)

PLP 6940: Colloquium in Plant Pathology

Credits: 2. Contact Hours: Lecture 2.

Repeatable.

Advanced topics in plant pathology, including biological control, cultural control, resistance gene deployment, genetic engineering for disease resistance, chemical control, integrated pest management, emerging diseases, fungal genetics, insect vector biology, professional communications, etc. (Typically Offered: Spring)

PLP 6980: Seminar

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

PLP 6990: Thesis and Dissertation Research

Credits: 1-30. Repeatable.

Thesis and dissertation research. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

Sustainable Agriculture

Interdepartmental Graduate Major

The Sustainable Agriculture interdepartmental major is offered through faculty in 21 departments – Agricultural and Biosystems Engineering; Agricultural Education and Studies; Agronomy; Animal Science; Civil, Construction and Environmental Engineering; Community and Regional Planning; Ecology, Evolution and Organismal Biology; Economics; Entomology; Food Science and Human Nutrition; Horticulture; Industrial and Manufacturing Systems Engineering; Journalism and Mass Communication; Landscape Architecture; Mechanical Engineering; Natural Resource Ecology and Management; Plant Pathology; Political Science; Sociology; World Languages and Cultures and Veterinary Diagnostic and Production Animal Medicine. Faculty in these departments cooperate to offer courses and direct research leading to M.S. and Ph.D. degrees with a major in Sustainable Agriculture.

The Sustainable Agriculture major is designed to balance depth in disciplinary knowledge and perspectives with broader, systems-level thinking. It integrates technical and social sciences through a sequence of team-taught interdisciplinary core courses emphasizing higher-order critical thinking skills and active, collaborative approaches to learning. Students learn agroecological principles, study social relations underlying sustainable farming and food systems, and gain experience with practical techniques of sustainable agriculture.

Applicants applying to the M.S. program must have a bachelor's degree in one of the life, social, or engineering sciences, or a bachelor's degree plus equivalent experience in these areas. Applicants applying to the Ph.D. program must have a master's degree and either an undergraduate or master's degree in one of the majors in the College of Agriculture and Life Sciences or its equivalent.

Graduates of the program will be able to design and manage agricultural systems that increase food security, enhance human communities, and protect environmental quality. Graduates of the program are qualified to work in a variety of settings, including university research, education, extension, agribusiness, governmental and non-governmental organizations, and farming.

Information on application procedures (<https://susag.iastate.edu/admissions/>), curriculum requirements (<https://susag.iastate.edu/academics/>), and faculty research areas (<https://www.susag.iastate.edu/people/faculty/>) is available on the Sustainable Agriculture website (<https://susag.iastate.edu/>).

Courses primarily for graduate students, open to qualified undergraduates:

SUSAG 5090: Agroecosystems Analysis

(Cross-listed with AGRON 5090/ SOC 5090).

Credits: 4. Contact Hours: Lecture 3, Laboratory 4.

Prereq: Graduate Standing or Permission of Instructor

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

SUSAG 5150: Integrated Crop and Livestock Production Systems

(Cross-listed with ABE 5150/ AGRON 5150/ ANS 5150).

Credits: 3. Contact Hours: Lecture 3.

Prereq: SUSAG 5090 or Graduate Classification

Methods to maintain productivity and minimize the negative ecological effects of agricultural systems by understanding nutrient cycles, managing manure and crop residue, and utilizing multispecies interactions. Crop and livestock production within landscapes and watersheds is also considered. Course includes a significant field component, with student teams analyzing Iowa farms. Offered odd-numbered years. (Typically Offered: Fall)

SUSAG 5300: Ecologically Based Pest Management Strategies

(Cross-listed with AGRON 5300/ ENT 5300/ PLP 5300).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Durable, least-toxic strategies for managing weeds, pathogens, and insect pests, with emphasis on underlying ecological processes. Offered odd-numbered years. (Typically Offered: Fall)

SUSAG 5440: Sociology of Food and Agricultural Systems

(Dual-listed with SOC 4440). (Cross-listed with SOC 5440).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate classification

Social organization of food and fiber production, processing, and distribution systems. Sociological comparison of conventional and alternative production systems; gender roles in agriculture and food systems; local, national and global food systems; perspectives on food and agricultural research and policy. Offered even-numbered years. (Typically Offered: Fall)

SUSAG 5460: Strategies for Diversified Food and Farming Systems

(Cross-listed with AGRON 5460/ HORT 5460).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Project-focused engagement in food and farming systems using tools and perspectives drawn from multiple disciplines. Includes a field component. Offered odd-numbered years. (Typically Offered: Spring)

SUSAG 5490: Sociology of the Environment

(Cross-listed with SOC 5490).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Social causes and social consequences of environmental problems.
Interrelationship between social inequality and environmental inequality.
Social construction and social experience of the environment.
Contemporary developments in the social theory of the environment.
International and domestic implications.

SUSAG 5710: Agroforestry Systems

(Dual-listed with NREM 4710/ SUSAG 4710). (Cross-listed with NREM 5710).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Concepts of sustainable land use, agroecological dynamics, and component interactions of agroforestry systems. Agroforestry systems in temperate and tropical regions. Design and evaluation techniques for agroforestry systems. Ecological, socioeconomic and political aspects of agroforestry. Offered even-numbered years. Meets International Perspectives Requirement. (Typically Offered: Spring)

SUSAG 5840: Organic Agricultural Theory and Practice

(Dual-listed with AGRON 4840/ HORT 4840/ SUSAG 4840). (Cross-listed with HORT 5840/ AGRON 5840).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Understanding of the historical origins and ecological theories underpinning the practices involved in organic agriculture.
Interdisciplinary examination of crop and livestock production and socio-economic processes and policies in organic agriculture from researcher and producer perspectives. Offered odd-numbered years. (Typically Offered: Spring)

SUSAG 5900: Special Topics

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

For students wishing to conduct in-depth study of a particular topic in sustainable agriculture. (Typically Offered: Fall, Spring, Summer)

SUSAG 5990: Creative Component

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Pre-enrollment contract required. For MS students pursuing the non-thesis degree option. Final product is a creative component. (Typically Offered: Fall, Spring, Summer)

Courses for graduate students:

SUSAG 6000: Sustainable Agriculture Colloquium

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Weekly seminar for graduate students in the Sustainable Agriculture program. (Typically Offered: Fall, Spring)

SUSAG 6100: Foundations of Sustainable Agriculture

(Cross-listed with ABE 6100/ AGRON 6100/ ANTHR 6100/ SOC 6100).

Credits: 3. Contact Hours: Lecture 3.

Historical, biophysical, socioeconomic, and ethical dimensions of agricultural sustainability. Strategies for evaluating existing and emerging agricultural systems in terms of the core concepts of sustainability and their theoretical contexts. (Typically Offered: Fall)

SUSAG 6990: Research

Credits: 1-30. Repeatable.

Prereq: Department Permission for Course

MS and PhD thesis and dissertation research. (Typically Offered: Fall, Spring, Summer)

IVY COLLEGE OF BUSINESS

David Spalding, Dean

Valentina Salotti, Associate Dean for Academic Affairs

Huifang Mao, Interim Associate Dean for Research and Academic Personnel

<https://www.ivybusiness.iastate.edu/>

Curriculum in Business

The Ivy College of Business strives to provide a high-quality professional education in business. Such an education should provide the student with: (1) an appreciation of the evolution of the profession and an awareness of the ethical, global, technological, economic, political and social forces shaping its future; (2) an understanding of the major functional areas of business with the opportunity for specialization for a career in business; (3) an ability to recognize and appreciate the effect of diversity in the work place; (4) an opportunity for advanced study.

A comprehensive education in business includes a broad foundation in the liberal arts, courses in the major functional areas of business activity, proficiency in analytical methods, and the ability to identify problems and arrive at logical solutions. In addition, a professional education is designed to inspire students to assume business and community leadership.

The curriculum in business is accredited by AACSB International, the Association to Advance Collegiate Schools of Business.

Organization of Curriculum

The undergraduate curriculum in business is divided into three areas: general education, foundational courses, and a core major. The general education program provides a broad spectrum of liberal arts coursework. The foundational business requirements provide a framework for business coursework. The last area includes two parts: (1) the business core which provides a common body of knowledge in all the functional areas in business, and (2) a major area of study. The twelve majors offered for the degree Bachelor of Science (B.S.) are accounting, actuarial science, business analytics, business economics, entrepreneurship, finance, healthcare management, human resource management, management, management information systems, marketing, and supply chain management. The college also offers the Bachelor of Business Administration (BBA) online degree completer program.

Curriculum Changes

Iowa State University students who want to change their curriculum to the Ivy College of Business should contact the Undergraduate Student Services Office for assistance. For more details on changing curriculum or majors, please visit: <https://catalog.iastate.edu/academics/#degreeplanningtext>. Students on Academic Probation will not be

allowed to change curriculum to the Ivy College of Business during enrollment period three. See Making Schedule Changes at: <http://catalog.iastate.edu/registration/#schedulechangestext>. (<http://catalog.iastate.edu/registration/#schedulechangestext>)

Academic Standards and Graduation Requirements

Policies for students enrolled in the Ivy College of Business may be obtained at <https://www.ivybusiness.iastate.edu/life-at-ivy/academic-services/undergraduate-student-services/academic-advising/> or from the Undergraduate Student Services Office in the Ivy College of Business.

Students are responsible for knowing and adhering to these Ivy College of Business policies as well as the university regulations found in this catalog. The following policies are in effect for students graduating from a professional curriculum in business with a B.S. degree under the 2025 catalog:

1. A minimum of 122 semester credits are required for Bachelor's of Science degrees.
2. At least 50 percent of the required business credits must be earned at Iowa State. All 3000 level and higher business credits must be earned at a four-year institution.
3. Cumulative ISU grade point average of at least 2.0 with no quality point deficiencies.
4. The major departments reserve the right to determine the appropriate section of the degree program to which transfer credits will be assigned.
5. No more than two transfer classes can be applied to the major.
6. Students must achieve communication proficiency by earning a grade of C or better in ENGL 2500, and one additional C or better from either ENGL 1500 or ENGL 3020.
7. A student must earn a grade of C or higher in a minimum of 30 credits applied to the business core and the major.
8. A student must earn at least 42 credits of 3000 level and higher coursework from a four-year institution.
9. Business majors may not take business courses Pass-Not Pass (P/NP).
10. General education and supporting courses may not be taken P/NP.
11. No more than 9 elective credits may be taken P/NP.
12. The last 32 credits applied for graduation must be taken at ISU. A waiver for Study Abroad and Internship/Co-ops may be granted.

Advising System

Each student in the Ivy College of Business has an assigned academic advisor who helps facilitate student progress toward graduation while supporting the academic standards of the College.

Advisors, as part of the Undergraduate Student Services Office staff, provide academic services to Business students including development of academic plans, study abroad planning, accessing pertinent University services and resources, and meeting their overall educational objectives.

The College encourages students to attend an orientation program prior to their entry, where information is shared and evaluated to help set the student out on the academic path appropriate to their goals, preparation, interests, and capabilities.

Honors

Entering freshmen who meet the criteria will be invited to apply for membership in the Freshman Honors Program by the University Honors Program. For more information on the University Honors Program, please visit: <https://www.ivybusiness.iastate.edu/life-at-ivy/get-involved/honors-program/>. (<https://www.ivybusiness.iastate.edu/life-at-ivy/get-involved/honors-program/>)

Currently enrolled students who have completed 12 graded credits at Iowa State University, earned a cumulative GPA of 3.50 or above, and have more than 48 credit hours remaining until graduation, are eligible to apply for membership to the University Honors Program (UHP). UHP students in the Ivy College of Business will work with designated advisors to incorporate elements of breadth, depth, and leadership into their business education through completion of academic, co-curricular, and personal/professional development experiences. In addition, to graduate with Honors in the Ivy College of Business, students must complete a minimum of two honors-designated courses, two 3000-level honors seminars, an honors project, 50 credits of 3000-level or higher coursework, and maintain a cumulative GPA of 3.50 or above. Additional details of requirements can be found on the Ivy College of Business Honors website at: <https://www.ivybusiness.iastate.edu/life-at-ivy/get-involved/honors-program/>. (<https://www.ivybusiness.iastate.edu/life-at-ivy/get-involved/honors-program/>)

Internships

Credit and non-credit internships in business may be approved for Ivy College of Business students in all majors. Credit hours and requirements vary, although internship credits only count as general electives.

Arrangements must be made in the college prior to the beginning of the internship. A career coordinator from the Business Career Services Office will assist students in making these arrangements.

Multiple Majors

Undergraduates pursuing a degree in the Ivy College of Business may complete additional majors in the Ivy College of Business. * Those desiring additional majors outside the college should refer to the catalog section of the appropriate college and department for the additional major requirements. A multiple major in business economics and

agricultural business or economics is not permitted. A major in business economics with a minor in economics is not permitted.

Undergraduates with a primary major outside the Ivy College of Business who want a second major in business must complete the following requirements: Foundation, Supporting Courses, Business Core, and major requirements. (Refer to the current Curriculum Guide).

All students pursuing multiple majors or multiple degrees within the Ivy College of Business are required to have a minimum of 15 credits of coursework in each major that is not used in the other majors.

Students are limited to three business majors/degrees/certificates/minors within the Ivy College of Business. This limit is on business majors/degrees/certificates/minors only and does not apply to multiple majors/degrees/certificates/minors taken outside the Ivy College of Business.

** BBA students cannot double major or earn a double degree in a business area. However, they may work towards a double degree in another college at Iowa State. Online minors and online certificates outside of the Ivy College of Business could be added to the BBA if desired. Consult with an advisor in the Undergraduate Student Services Office for assistance in identifying online minor options.*

Minors and certificates

Minor in International Business

Students with a major in the Ivy College of Business may earn a minor in International Business by completing 15 credits of approved coursework. The minor requires one course from the approved International Overview courses, two courses from the approved Business Focus courses, and by completing the faculty-led Global Awareness track, or the Foreign Language Global Awareness track, or through a plan of study approved by the Ivy International Programs Office. The minor must include at least six credits in courses numbered 3000 or above taken at Iowa State University with a grade of C or higher. The minor must include at least 3 credits that are not used to meet any other department, college, or university requirement. Students with declared majors have priority over students with declared minors in courses with space constraints.

Minor in Business and Technology Consulting

The Department of Marketing offers a specialty minor open to any undergraduate student at Iowa State University. The Business and Technology Consulting minor prepares you for a career as a business consultant. Every year consulting companies attract talented graduates across the world. As a consultant, you gain broad exposure to business issues, solve different business problems, make an impact on major businesses, and become an expert in a specific business functional area. The minor provides a systematic process for students to

strengthen problem-solving skills and prepare them to become better communicators and future leaders.

The minor requires 15 credits from an approved list of courses, including at least 6 credits in courses numbered 3000 or above taken at Iowa State University with a grade of C or higher. The minor must include at least 3 credits that are not used to meet any other department, college, or university requirement. Students with declared majors have priority over students with declared minors in courses with space constraints.

Minors for Business Students

Students with a major in the Ivy College of Business (excluding BBA students[^]) may qualify for a minor specialization in one of the college's departments. Minor specializations are available in: Accounting, Business Analytics, Entrepreneurship (see Entrepreneurship Cross-Disciplinary Minor below), Finance, International Business (see Minor in International Business above), Management, Management Information Systems, Marketing, and Supply Chain Management. These minors require at least 15 credit hours in the minor specialization (16 credit hours are required for a minor in accounting), 3 hours of which may not be used to satisfy any other department, college, or university requirement. The minor must include at least 6 credits in courses numbered 3000 or above taken at Iowa State University with a grade of C or higher. Students with declared majors have priority over students with declared minors in courses with space constraints.

Students are limited to three business majors/degrees/certificates/minors within the Ivy College of Business. This limit is on business majors/degrees/certificates/minors only and does not apply to multiple majors/degrees/certificates/minors taken outside the Ivy College of Business.

[^] BBA students can add online minors and online certificates offered outside the Ivy College of Business. Consult with an advisor in the Undergraduate Student Services Office for assistance in identifying online minor options.

Minor in General Business for Non-Business Students

The Ivy College of Business offers a structured minor in general business to students outside the College. The minor requires a minimum of 15 credits, not including pre-requisite courses. Requirements for the minor are:

Required Courses (6 credits):

ACCT 2840	Financial Accounting	3
ACCT 2850	Managerial Accounting	3
or ACCT 2150	Legal Environment of Business	

Elective Courses (9 credits):

Select three courses from the following list:

ENTSP 3100	Entrepreneurship and Innovation	3
FIN 3010	Principles of Finance	3

MIS 3010	Management Information Systems	3
MKT 3400	Principles of Marketing	3
MGMT 3700	Managing Organizations	3
SCM 3010	Supply Chain Management	3

The minor must include at least 6 credits in courses numbered 3000 or above taken at Iowa State University. A "C" average or better is required in courses used to satisfy the minor requirements. All requirements for the minor must be taken for a grade. Students with a major outside the Ivy College of Business are eligible for a general business minor or a minor in business and technology consulting only. They may not receive any other specific minor from a business department.

For more information on the General Business minor, please visit: <https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/minors-and-certificates/>. (<https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/minors-and-certificates/>)

Undergraduate Certificates

Healthcare Management Certificate

The Department of Management and Entrepreneurship offers a certificate in healthcare management that is open to all Iowa State University students. The certificate provides students with access to the same sort of robust, interdisciplinary curriculum that comprises the major in a more approachable format. Students will still learn valuable healthcare management skills and knowledge that complements their primary area of study. Built around a foundation of four required classes, the certificate includes elective courses from a wide variety of healthcare-related programs across campus, making it synergistic for students from a wide variety of majors. For students who want to work in a healthcare related field and do not want to major in healthcare management, earning the healthcare management certificate provides a recognizable credential that can help position them for success upon graduation and beyond.

Students need to fulfill the course prerequisites set by the Ivy College of Business. The certificate requires 20 credits (minimum) from a designated list of courses.

For more information about the Healthcare Management Certificate, please visit: <https://catalog.iastate.edu/collegeofbusiness/healthcaremanagement/#undergraduatecertificatetext>.

Professional Sales Certificate

The certificate in professional sales is a course of study administered by the Department of Marketing in the Ivy College of Business. It is designed for all undergraduate majors who wish to enhance their degree and employment possibilities by adding expertise in professional selling. The certificate program will equip students with knowledge and skills related to developing and managing mutually beneficial relationships

with customers. The certificate program is built on a strong theoretical background but emphasizes applications and practice. The certificate provides students with an opportunity to learn about the ethical, technological, analytical, and global aspects of professional sales.

Students need to fulfill the course prerequisites set by the Ivy College of Business. The certificate requires 21 credits from a designated list of courses.

For more information about the Professional Sales Certificate, please visit: <https://catalog.iastate.edu/collegeofbusiness/marketing/#undergraduatecertificatetext>. (<https://catalog.iastate.edu/collegeofbusiness/marketing/#undergraduatecertificatetext>)

Risk Management and Insurance Certificate

The Certificate in Risk Management and Insurance (RMI) is a course of study administered by the Department of Finance in the Ivy College of Business. The certificate will give students, regardless of major or college, a deeper understanding of personal and corporate risk management and of the insurance industry. The certificate will allow students with an interest in risk management and insurance to signal their expertise and focused study to potential employers.

Students need to fulfill the course prerequisites set by the Ivy College of Business. The certificate requires 21 credits from a designated list of courses.

For more information about the Certificate in Risk Management and Insurance, please visit: <https://catalog.iastate.edu/collegeofbusiness/finance/#undergraduatecertificatetext>.

Students are limited to three business majors/degrees/certificates/minors within the Ivy College of Business. This limit is on business majors/degrees/certificates/minors only and does not apply to multiple majors/degrees/certificates/minors taken outside the Ivy College of Business.

Actuarial Science Certificate

The certificate in actuarial science is available from the *College of Liberal Arts and Sciences* for non-actuarial science majors at Iowa State. The certificate requires 23 credits from a designated list of courses. There are 7 prerequisite courses required for the certificate's required courses.

For more information about the Actuarial Science Certificate, please visit: <https://catalog.iastate.edu/collegeofbusiness/actuarialscience/#certificatetext>. (<https://catalog.iastate.edu/collegeofbusiness/actuarialscience/#certificatetext>)

Entrepreneurship Cross-Disciplinary Minor

The Ivy College of Business participates in a university-wide minor in Entrepreneurship. This minor is available to any undergraduate student. Requirements for the minor include, ENTSP 3100 Entrepreneurship and Innovation (3 credits), either ENTSP 3130 Feasibility Analysis for New Ventures or ENTSP 3200 Corporate Entrepreneurship or ENTSP 4100 Social Entrepreneurship (3 credits), two business-oriented electives from an approved list (6 credits), and an experiential learning component (3 credits). The approved list of courses is available at: <https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/minors-and-certificates/entrepreneurship-minor/>. (<https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/minors-and-certificates/entrepreneurship-minor/>) The minor requires at least 15 credits, including at least 6 credits in courses numbered 3000 or above taken at Iowa State University with a grade of C or higher. The minor must include at least 3 credits that are not used to meet any other department, college, or university requirement.

Non-degree Seeking Students

Students who wish to take courses in the Ivy College of Business, but are not seeking an undergraduate degree, should apply to the college as non-degree seeking students.

Departments of the College

- Accounting (<https://www.ivybusiness.iastate.edu/about-ivy/academic-departments/accounting/>)
- Finance (<https://www.ivybusiness.iastate.edu/about-ivy/academic-departments/finance/>)
- Information Systems and Business Analytics (<https://www.ivybusiness.iastate.edu/about-ivy/academic-departments/information-systems-and-business-analytics/>)
- Management and Entrepreneurship (<https://www.ivybusiness.iastate.edu/about-ivy/academic-departments/management-and-entrepreneurship/>)
- Marketing (<https://www.ivybusiness.iastate.edu/about-ivy/academic-departments/marketing/>)
- Supply Chain Management (<https://www.ivybusiness.iastate.edu/about-ivy/academic-departments/supply-chain-management/>)

Curriculum in Business

The college offers programs of study leading to the degree Bachelor of Science with a major in accounting, actuarial science, business analytics, business economics, entrepreneurship, finance, healthcare management, human resource management, management, management information systems, marketing, or supply chain management.

The college also offers a degree completer program leading to a Bachelor of Business Administration (BBA). Total credits required: 120.

See also: A 4-year (8 semester) plan of study for each business degree.

Business Curriculum

For Actuarial Science curriculum, please go to: <https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/actuarial-science/>. (<https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/actuarial-science/>)

For BBA curriculum, please go to: <https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/bachelor-of-business-administration/>. (<https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/bachelor-of-business-administration/>)

For all Business majors, students may apply 9 P-NP credits of free electives; must earn an overall 2.00 minimum GPA; and apply only 65 credits from a 2-year institution, which may include up to 16 technical credits.

International Perspective: 3 cr. (see footnote 3 below)

U.S. Cultures and Communities: 3 cr. (see footnote 4 below)

Communication: 13 cr.

Proficiency met with grade of C or better in ENGL 2500, and one additional C or better from either ENGL 1500 or ENGL 3020.

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
ENGL 3020	Business Communication	3
SPCM 3120	Business and Professional Speaking	3
LIB 1600	Introduction to College Level Research	1

Humanities/Social Science: 9 cr.

9 cr. from approved humanities/social science list.

Global Perspectives: 6 cr. (see footnote 3 below)

6 cr. from approved global perspectives list.

Natural Science: 3 cr.

3 cr. from approved natural sciences list.

An approved list of the general education courses above are available at: <https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/general-education-requirements/> or from the Undergraduate Student Services Office in the Ivy College of Business.

Foundation: 20 cr.

BUSAD 1020	Business Learning Team Orientation	1
	or BUSAD 1030 Orientation	
BUSAD 2030	Professional Development in Business	1

MATH 1500	Discrete Mathematics for Business and Social Sciences ^{1, 2}	3
COMS 1130	Introduction to Spreadsheets and Databases	3
ECON 1010	Principles of Microeconomics	3
ECON 1020	Principles of Macroeconomics	3
STAT 2260	Introduction to Business Statistics I	3
ACCT 2840	Financial Accounting	3
Total Credits		20

Supporting Courses: 9-13 cr.

NOTE: Additional supporting courses are required for Actuarial Science.

See <https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/actuarial-science/> for specific requirements for Actuarial Science.

MATH 1510	Calculus for Business and Social Sciences ¹	3
ACCT 2150	Legal Environment of Business	3
ACCT 3010	The Accounting Cycle (For ACCT majors only) ¹	1
MIS 2070	Fundamentals of Programming for Business and Analytics (For MIS majors only) ¹	3
STAT 3260	Introduction to Business Statistics II (For ACCT, BUSAN, BUSEC, and FIN majors only) ¹	3
PHIL 2300	Moral Theory and Practice	3

Business Core: 27 cr.

ACCT 2850	Managerial Accounting	3
ENTSP 3100	Entrepreneurship and Innovation	3
FIN 3010	Principles of Finance	3
MIS 3010	Management Information Systems	3
MGMT 3710	Organizational Behavior	3
MGMT 3720	Ethical and Responsible Management	3
MKT 3400	Principles of Marketing	3
SCM 3010	Supply Chain Management	3
MGMT 4780	Strategic Management *	3
Total Credits		27

*Must have credit or enrollment in all core courses listed above, except for MGMT 3720, plus senior standing, in order to enroll in MGMT 4780.

BUSINESS MAJOR: 18-24 cr. (depending on major)

ELECTIVES: 0-17 cr. (depending on major)

FootNotes:

¹ Accounting, Business Analytics, Business Economics, and Finance majors will also take STAT 3260 Introduction to Business Statistics II as part of the supporting courses. Business Economics majors will take MATH 1600 Survey of Calculus and ECON 2070 Applied Economic Optimization instead of MATH 1500 Discrete Mathematics for Business

and Social Sciences and MATH 1510 Calculus for Business and Social Sciences. Accounting majors will take ACCT 3010 The Accounting Cycle concurrently with ACCT 2850 Managerial Accounting as part of the Supporting Courses. Management Information Systems majors will take MIS 2070 Fundamentals of Programming for Business and Analytics as part of the Supporting Courses.

² Students not adequately prepared in mathematics may have to take a supplemental course in addition to courses listed above.

³ Students may satisfy the Global/International Perspectives requirement by taking six credit hours from the University International Perspectives list.

⁴ Courses used for the U.S. Cultures and Communities requirements may also be used to fulfill Humanities/Social Sciences.

Professional Programs

The Ivy College of Business and the curriculum in accounting are accredited by AACSB International, the Association to Advance Collegiate Schools of Business.

Accounting major: 24 cr.

<https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/accounting/>

Actuarial Science major: 23 cr.

<https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/actuarial-science/>

Business Analytics major: 21 cr.

<https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/business-analytics/>

Business Economics major: 19 cr.

<https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/business-economics/>

Entrepreneurship major: 18 cr.

<https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/entrepreneurship/>

Finance major: 21 cr.

<https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/finance/>

Healthcare Management major: 24 cr.

<https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/healthcare-management/>

Human Resource Management Major: 21 cr.

<https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/human-resource-management/>

Management major: 18 cr.

<https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/management/>

Management Information Systems major: 18 cr.

<https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/management-information-systems/>

Marketing major: 18 cr.

<https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/marketing/>

Supply Chain Management major: 18 cr.

<https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/supply-chain-management/>

International Business *Secondary* major: 18 cr.

The secondary major in International Business will be discontinued Fall 2025 pending Board of Regents State of Iowa approval.

<https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/international-business/>

Bachelor of Business Administration degree: 21 cr.

<https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/bachelor-of-business-administration/>

Bachelor of Science

The Bachelor of Science (B.S.) degree offers a high-quality professional education in business. It prepares students for professional careers in specialized functions of business and government. Candidates for this degree must satisfy the requirements established by the Ivy College of Business and also the requirements for individual majors specified by the departments of the College. All candidates for the B.S. degree are required to complete one of the following majors: accounting, actuarial science, business analytics, business economics, entrepreneurship, finance, healthcare management, human resource management, management, management information systems, marketing, or supply chain management.

Majors

Accounting

Actuarial Science

Business Analytics

Business Economics

Entrepreneurship

Finance

Healthcare Management

Human Resource Management

International Business (second major only)

Management

Management Information Systems

Marketing
Supply Chain Management

Degree Completer Program:

Bachelors of Business Administration (BBA) (online degree completer program)

Minors

For Business Majors Only

Accounting
Business Analytics
Business and Technology Consulting
Entrepreneurship
Finance
International Business
Management
Management Information Systems
Marketing
Supply Chain Management

For Non-Business Majors

Business and Technology Consulting (<http://catalog.iastate.edu/collegeofbusiness/marketing/#undergraduateminortext>)

General Business Minor

Entrepreneurship

Certificates

For any ISU major

Healthcare Management Certificate (<https://catalog.iastate.edu/collegeofbusiness/healthcaremanagement/#undergraduatecertificatetext>)

Professional Sales Certificate

Risk Management and Insurance Certificate

Real Estate Certificate

GRADUATE STUDY

Master's Programs

Ten programs are offered at the master's level: a Master of Business Administration (MBA), a Professional Master of Business Administration (PMBA), a Master of Accounting (MAcc), a Master of Accounting Analytics (MAA), a Master of Business Analytics (MBAN), a Master of Entrepreneurship (MEP), a Master of Finance (MFIN), a Master's in

Healthcare Analytics and Operations (MHAO), a Master of Real Estate Development (MRED), and a Master of Science in Information Systems (MSIS). These programs are intended to meet distinct sets of educational objectives.

Master of Business Administration (MBA)

The Master of Business Administration (MBA) is the professional management education program for those pursuing careers in business. The goal of the MBA program is to educate future business leaders preparing them for the challenges of tomorrow by giving them the vision, knowledge, skills, and confidence to make the best decisions for all involved stakeholders. The MBA program consists of a 48-credit curriculum leading to a non-thesis, non-creative component Master of Business Administration. Students may pursue a specialization in accounting, accounting analytics, business analytics, entrepreneurship, finance, healthcare analytics and operations, information systems, leadership, marketing, real estate, or supply chain management.

The Ivy College of Business also offers a business administration graduate minor to students with majors outside the college. For more information on the graduate minor in business administration, please visit: <https://www.ivybusiness.iastate.edu/academics/graduate-programs/graduate-minor/>. (<https://www.ivybusiness.iastate.edu/academics/graduate-programs/graduate-minor/>)

A concurrent BS/MBA is available to eligible engineering undergraduate students majoring in aerospace, agricultural, biological systems, chemical, civil, computer, construction, cybersecurity, electrical, industrial, materials science, mechanical, or software engineering. A concurrent BS/MBA is available to eligible undergraduate students majoring in agricultural systems technology, agronomy, animal science, chemistry, computer science, food science, geology, industrial design, industrial technology, and meteorology.

Double master's degree programs are offered with accounting (MBA/MAcc), architecture (MBA/MArch), business analytics (MBA/MBAN), community and regional planning (MBA/MCRP), entrepreneurship (MBA/MEP), finance (MBA/MFIN), healthcare analytics and operations (MBA/MHAO), information systems (MBA/MSIS), and real estate development (MBA/MRED).

Earn a Master of Business (MBA) and a Doctor of Veterinary Medicine degree (DVM) at the same time through our concurrent MBA program partnership with the College of Veterinary Medicine.

Professional Master of Business Administration (PMBA)

The professional Master of Business Administration (PMBA) is the professional management education program for those pursuing careers in business. The goal of the PMBA program is to educate future business leaders preparing them for the challenges of tomorrow by giving them the vision, knowledge, skills, and confidence to make the best decisions

for all involved stakeholders. The PMBA program consists of a 42-credit curriculum leading to a non-thesis, non-creative component professional Master of Business Administration. Students may pursue a specialization in accounting, accounting analytics, business analytics, entrepreneurship, finance, healthcare analytics and operations, information systems, leadership, marketing, real estate, or supply chain management.

Double master's degree programs are offered with accounting (PMBA/MAcc), business analytics (PMBA/MBAN), entrepreneurship (PMBA/MEP), healthcare analytics and operations (PMBA/MHAO), and real estate development (PMBA/MRED).

Multiple concurrent degree programs are offered between the Ivy College of Business and other Colleges at ISU. The concurrent degree programs allow qualified students to be admitted to a master's program while completing their undergraduate degree. Students can double count up to 6 credits of coursework between the degrees, allowing them to complete both a Bachelor of Science and a master's degree in as little as five years. The concurrent degree programs offered include:

- B.S. Accounting (ACCT) and Master of Accounting (MAcc)
- B.S. Business Analytics (BUSAN) and Master of Business Analytics (MBAN)
- B.S. Business Analytics (BUSAN) and Master of Science in Information Systems (MSIS)
- B.S. Finance (FIN) and Master of Finance (MFIN)
- B.S. Management Information Systems (MIS) and Master of Science in Information Systems (MSIS)
- B.S. Management Information Systems (MIS) and Master of Business Analytics (MBAN)
- B.S. Software Engineering (SE) and Master of Science in Information Systems (MSIS)

For more information on the concurrent Bachelors and master's programs offered through the Ivy College, please visit: <https://www.ivybusiness.iastate.edu/academics/graduate-programs/concurrent-degree-options/>.

Master of Accounting (MAcc)

The Master of Accounting (MAcc) program is designed to equip students for successful careers in both public and private accounting. Program curriculum focuses on interpreting and analyzing accounting information to drive informed decision-making, while also preparing students for certification as a Certified Public Accountant (CPA) or Certified Management Accountant (CMA). The 30-credit hour program requires a variety of graduate-level accounting courses, including core courses in data analytics and communication. Students can tailor their education by choosing from specialized tracks in Financial Reporting and Assurance, Information Systems and Analytics, Tax, or Managerial Decision Making.

Additionally, the program offers six credits dedicated to helping students prepare for their certification exam.

Master of Accounting Analytics (MAA)

The Master of Accounting Analytics (MAA) is designed to meet the demand for accounting professionals with advanced business analytics expertise. The MAA program curriculum provides a deep dive into a comprehensive selection of accounting and business analytics topics focusing on interpreting and analyzing accounting information for decision-making. The 30-hour program is delivered entirely in an online asynchronous format, allowing students to complete their coursework from anywhere and work at their own pace. The MAA program is ideal for working professionals seeking to further their education while remaining on the job and for those looking to further their education and enter the workforce with an in-demand special set of skills.

Master of Business Analytics (MBAN)

The Master of Business analytics (MBAN) is an interdisciplinary program that addresses the challenges of dealing with data analytics and business intelligence in the "Big Data" environment. The goal is to develop managers who will master analytics in ways that lead to increased profits for their company. The program, offered both online or in-person, offers a comprehensive approach that draws from Business, Computer Science, Electrical and Computer Engineering, Statistics, and Industrial and Manufacturing Systems Engineering. It provides a foundation in data analytics project management, statistical and predictive modeling, consumer sentiment analysis, knowledge discovery, analytical reporting, segmentation analysis and data visualization. The program requires 30 credits of graduate level courses over a 21-month period.

A certificate in business analytics is also available for working professionals. The certificate requires a minimum of 12 graduate level approved credits, which may be taken either on-line or face-to-face. For more information on the graduate certificate in business analytics, please visit: <http://catalog.iastate.edu/collegeofbusiness/businessanalytics/#graduatecertificatetext>. (<http://catalog.iastate.edu/collegeofbusiness/businessanalytics/#graduatecertificatetext>)

Master of Finance (MFIN)

The Master of Finance (MFIN) is designed to provide students with in-depth coverage of financial topics and a strong quantitative skill set. Students will learn financial analysis, valuation, modeling, and risk management techniques. The 30-credit program requires 24 finance credits, of which 6 are finance electives. The remaining 6 credits are electives selected from any related area.

A certificate in finance is also available. The certificate requires a minimum of 12 graduate level approved credits, which may only be taken face-to-face. For more information on the graduate certificate in finance,

please visit: <http://catalog.iastate.edu/collegeofbusiness/finance/#graduatecertificatetext>.

Masters in Healthcare Analytics and Operations (MHAO)

Graduates of the Master's in Healthcare Analytics and Operations (MHAO) program will leverage data and advanced analytical models to evaluate operations and supply chains, generating actionable insights that enhance outcomes in the healthcare sector. This program emphasizes the use of both historical and real-time data to identify trends and optimize processes, ultimately benefiting patients, healthcare professionals, and supply chain partners alike. With a requirement of 30 credit hours, the program is delivered entirely online, making it an excellent choice for full-time professionals in the healthcare industry. The MHAO program curriculum aligns with the competencies required for the Certified Health Data Analyst (CHDA) exam.

Master of Real Estate Development (MRED)

The Master of Real Estate Development (MRED) is a 30-credit non-thesis, non-creative component program. The MRED program offers academic training, networking opportunities and collaboration with leading academics and practitioners to solve real world problems. Areas of study include real estate market analysis, finance, investments, leadership and negotiation, fundamentals of the build environment, construction science and urban planning. The curriculum is offered in a convenient format of distance learning and brief campus residencies, making it ideal for the full-time working professional.

Master of Science in Information Systems (MSIS)

The Master of Science in information systems (MSIS) is designed to provide students with strong technical skills and a broad background in business needed to effectively develop and manage information systems projects. Using the latest software, students will apply information systems theory and concepts to modern information systems development. The 30-credit program includes business foundation courses, information systems core courses and electives, and a research requirement (creative component).

A certificate in enterprise cybersecurity management is also available. The certificate requires a minimum of 12 graduate level approved credits, which may be taken either on-line or face-to-face. For more information on the graduate certificate in enterprise cybersecurity management, please visit: <http://catalog.iastate.edu/collegeofbusiness/managementinformationssystem/#graduatecertificatetext>.

A certificate in supply chain management is also available. The certificate requires a minimum of 12 graduate level approved credits, which may only be taken on-line. For more information on the graduate certificate in supply chain management, please visit: <http://catalog.iastate.edu/collegeofbusiness/supplychainmanagement/#graduatecertificatetext>.

Master of Entrepreneurship (MEP)

The Master of Entrepreneurship (MEP) is designed to provide students with the knowledge, skills, and practical experience to prepare student to start and manage new business ventures independently — or within an established organization. Students will develop and practice the primary entrepreneurial skills needed to identify and evaluate market opportunities and think creatively to formulate and implement successful strategies for moving a business idea forward. The 30-credit program requires both core and elective credit in addition to experiential components.

A certificate in entrepreneurship and innovation is also available. The certificate requires a minimum of 12 graduate level approved credits, which may be taken either on-line or face-to-face. For more information on the graduate certificate in entrepreneurship and innovation, please visit: <http://catalog.iastate.edu/collegeofbusiness/entrepreneurship/#graduatecertificatetext>.

A certificate in Digital Marketplace Analytics is offered by the Ivy College of Business and the College of Health and Human Sciences. The 15-credit certificate, which incorporates coursework from both colleges, provides an innovative program for individuals who want to build their data analytics skills and to apply analytics tools to problem-solving in the fashion, events, and hospitality industries. For more information on the graduate certificate in digital marketplace analytics, please visit: <http://catalog.iastate.edu/collegeofbusiness/businessanalytics/#graduatecertificatetext>. (<http://catalog.iastate.edu/collegeofbusiness/businessanalytics/#graduatecertificatetext>)

The Ivy College of Business participates in the following graduate level interdepartmental programs: Cyber Security, Engineering Management, Human Computer Interaction, and Seed Technology and Business.

PhD in Business and Technology

The Ivy College of Business offers graduate work leading to the Doctor of Philosophy degree in business and technology, with one of six specializations—entrepreneurship (ENTSP), finance, (FIN), information systems and business analytics (ISBA), management (MGMT), marketing (MKT), or supply chain management (SCM). Departments in the college (Finance, Management and Entrepreneurship, Marketing, Supply Chain Management, and Information Systems and Business Analytics), along with select other departments from across campus cooperate in providing coursework toward this degree. The program prepares individuals for academic careers in research, teaching, and public service at institutions of higher learning in the United States and other countries. The program consists of seminars in content areas, statistics, and research methodology in the first two years. After passing comprehensive exams, students will focus on their dissertation.

The standard length of this 74-credit program is five years. All work, including the dissertation, must be done in residence (on campus).

For more details or application information contact the Graduate Programs office in the Ivy College of Business or visit: <https://www.ivybusiness.iastate.edu/academics/phd-program/>. (<https://www.ivybusiness.iastate.edu/academics/phd-program/>)

Accounting

Accountants are the business leaders in corporations and governments who manage, analyze, and explain complex information. Accountants are at the forefront of data analytics and lead the planning, evaluating, controlling, and reporting of activities in an entity.

The major in accounting is designed to give students a conceptual foundation, developing their financial acumen and analytical skills for use in every facet of business. Students who complete the accounting major are well prepared for careers in industry, government, and the public accounting profession.

Accountants both provide and explain useful financial information to internal users (such as managers in a company) and external users (such as investors, creditors, government officials, and the general public). Accounting is an integral part of the management of business and government organizations. Accounting information is needed by external users to make investment decisions, to grant or withhold credit, and in the case of government, to collect revenue and gather statistical information. To provide useful information, accountants collect, analyze, synthesize, and communicate data in an understandable manner.

The curriculum in accounting is accredited by AACSB International, the Association to Advance Collegiate Schools of Business.

Undergraduate Major in Accounting

For undergraduate curriculum in business, major in accounting.

The Department of Accounting offers a major in accounting. Students will complete the general education requirements (including business foundation courses), supporting courses/major prerequisites, business core requirements for the Bachelor of Science (B.S.) degree, and 24 additional credits in the major.

The instructional objective of the Accounting Program is to provide a well-rounded professional education in accounting. Such an education should provide the student with:

1. A mastery of basic accounting concepts.
2. An ability to solve accounting problems and analyze accounting issues utilizing critical thinking.

3. An ability to communicate effectively and work with others as a member of a team.
4. An awareness and sensitivity for dealing with ethical concerns.

For more information on the undergraduate major in accounting, please visit: <https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/accounting/>. (<https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/accounting/>)

Student Learning Outcomes

Upon graduation, undergraduate students majoring in accounting will:

1. Learners will possess fundamental accounting knowledge.
2. Learners will be effective communicators.
3. Learners will be critical thinkers.
4. Learners will be skilled in the use of information technology.
5. Learners will be effective team members.
6. Learners will be ethical decision makers.

Curriculum:

In addition to the basic business degree requirements (<https://catalog.iastate.edu/collegeofbusiness/#curriculuminbusiness>), the requirements for the accounting major are met by successful completion of the following courses:

Required Courses (18 credits):

ACCT 3830	Intermediate Managerial Accounting	3
ACCT 3840	Accounting Information Systems and Analytics	3
ACCT 3860	Intermediate Financial Accounting I	3
ACCT 3870	Intermediate Financial Accounting II	3
ACCT 4850	Principles of Federal Income Tax	3
ACCT 4970	Introduction to Auditing	3

Elective Courses (6 credits):

Select six credit hours from the following list:

ACCT 3150	Business Data Streams and Issues	3
ACCT 4010	Financial Management for Healthcare Organizations	3
ACCT 4160	Business Law *	3
ACCT 4420X	Generative AI in Business Decision-Making	3
ACCT 4610	Entrepreneurship and Accounting Information	3
ACCT 4830	Application and Communication in Managerial Accounting	3
ACCT 4840	Advanced Accounting Information Systems	3
ACCT 4870	Volunteer Income Tax Assistance	3
ACCT 4880	Governmental and Non-profit Institution Accounting	3

ACCT 4890	Corporate Social Responsibility Reporting	3
ACCT 4930	Corporate Taxation	3
ACCT 4950	Advanced Financial Accounting Problems	3
ACCT 4960	Accounting in the Global Economy	3
ACCT 4980	Accounting Communication and Analysis	3

* ACCT 4160 Business Law does not count towards the CPA exam requirements.

NOTE: Accounting majors must take ACCT 3010 The Accounting Cycle and STAT 3260 Introduction to Business Statistics II as part of the supporting courses.

See the CPA Licensure Note below for the 150-hour education requirement for CPA certification in Iowa.

In addition, it is highly recommended that an accounting major include ACCT 4160 Business Law. The Department of Accounting should be consulted for information on alternative plans of study.

Students are limited to three business majors/degrees/certificates/minors within the Ivy College of Business. This limit is on business majors/degrees/certificates/minors only and does not apply to multiple majors/degrees/certificates/minors taken outside the Ivy College of Business.

CPA Licensure Note: The CPA licensure designation is a symbol of competence in the accounting profession, which employers value both immediately upon graduation and throughout career advancement. While students may sit for the CPA exam in Iowa after completing the required accounting coursework and earning a bachelor's degree, CPA candidates must complete a total of 150 credits in order to be certified or licensed to practice in Iowa. Qualified students should consider earning the Master of Accounting (MAcc) to satisfy the 150-credit requirement. Juniors and seniors in accounting who are interested in graduate study should contact the coordinator of the MAcc program as early as possible to complete their graduate degree in an efficient manner. *Students planning certification outside Iowa must check local rules, as each state determines its own CPA exam qualification and licensing requirements.*

Accounting, B.S.

Sample 4-Year Plan (Your plan may differ)

Freshman

Fall	Credits Spring	Credits
BUSAD 1020 or 1030	1 ECON 1020	3
ECON 1010	3 ACCT 2840	3
COMS 1130	3 HUM/SOC SCI	3
ENGL 1500	3 STAT 2260	3

MATH 1500	3 PHIL 2300	3
LIB 1600	1 BUSAD 2030	1
	14	16

Sophomore

Fall	Credits Spring	Credits
MATH 1510	3 SPCM 3120	3
ACCT 2850	3 ACCT 2150	3
ACCT 3010	1 ACCT 3860	3
ENGL 2500	3 STAT 3260	3
MIS 3010	3 Natural Science	3
U.S. Cultures and Communities [#]	3	
	16	15

Junior

Fall	Credits Spring	Credits
ACCT 3870	3 ACCT 3830	3
Global/International Perspective [@]	3 ACCT 3840	3
Core Business Course	6 Core Business Courses	6
HUM/SOC SCI	3 ENGL 3020	3
	15	15

Senior

Fall	Credits Spring	Credits
ACCT 4850	3 MGMT 4780 [*]	3
ACCT 4970	3 ACCT Elective	6
Core Business Courses	6 HUM/SOC SCI	3
General Electives	3 Global/International Perspective [@]	3
	General Elective	1
	15	16

Total Credits: 122

@ Courses in these requirements may also be used as Global Perspective.

U.S. Cultures and Communities courses may be used to satisfy HUM/SOC SCI.

* Must have credit or enrollment in all core courses listed above, except for MGMT 3720, plus senior standing, in order to enroll in MGMT 4780.

Graduation Requirements:

1. Grade of "C" or higher in at least 30 credits of Core and Major courses.
2. 42 credits of 3000-level courses from a four-year institution.

3. 50% of required Business courses must be earned at ISU.
4. At least 32 credits and the LAST 32 credits must be earned at ISU (exceptions for study abroad and internship may be requested).
5. 122 Credits minimum and a Cumulative GPA of at least 2.00 with no quality point deficiencies.
6. A grade of C or better in ENGL 2500 required, and also in one other required ENGL course.
7. All 3000-level and higher business credits must be earned at a four-year college.
8. Multiple business **majors** must have at least 15 distinct credits in each of the major requirements; when applicable, one course can be shared between business majors; see your advisor regarding multiple business **degree requirements**.

Undergraduate Minor in Accounting

The Department of Accounting also offers a minor for non-accounting majors in the Ivy College of Business. The minor requires 16 credits from an approved list of courses, including at least 6 credits in courses numbered 3000 or above taken at Iowa State University with a grade of C or higher. The minor must include at least 3 credits that are not used to meet any other department, college, or university requirement. Students with declared majors have priority over students with declared minors in courses with space constraints.

Required Courses (7 credits):

ACCT 2840	Financial Accounting	3
ACCT 2850	Managerial Accounting	3
ACCT 3010	The Accounting Cycle	1

Elective Courses (9 credits):

Select nine credit hours from 3000 or 4000 level Accounting courses, except ACCT 4160.

Students are limited to three business majors/degrees/certificates/minors within the Ivy College of Business. This limit is on business majors/degrees/certificates/minors only and does not apply to multiple majors/degrees/certificates/minors taken outside the Ivy College of Business.

For more information on the undergraduate minor in accounting, please visit: <https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/minors-and-certificates/>. (<https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/minors-and-certificates/>)

Master of Accounting (MAcc) 4+1 Program

The Master of Accounting (MAcc) is a 30-credit hour, non-thesis graduate program with six credits dedicated to CPA exam preparation. This path allows students the time necessary to adequately study for and complete all four sections of the CPA exam before starting a full-time job. In addition, the program provides a solution to satisfying the 150 total credit hour CPA requirement while earning a higher degree!

Each MAcc student customizes their curriculum to fit their interests and intended career path. Both a CPA certification track and CMA certification track are available. Within their selected track, students earn a specialization in one of the following areas of their choice: financial reporting and assurance, information systems and analytics, tax, or managerial decision-making. A four-week, six-credit study abroad option in Paris is available.

Students considering the MAcc should meet with Kayla Sander, MAcc coordinator and advisor, during the first semester of their junior year. Students are required to apply for the program the semester before beginning graduate coursework. For more information and a more detailed program outline, visit: <https://www.ivybusiness.iastate.edu/academics/graduate-programs/master-of-accounting/>. (<https://www.ivybusiness.iastate.edu/academics/graduate-programs/master-of-accounting/>)

MAcc 4+1 Program Highlights

Freshman Spring

ACCT 2840: Financial Accounting

Credits: 3. Contact Hours: Lecture 3.

Introduction to the basic concepts and procedures of financial accounting from a user perspective. The course examines the accounting cycle, business terminology, basic control procedures, and the preparation and evaluation of financial reports, with an emphasis on financial statement analysis. (Typically Offered: Fall, Spring, Summer)

Sophomore Fall

ACCT 3010: The Accounting Cycle

Credits: 1. Contact Hours: Lecture 1.

Prereq: ACCT 2840

Interactive computer-based analysis of the accounting cycle including transactions and financial statements. Preparation of journal entries and adjusting entries and completion of the closing process. (Typically Offered: Fall, Spring, Summer)

ACCT 2850: Managerial Accounting

Credits: 3. Contact Hours: Lecture 3.

Prereq: ACCT 2840

Understanding of fixed and variable costs and their role in planning, control and performance evaluation. Examination of alternative costing methods. Making decisions by identifying and developing relevant information. Development of spreadsheet skills. (Typically Offered: Fall, Spring, Summer)

MIS 3010: Management Information Systems

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 1130

The role of information technology in organizations. Overview of methodologies for design and development of systems including decision support systems, expert systems, data bases, end-user computing, etc. Computer applications relate concepts to practice. Lecture and laboratory work emphasizes the enabling role of IT in contemporary organizations. (Typically Offered: Fall, Spring, Summer)

Sophomore Spring**ACCT 3860: Intermediate Financial Accounting I**

Credits: 3. Contact Hours: Lecture 3.

Prereq: (ACCT 2840 or ACCT 2840H) and ACCT 3010

The conceptual framework of financial accounting. Communication of financial information on the income and retained earnings statements, statement of cash flows, and the balance sheet. Accounting concepts relating to current and operational assets of the firm. (Typically Offered: Fall, Spring)

STAT 2260: Introduction to Business Statistics I

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 1040 or MATH 1500 or MATH 1510 or MATH 1600 or MATH 1650

Obtaining, organizing, and presenting statistical data; measures of location and dispersion; the Normal distribution; sampling and sampling distribution of the sample mean; elements of statistical inference; confidence intervals and hypothesis testing for the mean; describing bivariate relationships and inference for simple linear regression analysis; use of computers to visualize and analyze data. Graduation Restriction: Credit for only one of the following courses may be applied toward graduation: STAT 1010, STAT 1040, STAT 2010, or STAT 2260. (Typically Offered: Fall, Spring, Summer)

Junior Fall**ACCT 3870: Intermediate Financial Accounting II**

Credits: 3. Contact Hours: Lecture 3.

Prereq: Minimum of C- in ACCT 3860

Financial accounting and reporting practices for business entities. Generally accepted accounting principles (GAAP) relative to firm liabilities, equity, income, taxes, employee benefits, leases, accounting changes and cash flows. Discussion of current issues in financial accounting. (Typically Offered: Fall, Spring)

Plan MAcc Program**Junior Spring****ACCT 3830: Intermediate Managerial Accounting**

Credits: 3. Contact Hours: Lecture 3.

Prereq: ACCT 2850 and credit or enrollment in ACCT 3010

Generation, communication and use of information to assist management with planning, control, and decision making in manufacturing and service organizations. Includes cost concepts and relevance to decision situations, operational and capital budgeting, and performance evaluation. Emphasis on developing effective teamwork skills as well as spreadsheet capabilities. (Typically Offered: Fall, Spring)

ACCT 3840: Accounting Information Systems and Analytics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or enrollment in ACCT 3010 and MIS 3010

Concepts and procedures underlying creating, sharing, reporting, storing, and analyzing accounting data. Information technology internal controls and audit techniques. Trends in accounting information systems.

Senior Fall**ACCT 4850: Principles of Federal Income Tax**

Credits: 3. Contact Hours: Lecture 3.

Prereq: Minimum of C- in ACCT 3860

Introduction to the fundamentals of federal income taxation and concepts applicable to all tax entities. Addresses issues related to the measurement and recognition of income, deductions, gains, and losses, taxation of property transactions, and basis / cost recovery concepts. Includes coverage of tax law policy objectives, tax implications of business and investment decisions, tax versus financial reporting treatment of common business transactions, and ethical issues related to tax compliance and planning. (Typically Offered: Fall, Spring)

ACCT 4970: Introduction to Auditing

Credits: 3. Contact Hours: Lecture 3.

Prereq: ACCT 3840 and ACCT 3870 and STAT 3260

The conceptual framework of auditing. Professional ethics. External reporting concepts. Audit methodology including risk analysis, internal control, procedures for gathering evidence and the role of statistical sampling in auditing. (Typically Offered: Fall, Spring)

Apply to MAcc Program

Senior Spring

Two (2) ACCT Electives

Optional Concurrent Status to Get Started on MAcc Requirements Early!

Senior Summer

Optional Study Abroad in Paris

Graduate Fall**ACCT 5150: Accounting Analytics**

Credits: 3. Contact Hours: Lecture 3.

Prereq: ACCT 3840 or Permission of Department

Applications and skills for performing data analytics in accounting contexts. Explores conceptual framework for providing data-driven insights and recommendations. Includes hands-on experiences working with different types of data and the latest analysis tools. (Typically Offered: Fall)

ACCT 5980: Financial Accounting: Theory and Contemporary Issues

Credits: 3. Contact Hours: Lecture 3.

Prereq: ACCT 3860 or ACCT 5010

Theoretical discussion of the financial accounting and reporting environment. The usefulness of financial accounting information for decision making. Current financial accounting issues, the financial accounting standard setting process, FASB Standards Codification, and the role of the SEC in financial reporting. (Typically Offered: Fall)

ACCT 5900: Special Topics

Credits: 1-3. Repeatable.

Prereq: Department Permission for Course

For students wishing to do individual research in a particular area of accounting. (Typically Offered: Fall, Spring, Summer)

CPA or CMA Exam Prep Specialization Coursework

Please address MAcc questions to Kayla Sander, MAcc coordinator and advisor, at kayla@iastate.edu. An *Accounting Student Resources* folder,

available to all Ivy accounting majors, is found in Canvas. This folder provides useful, detailed information on both the CPA exam and the Iowa State University Master of Accounting 4+1 program.

Graduate Programs

Master of Accounting (MAcc)

The department offers a graduate degree, the Master of Accounting (MAcc). This is a 30-credit hour degree which offers paths to certification as a Certified Public Accountant (CPA) or Certified Management Accountant (CMA). Areas of specialization are also available within those 30 hours. Students pursuing the CPA certification may specialize in Financial Reporting and Assurance, Information Systems and Analytics, or Tax. Students pursuing the CMA certification may specialize in Managerial Decision Making or Information Systems and Analytics. The program requires 15 hours of core courses which includes: ACCT 5150 Accounting Analytics, ACCT 5980 Financial Accounting: Theory and Contemporary Issues, ACCT 5900 Special Topics (Accounting Communication & Analysis), and two Certification Preparation courses. The remaining 15 hours of the degree are determined by the selection of an area of specialization.

The MAcc is appropriate for accounting undergraduate students seeking to pursue a variety of accounting careers. It is an efficient way for candidates to meet the 150-hour education requirement for CPA certification in Iowa. A key advantage of the program is the opportunity to prepare for and complete the CPA exam before starting full-time employment, allowing dedicated time for successful preparation. Students without an accounting degree will be required to complete a substantial amount of accounting coursework prior to being considered for admission to the MAcc. For more details, please contact the MAcc program coordinator.

Student Learning Outcomes

Upon graduation, Master of Accounting (MAcc) students will:

1. Be critical thinkers.
2. Be effective communicators.
3. Be effective team members.
4. Be ethical decision makers.
5. Be adequately prepared for professional certification or licensure.

For more information about the MAcc program, please visit: <https://www.ivybusiness.iastate.edu/academics/graduate-programs/master-of-accounting/>. (<https://www.ivybusiness.iastate.edu/academics/graduate-programs/master-of-accounting/>)

Double Graduate Degrees

The Accounting Department participates in one double degree program at the graduate level. Students can simultaneously pursue a double degree in Master of Business Administration (MBA) and Master of Accounting

(MAcc). The double degree plan allows students to share credits between the degrees. See the Director of Graduate Education for more details on sharing credits.

For more information on the double degree in Master of Business Administration (MBA) and Master of Accounting (MAcc), please visit: <https://www.ivybusiness.iastate.edu/academics/graduate-programs/double-degree-options/mba-macc> (<https://www.ivybusiness.iastate.edu/academics/graduate-programs/double-degree-options/mba-macc/>).

Master of Accounting Analytics (MAA)

If you want to be on the cutting edge of accounting and business analytics, the online Master of Accounting Analytics (MAA) is for you. Designed to meet the demand for accounting professionals with advanced business analytics expertise, the MAA program curriculum provides a deep dive into a comprehensive selection of accounting and business analytics topics focusing on interpreting and analyzing accounting information for decision-making.

All courses will be delivered in an online asynchronous format, allowing students to complete their coursework from anywhere and work at their own pace. The MAA program is ideal for working professionals seeking to further their education while remaining on the job and for those looking to further their education and enter the workforce with an in-demand special set of skills.

The MAA faculty are respected nationally and have been making a difference as editors and co-editors of the top journals in their area of expertise. The accounting faculty hosts annual training conferences for continuing education credits and provide external consulting. These external experiences provide a link for our students from the classroom to real-world practice. We are absolutely committed to providing you with a rewarding and valuable educational experience.

Student Learning Outcomes

Upon graduation, Master of Accounting analytics (MAA) students will:

1. Think critically about accounting problems.
2. Apply advanced quantitative modeling techniques to accounting data.
3. Interpret and analyze accounting information for decision-making.
4. Visualize and disseminate accounting information effectively.

For more information about the MAA program, please visit: <https://www.ivybusiness.iastate.edu/academics/graduate-programs/master-of-accounting-analytics/>. (<https://www.ivybusiness.iastate.edu/academics/graduate-programs/master-of-accounting-analytics/>)

Master of Business Administration (MBA)

The Department of Accounting participates in the full-time, part-time, and executive Master of Business Administration (MBA) programs. The MBA is a 48-credit, non-thesis, non-creative component curriculum. Thirty of the 48 credits are core courses and the remaining 18 are graduate electives. Within the MBA program, students may develop an area of specialization in accounting or accounting analytics.

The specialization in accounting is designed to help meet the education requirement for CPA certification in Iowa.

The specialization in accounting analytics will place students a step ahead in today's business environment. The specialization curriculum provides a deep dive into a well-rounded selection of accounting topics while placing an emphasis on expanding students' analytical skills - skills critical to the accounting profession.

Student Learning Outcomes

Upon graduation, MBA students will:

1. Demonstrate effective communication skills.
2. Effectively lead and work in diverse teams.
3. Critically solve business problems.
4. Integrate ethical and global perspectives in decision making.

For more information about the MBA program with a specialization in Accounting or Accounting Analytics, please visit: <https://www.ivybusiness.iastate.edu/academics/graduate-programs/ivy-mba/>. (<https://www.ivybusiness.iastate.edu/academics/graduate-programs/ivy-mba/>)

Actuarial Science

Actuaries have a deep understanding of finance, business, mathematics, and statistics. With this knowledge, they help businesses measure and manage risk, develop new products, and make strategic value-enhancing decisions. In high demand, actuaries work for and with businesses engaged in many different types of activities, including life-, health-, and property-casualty insurance, banking, investments, financial services, government, energy, e-commerce, marketing, and consulting.

Students studying actuarial science will acquire the knowledge base and skills in finance, mathematics, and statistics needed to pass the preliminary actuarial exams offered by the Society of Actuaries and Casualty Society of America, while acquiring essential business skills to be successful in the field.

Undergraduate Major

The Department of Finance in the Ivy College of Business offers a major in actuarial science. Students will complete the business general education requirements (including business foundation courses), supporting

courses/major prerequisites, business core requirements for the Bachelor of Science (B.S.) degree, and 23 additional credits in the major.

The actuarial science major, intended for students with strong quantitative backgrounds and interest in business, has the goal of educating students in business and risk management, while providing the background and training needed for certification as an actuary (via the 5 preliminary exams of the profession). The major is an excellent opportunity for individuals who want to use advanced technical and analytical skills to solve important business problems.

Certificate

The certificate in actuarial science is available from the *College of Liberal Arts and Sciences* for non-actuarial science majors at Iowa State (or students who hold a baccalaureate degree from an accredited institution). The certificate requires 23 credits from a designated list of courses. There are 7 prerequisite courses required for the certificate's required courses.

The certificate is intended for students who wish to prepare for a career in the field while obtaining the advanced technical and analytical skills in their chosen major. Students studying mathematics, statistics, or other quantitative STEM disciplines will find their primary coursework matches well with the prerequisites and courses required for the certificate. Students completing the certificate will have sufficient background to pass the first 4 preliminary exams of the profession, along with applying actuarial mathematics to problems in finance, investments, and risk analysis for a broad range of businesses and consumers.

For undergraduate curriculum in business, major in actuarial science.

The Department of Finance offers a major in actuarial science. Students will complete the general education requirements (including business foundation courses), supporting courses/major prerequisites, business core requirements for the Bachelor of Science (B.S.) degree, and 23 additional credits in the major.

Actuaries measure and manage risk and work for and with businesses with a financial focus, such as finance and insurance. The actuarial science program provides a background in probability, statistics, finance, and actuarial mathematics to enable students to pass the 5 preliminary exams offered by the Society of Actuaries and Casualty Society of America. After completion of this program, students will acquire the business-related skills needed to be a successful actuary. These include the ability to: understand how a business is organized and functions; communicate effectively in written, oral, visual, and electronic modes; work in teams; make ethical choices; use quantitative and analytical methods to address unstructured business problems; think critically; understand financial statements; and understand markets and investments.

Areas of study in the field of actuarial science include interest theory, theory of probability, financial futures and options, loss models, credibility theory, and mathematics of life contingencies.

The instructional objective of the Actuarial Science program is to provide a well-rounded professional business education in actuarial science. Such a program will provide the student with:

- 1. A mastery of actuarial concepts and methods of analysis.
- 2. A basic understanding of insurance operations in a global setting and of the role of financial institutions in the economy.
- 3. An ability to effectively communicate and work with others as an actuary.
- 4. An ability to demonstrate leadership capabilities in actuarial, financial analysis, and portfolio management.

For more information on the undergraduate major in Actuarial Science, please visit: <https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/actuarial-science/>. (<https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/actuarial-science/>)

Student Learning Outcomes

Upon graduation, undergraduate students majoring in Actuarial Science will:

- 1. Be effective communicators.
- 2. Be effective collaborators.
- 3. Be problem solvers.
- 4. Understand business concepts.
- 5. Recognize ethical and legal responsibilities to organizations.

Curriculum:

While the General Education Requirements for Actuarial Science majors remains the same as all other Business majors, there are specific changes in the following areas that must be completed in order to receive a Bachelor's degree in Actuarial Science:

Foundation: (21)

BUSAD 1020	Business Learning Team Orientation	1
or BUSAD 1030 Orientation		
BUSAD 2030	Professional Development in Business	1
COMS 1130	Introduction to Spreadsheets and Databases	3
MATH 1650	Calculus I	4
ECON 1010	Principles of Microeconomics	3
ECON 1020	Principles of Macroeconomics	3
STAT 2260	Introduction to Business Statistics I	3
ACCT 2840	Financial Accounting	3

Supporting Courses: (17)

ACCT 2150	Legal Environment of Business	3
MATH 1660	Calculus II	4
MATH 2070	Matrices and Linear Algebra	3
MATH 2650	Calculus III	4
PHIL 2300	Moral Theory and Practice	3

Business Core: (27)

ACCT 2850	Managerial Accounting	3
ENTSP 3100	Entrepreneurship and Innovation	3
FIN 3010	Principles of Finance	3
MGMT 3710	Organizational Behavior	3
MGMT 3720	Ethical and Responsible Management	3
MIS 3010	Management Information Systems	3
MKT 3400	Principles of Marketing	3
SCM 3010	Supply Chain Management	3

Above courses are prerequisites and must be taken prior to:

MGMT 4780	Strategic Management	3

Major – Actuarial Science: (23)

Required Courses:

MATH 2400	Mathematics of Investment and Credit	3
STAT 3410	Introduction to the Theory of Probability and Statistics I	4
STAT 3420	Introduction to the Theory of Probability and Statistics II	4
FIN 4550	Risk Modeling	3
ACSCI 4010	Loss Models I	3
ACSCI 4020	Credibility Theory	3
MATH 4410	Life Contingencies I	3

Elective Courses:

The following electives are highly recommended for Actuarial Science majors:

ACSCI 3910	Actuarial Exam P Lab	1
ACSCI 3920	Actuarial Exam FM Lab	1
FIN 3100	Corporate Finance	3
FIN 4240	Financial Futures and Options	3
MATH 4420	Life Contingencies II	3

Students are limited to three business majors/degrees/certificates/minors within the Ivy College of Business. This limit is on business majors/degrees/certificates/minors only and does not apply to multiple majors/degrees/certificates/minors taken outside the Ivy College of Business.

Actuarial Science, B.S.

Sample 4-Year Plan (Your plan may differ)

Freshman

Fall	Credits Spring	Credits
BUSAD 1020 or 1030	1 ACCT 2840*	3
ECON 1010*	3 ECON 1020*	3
COMS 1130	3 MATH 1660	4
ENGL 1500	3 HUM/SOC SCI	3
MATH 1650	4 STAT 2260	3
PHIL 2300	3 BUSAD 2030	1
	17	17

Sophomore

Fall	Credits Spring	Credits
ACCT 2850	3 Business Core Course	6
MATH 2400	3 STAT 3410	4
MATH 2650	4 ENGL 2500	3
FIN 3010*	3 Global/International Perspective [@]	3
Recommended ACSCI elective from list	1 LIB 1600	1
(Students should take FM exam during winter break)	(Students should take P exam summer after sophomore year)	
	14	17

Junior

Fall	Credits Spring	Credits
MATH 2070	3 ENGL 3020	3
ACSCI 4010	3 ACSCI 4020	3
Business Core Course	3 STAT 3420*	4
SPCM 3120	3 Business Core Course	3
Natural Science	3 U.S. Cultures and Communities [#]	3
	(Students should take IFM (or STAM) exam summer after junior year)	
	15	16

Senior

Fall	Credits Spring	Credits
MATH 4410	3 Global/International Perspective [@]	3
Business Core Courses	3 ACCT 2150	3
FIN 4550	3 MGMT 4780**	3

@Courses in these requirements may also be used as Global Perspective.

U.S. Cultures and Communities courses may be used to satisfy HUM/
SOC SCI.

* Validation of Educational Experience courses

**Must have credit or enrollment in all core courses listed above, except
for MGMT 3720, plus senior standing, in order to enroll in MGMT 4780.

P = Probability exam

STAM = Short-Term Actuarial Mathematics exam

Graduation Requirements:

- 3

For the undergraduate certificate in actuarial science.

The College of Liberal Arts and Sciences offers a certificate in Actuarial Science. It is available to any non-Actuarial Science major (or student who holds a baccalaureate degree from an accredited institution). Students studying mathematics, statistics, or other quantitative STEM disciplines will find their primary coursework matches well with the prerequisites and courses required for the certificate. The certificate provides students with the necessary background in mathematics, statistics, and the basic principles of finance for a career in actuarial science while obtaining advanced technical and analytical skills in their chosen major. Students completing the certificate will have the background to pass 4 of the preliminary exams in the profession, will have obtained the specialized knowledge required for success in the field, and will be prepared to work for and with businesses with a financial focus, such as insurance, banking, and investments.

After completing the certificate in actuarial science, students will:

- Master the quantitative and analytical skills required to obtain an entry-level position in the profession,
- Have sufficient background to pass the first 4 professional exams offered by the professional actuarial organizations,
- Apply actuarial mathematics to problems in finance, investment, and risk analysis, and
- Demonstrate the ability to communicate the results of quantitative analysis, both in writing and orally.

The certificate in actuarial science requires the completion of 7 courses, totaling 23 credit hours.

These courses are:

ACSCI 4010	Loss Models I	3
FIN 3010	Principles of Finance	3
MATH 2400	Mathematics of Investment and Credit	3
MATH 4410	Life Contingencies I	3
MATH 4420	Life Contingencies II	3
or ACSCI 4020 Credibility Theory		
STAT 3410	Introduction to the Theory of Probability and Statistics I	4
STAT 3420	Introduction to the Theory of Probability and Statistics II	4

The seven courses in the list above require seven prerequisite courses: ACCT 2840, ECON 1010, MATH 1650, MATH 1660, MATH 2650, (MATH 2070 or MATH 3170), and one course from (STAT 1010, 1040, 2010, 2260, 2310, 2050, 3220, or 3300).

Courses for the certificate cannot be taken on a pass/not-pass basis.

A cumulative GPA of at least 2.0 is required in the seven courses for the certificate.

The Actuarial Science Certificate is an LAS Certificate and must meet University-wide policies for undergraduate certificates.

Business Administration

The Business Administration unit supports graduate and undergraduate programs in the departments of Accounting, Finance, Information Systems and Business Analytics, Management and Entrepreneurship, Marketing, and Supply Chain Management, by providing specialized coursework in orientation to business, professional development, and cooperative education opportunities.

Undergraduate Bachelor of Business Administration (BBA) Degree

For undergraduate curriculum in business, Bachelor of Business Administration.

The Department of Management and Entrepreneurship offers an undergraduate Bachelor of Business Administration (BBA) degree. This degree-completer program is a general business degree that is offered online. The BBA is accessible if you have some prior college experience and is aimed at working professionals with at least 45 college credits.

Students will complete the general education requirements (including business foundation courses), business core requirements for the Bachelor of Business Administration (BBA) degree, and 21 additional credits in the major.

The instructional objective of the BBA degree is to learn the foundation in all areas of business, and then through the required and elective upper-level coursework, build out specialized knowledge in specific areas of business to align with your personal and professional interests and include an emphasis on critical management and leadership skills. By enrolling in the BBA program, you will be able to balance full time employment, or other personal commitments, and the completion of a four-year degree in business.

The major-specific coursework targets the following skills:

- Managing projects
- Negotiating and resolving conflicts
- Managing human resources
- Managing the supply chain

- Managing finances
- Managing a global and diverse workforce
- Managing sales and understanding consumer behavior

For more information on the undergraduate Bachelor of Business Administration, please visit: <https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/bachelor-of-business-administration/>.

Student Learning Outcomes

Upon graduation, undergraduate students receiving a bachelor's in business administration will:

1. Be effective communicators.
2. Be effective collaborators.
3. Be problem solvers.
4. Understand business concepts.
5. Recognize ethical and legal responsibilities to organizations.

Curriculum:

The department of Management and Entrepreneurship offers a fully online degree-completer program leading to a general business degree. This degree-completer program consists of 21 credits of coursework in the business administration major, including 9 credit hours of required courses, and 12 credit hours of major electives.

The General Education Requirements for the Bachelor of Business Administration degree is different from all other Business majors. There are specific changes in the following areas (including global & international perspectives, humanities, social sciences, and natural sciences) that must also be completed in order to receive a bachelor's degree in business administration.

Foundation: (17)

BUSAD 1030	Orientation	1
BUSAD 2030	Professional Development in Business	1
COMS 1130	Introduction to Spreadsheets and Databases	3
MATH 1500	Discrete Mathematics for Business and Social Sciences	3
ECON 1010	Principles of Microeconomics	3
	or ECON 1020 Principles of Macroeconomics	
STAT 2260	Introduction to Business Statistics I *	3
ACCT 2840	Financial Accounting	3

Supporting Courses: (3)

ACCT 2150	Legal Environment of Business	3

Electives: (24-30)

Take additional "free" electives to fulfill the minimum graduation requirement of 120 credits.

Business Core: (27)

ACCT 2850	Managerial Accounting	3
ENTSP 3100	Entrepreneurship and Innovation	3
FIN 3010	Principles of Finance	3
MGMT 3710	Organizational Behavior	3
MGMT 3720	Ethical and Responsible Management	3
MIS 3010	Management Information Systems	3
MKT 3400	Principles of Marketing	3
SCM 3010	Supply Chain Management	3

Must have credit or enrollment in all core courses listed above, except for MGMT 3720, plus senior standing, in order to enroll in:

MGMT 4780	Strategic Management ^	3

BBA Major Courses: (21)

Required Courses (9 credits):

MIS 3400	Project Management	3
MGMT 4220	Negotiation and Conflict Resolution	3
MGMT 4710	Introduction to Human Resource Management	3

Elective Courses (12 credits):

Choose ONE from each pairing		
SCM 4240	Process Management, Analysis, and Improvement	3
or SCM 4610	Principles of Transportation	

ACCT 3830	Intermediate Managerial Accounting	3
or FIN 3300	Financial Markets and Institutions	
or FIN 3710	Real Estate Principles	

MGMT 4140	International Management	3
or MGMT 4720	Diversity, Equity, and Inclusion in Organizations	

MKT 3420	Foundation Of Personal Selling	3
or MKT 4470	Consumer Behavior	

* Transfer coursework may be a substitute for STAT 2260 Introduction to Business Statistics I, if approved.

^ Must have credit or enrollment in all core courses listed above, except for MGMT 3720, plus senior standing, in order to enroll in MGMT 4780.

BBA students cannot double major or earn a double degree in a business area. However, they may work towards a double degree in another college at Iowa State. Online minors or online certificates outside the Ivy College of Business could be added to the BBA if desired. Consult with an advisor in the Undergraduate Student Services Office for assistance in identifying online minor options.

Graduate Programs

The Ivy College of Business offers two professional graduate degree programs in business administration, the Master of Business Administration (MBA) and the professional Master of Business Administration (PMBA), which are described below. The college also has eight specialized master's degree programs: the Master of Accounting (MAcc), the Master of Accounting Analytics (MAA), the Master of Business Analytics (MBAN), the Master of Entrepreneurship (MEP), the Master of Finance (MFIN), the Master's in Healthcare Analytics and Operations (MHAO), the Master of Real Estate Development (MRED), and the Master of Science in Information Systems (MSIS). The college also offers a PhD in Business and Technology, with specializations in Entrepreneurship, Finance, Information Systems and Business Analytics, Management, Marketing, and Supply Chain Management. Finally, the Ivy College of Business is a participating member of the following interdepartmental programs: Master of Science in Cybersecurity, Master of Engineering Management, Master of Science and PhD in Human Computer Interaction, and Master of Science in Seed Technology and Business.

Master of Business Administration (MBA)

The Ivy College of Business offers a 48-credit program leading to a non-thesis Master of Business Administration degree with a specialization in accounting, accounting analytics, business analytics, entrepreneurship, finance, healthcare analytics and operations, information systems, leadership, marketing, real estate, or supply chain management. The coursework is designed to provide the knowledge, skills, and abilities for managerial success and leadership in organizations. The MBA is the professional management education program for those pursuing careers in business.

Students working toward the MBA are required to complete a series of core courses in the basic functional areas of business (accounting, economics, quantitative analysis, finance, supply chain management, organizational behavior, management information systems, marketing, professional responsibilities, and strategic management), as well as advanced elective coursework. Two courses on professional skills development are also required for full-time MBA students.

Courses for the MBA are provided by the departments of Accounting, Economics, Finance, Management and Entrepreneurship, Marketing, Supply Chain Management, and Information Systems and Business

Analytics. Courses from other departments may also be chosen to meet specific student interests.

A concurrent B.S./MBA is available to eligible engineering undergraduate students majoring in aerospace, agricultural, biological systems, chemical, civil, computer, construction, cybersecurity, electrical, industrial, materials science, mechanical, or software engineering. A concurrent B.S./MBA is available to eligible undergraduate students majoring in agricultural systems technology, agronomy, animal science, chemistry, computer science, food science, geology, industrial design, industrial technology, and meteorology.

For more information on the MBA program, please visit: <https://www.ivybusiness.iastate.edu/academics/graduate-programs/ivy-mba/>. (<https://www.ivybusiness.iastate.edu/academics/graduate-programs/ivy-mba/>)

MBA Graduate Certificates

The Ivy College of Business currently has six graduate certificate programs, including:

- Business Analytics
- Digital Marketplace Analytics
- Enterprise Cybersecurity Management
- Entrepreneurship and Innovation
- Finance
- Supply Chain Management

Most certificates require 12 credits (digital marketplace analytics requires 15 credits) –with approval of the director of certificates (DOC), all 12-15 credits may apply towards a future Ivy graduate program. Certificates may be earned before, after, or concurrently with a master's or doctoral degree. Credit from a previously earned master's or doctoral degree from Iowa State University cannot be applied toward a future Ivy certificate.

For more information on any of the graduate certificates offered, please visit: <https://www.ivybusiness.iastate.edu/academics/graduate-programs/graduate-certificates/>. (<https://www.ivybusiness.iastate.edu/academics/graduate-programs/graduate-certificates/>)

Double master's degree programs are offered with accounting (MBA/MAcc), architecture (MBA/MArch), business analytics (MBA/MBAN), community and regional planning (MBA/MCRP), entrepreneurship (MBA/MEP), finance (MBA/MFIN), healthcare analytics and operations (MBA/MHAO), information systems (MBA/MSIS), and real estate development (MBA/MRED). A double degree program (DVM/MBA) is also available to eligible Veterinary Medicine students.

The MBA program is open to all individuals with a baccalaureate degree. Undergraduates from arts and humanities, science, and technical programs are especially encouraged to apply. Academic potential and

promise for a productive career in business and for managerial success and leadership in organizations are important criteria for admission. Applicants must submit official transcripts of previous academic work, Graduate Management Admission Test (GMAT) scores or Graduate Record Exam (GRE) scores, personal essays, a resume, and two letters of reference. Students whose native language is not English and who did not graduate from a U.S. college or university are required to submit the Test of English as a Foreign Language (TOEFL) or International English Language Testing System (IELTS) scores.

Applicants are considered for fall semester entry only into the full-time MBA. Although applications will be considered after this date, candidates are encouraged to submit their application materials by June 15. Part-time MBA applications are considered for fall, spring, or summer entry.

Student Learning Outcomes

Upon graduation, MBA students will:

1. Demonstrate effective communication skills.
2. Effectively lead and work in diverse teams.
3. Critically solve business problems.
4. Integrate ethical and global perspectives in decision making.

For more information about the MBA program in any of the areas of specialization listed above, please visit: <https://www.ivybusiness.iastate.edu/academics/graduate-programs/ivy-mba/>. (<https://www.ivybusiness.iastate.edu/academics/graduate-programs/ivy-mba/>)

Professional Master of Business Administration (PMBA)

The Ivy College of Business offers a 42-credit program leading to a non-thesis professional Master of Business Administration degree with a specialization in accounting, accounting analytics, business analytics, entrepreneurship, finance, healthcare analytics and operations, information systems, leadership, marketing, real estate, or supply chain management. PMBA students should note that courses required for the specializations may be delivered online, hybrid or in-person in Ames or Des Moines. The coursework is designed to provide the knowledge, skills, and abilities for managerial success and leadership in organizations. The PMBA is the professional management education program for those pursuing careers in business.

The part-time MBA is designed for employed professionals. Part-time MBA core classes are hybrid or fully-online, offering a combination of online and face-to-face instruction held in the evenings in downtown Des Moines. MBA electives may be delivered online, hybrid or in-person in Ames or Des Moines.

Students working toward the PMBA are required to complete a series of core courses in the basic functional areas of business (accounting, economics, quantitative analysis, finance, supply chain

management, organizational behavior, management information systems, marketing, professional responsibilities, and strategic management), as well as advanced elective coursework.

Courses for the PMBA are provided by the departments of Accounting, Economics, Finance, Management and Entrepreneurship, Marketing, Supply Chain Management, and Information Systems and Business Analytics. Courses from other departments may also be chosen to meet specific student interests.

PMBA Graduate Certificates

The Ivy College of Business currently has six graduate certificate programs, including:

- Business Analytics
- Digital Marketplace Analytics
- Enterprise Cybersecurity Management
- Entrepreneurship and Innovation
- Finance
- Supply Chain Management

Most certificates require 12 credits (digital marketplace analytics requires 15 credits) –with approval of the director of certificates (DOC), all 12-15 credits may apply towards a future Ivy graduate program. Certificates may be earned before, after, or concurrently with a master's or doctoral degree. Credit from a previously earned master's or doctoral degree from Iowa State University cannot be applied toward a future Ivy certificate.

For more information on any of the graduate certificates offered, please visit: <https://www.ivybusiness.iastate.edu/academics/graduate-programs/graduate-certificates/>. (<https://www.ivybusiness.iastate.edu/academics/graduate-programs/graduate-certificates/>)

Double master's degree programs are offered with accounting (PMBA/MAcc), business analytics (PMBA/MBAN), entrepreneurship (PMBA/MEP), healthcare analytics and operations (PMBA/MHAO), and real estate development (PMBA/MRED). PMBA students should note that courses required in the double degree programs may be delivered online, hybrid or in-person in Ames or Des Moines.

The PMBA program is open to all individuals with a baccalaureate degree. Undergraduates from arts and humanities, science, and technical programs are especially encouraged to apply. Academic potential and promise for a productive career in business and for managerial success and leadership in organizations are important criteria for admission. Applicants must submit official transcripts of previous academic work, personal essays, a resume, and two letters of reference. Students whose native language is not English and who did not graduate from a U.S. college or university are required to submit the Test of English as a

Foreign Language (TOEFL) or International English Language Testing System (IELTS) scores.

Professional MBA applications are considered for fall, spring, or summer entry.

Student Learning Outcomes

Upon graduation, PMBA students will:

1. Demonstrate effective communication skills.
2. Effectively lead and work in diverse teams.
3. Critically solve business problems.
4. Integrate ethical and global perspectives in decision making.

For more information about the PMBA program in any of the areas of specialization listed above, please visit: <https://www.ivybusiness.iastate.edu/academics/graduate-programs/>. (<https://www.ivybusiness.iastate.edu/academics/graduate-programs/>)

Executive Master's in Business Administration (EMBA)

The EMBA program is for professionals in the food, agriculture, and biosystems industry. The curriculum is a 48-credit program leading to a non-thesis Master of Business Administration degree. The customized content is delivered 80% in-person, and 20% online.

Student Learning Outcomes

Upon graduation, executive MBA (EMBA) students will:

1. Be effective leaders.
2. Be effective collaborators.
3. Be critical thinkers in food, agriculture, and biosystems.
4. Recognize ethical and global responsibilities around food, agriculture, and biosystems.

For more information on the EMBA program, please visit: <https://www.ivybusiness.iastate.edu/academics/graduate-programs/ivy-mba/executive-mba/>. (<https://www.ivybusiness.iastate.edu/academics/graduate-programs/ivy-mba/executive-mba/>)

PhD in Business and Technology

The doctoral program at the Ivy College of Business is a full-time, residential program that prepares individuals to conduct and publish scholarly research in top journals. The standard length of this 74-credit program is five years. Graduates compete for academic positions at leading research universities in the United States and abroad. There are six specializations: entrepreneurship, finance, information systems and business analytics, management, marketing, and supply chain management.

Student Learning Outcomes

Upon graduation, PhD students will be able to:

1. Understand and advance knowledge.
2. Create knowledge through original research.
3. Teach effectively in an institution of higher education.

For more information about the PhD program, please visit: <https://www.ivybusiness.iastate.edu/academics/phd-program/>.

Graduate Minor in Business Administration

The Ivy College of Business also offers a business administration minor to students with majors outside the college. In order to obtain a graduate minor in business administration at Iowa State University, a student must complete eighteen credit hours of the required core courses for the major in business administration. A student who wishes to minor in business administration must have full admission status in his/her respective graduate program and must be in good academic standing (graduate transcript required). Courses are offered hybrid, in Des Moines, or online.

Required Courses (9 credits):

ACCT 5010	Financial Accounting	3
MGMT 5020	Organizational Behavior	3
MGMT 5030	Professional Responsibility in Business and Society	3

Choose THREE additional courses from the list below (9 credits):

FIN 5010	Financial Valuation and Corporate Financial Decisions	3
MKT 5010	Marketing	3
SCM 5010	Supply Chain Management	3
MIS 5010	Management Information Systems	3

Applications for the graduate minor in business administration are accepted for fall, spring or summer semester entry.

For more information on the graduate minor in business administration, please visit: <https://www.ivybusiness.iastate.edu/academics/graduate-programs/graduate-minor/>.

Business Analytics

We live in a day where we are overwhelmed with data. Today's companies are data-rich and information-poor (DRIP). Business analytics is the transformation of data into insights for better decision making. This transformation is iterative and multi-disciplinary. Business analytics falls at the intersection of technology, statistics, and business.

Students studying business analytics will gain the knowledge and skills necessary to understand and apply quantitative modeling techniques, design cross-functional solutions using standard and advanced business analytics technologies and software, evaluate data mining methods, communicate solutions using data visualizations, develop team

and project management skills in a big data context, and effectively communicate analytical findings both orally and in writing.

Undergraduate Major in Business Analytics

For undergraduate curriculum in business, major in Business Analytics.

The Department of Information Systems and Business Analytics offers a major in Business Analytics. Students will complete the general education requirements (including business foundation courses), business core requirements for the Bachelor of Science (B.S.) degree, and 21 additional credits in the major.

The instructional objective of the business analytics major is to prepare students to realize the opportunities presented by data. This includes bringing structure to data, finding compelling patterns in data, communicating the stories buried in data, and advising decision-makers at all levels on the implications for processes and decisions through a data-driven approach.

For more information on the undergraduate major in Business Analytics, please visit: <https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/business-analytics/>. (<https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/business-analytics/>)

Student Learning Outcomes

Upon graduation, undergraduate students majoring in Business Analytics will:

1. Be effective communicators.
2. Be effective collaborators.
3. Be problem solvers.
4. Understand business concepts.
5. Recognize ethical and legal responsibilities to organizations.

Degree Requirements

In addition to the basic business degree requirements (<https://catalog.iastate.edu/collegeofbusiness/#curriculuminbusiness>), Business Analytics majors must also complete:

Required Courses (12 credits):

MIS 2070	Fundamentals of Programming for Business and Analytics	3
MIS 3200	Database Management Systems *	3
	or ACCT 3840 Accounting Information Systems and Analytics	
MIS 4360	Introduction to Business Analytics #	3
MIS 4460	Advanced Business Analytics #	3

Elective Courses (9 credits):

Select three courses from the following list:

ACCT 4840	Advanced Accounting Information Systems	3
FIN 4260	Quantitative Investment Analysis	3
FIN 4500	Analytical Methods in Finance	3
MGMT 4730	Evidence-Based Decision Making in Human Resource Management	3
MIS 3070	Intermediate Business Programming	3
MIS 3116X	Data Visualization and Storytelling	3
MIS 3150	Business Data Streams and Issues	3
MIS 4100	Blockchain and Cryptocurrency	3
MIS 4680	Analytics for Marketing Strategies	3
MKT 3610	Social Media Marketing Strategy	3
MKT 3670	Consultative Problem Solving	3
MKT 4450	Customer Relationship Management	3
SCM 4300	Supply Chain Analytics	3
SCM 4600	Decision Tools for Logistics and Operations Management	3

* If both MIS 3200 and ACCT 3840 are taken, one will count for 3 elective credits in the major.

STAT 3260 is a prerequisite for these courses.

NOTE: Business Analytics majors must take STAT 3260 Introduction to Business Statistics II as part of the supporting courses.

The X designation after a course number indicates this is an experimental course offered by the Department. Although in an experimental phase, these courses are open for registration just the same as permanent courses listed in the course catalog and count as elective choices in the major.

Students are limited to three business majors/degrees/certificates/minors within the Ivy College of Business. This limit is on business majors/degrees/certificates/minors only and does not apply to multiple majors/degrees/certificates/minors taken outside the Ivy College of Business.

Business Analytics, B.S.

Sample 4-Year Plan (Your plan may differ)

Freshman

Fall	Credits Spring	Credits
BUSAD 1020 or 1030	1 ECON 1020	3
ECON 1010	3 STAT 2260	3
COMS 1130	3 PHIL 2300	3
ENGL 1500	3 ACCT 2840	3
MATH 1500	3 Global/International Perspective [@]	3

LIB 1600	1 BUSAD 2030	1
	14	16

Sophomore

Fall	Credits Spring	Credits
ACCT 2850	3 MIS 3010	3
ACCT 3010 (1 cr if taking ACCT 3840)	STAT 3260	3
MIS 2070	3 SPCM 3120	3
MATH 1510	3 Natural Science	3
ENGL 2500	3 Business Core Course	3
HUM SOC/SCI	3	
	15	15

Junior

Fall	Credits Spring	Credits
MIS 3200 or ACCT 3840	3 MIS 4360	3
Business Core Courses	6 Business Core Courses	6
ACCT 2150	3 Global/International Perspective [@]	3
U.S. Cultures and Communities [#]	3 ENGL 3020	3
General Electives (only 1 cr if ACCT 3010 taken)	2	
	17	15

Senior

Fall	Credits Spring	Credits
MIS 4460	3 Business Analytics Elective	3
Business Core Course	3 MGMT 4780 [*]	3
Business Analytics Electives	6 General Electives	9
HUM/SOC SCI	3	
	15	15

Total Credits: 122

@ Courses in these requirements may also be used as Global Perspective.

U.S. Cultures and Communities courses may be used to satisfy HUM/ SOC SCI.

* Must have credit or enrollment in all core courses listed above, except for MGMT 3720, plus senior standing, in order to enroll in MGMT 4780.

Graduation Requirements:

1. Grade of "C" or higher in at least 30 credits of Core and Major courses.

2. 42 credits of 3000+ level courses from a four-year institution.

3. 50% of required Business courses must be earned at ISU.
4. At least 32 credits and the LAST 32 credits must be earned at ISU (exceptions for study abroad and internship may be requested).
5. 122 Credits minimum and a Cumulative GPA of at least 2.00 with no quality point deficiencies.
6. A grade of C or better in ENGL 2500 required, and also in one other required ENGL course.
7. All 3000-level and higher business credits must be earned at a four-year college.
8. Multiple business **majors** must have at least 15 distinct credits in each of the major requirements; when applicable, one course can be shared between business majors; see your advisor regarding multiple business **degree requirements**.

Undergraduate Minor in Business Analytics

The Department of Information Systems and Business Analytics also offers a minor for non-Business Analytics majors in the Ivy College of Business. The minor requires 15 credits from an approved list of courses, including at least 6 credits in courses numbered 3000 or above taken at Iowa State University with a grade of C or higher. The minor must include at least 3 credits that are not used to satisfy any other department, college, or university requirement. Students with declared majors have priority over students with declared minors in courses with space constraints.

Required Courses (9 credits):

MIS 2070	Fundamentals of Programming for Business and Analytics	3
MIS 3200	Database Management Systems *	3
or ACCT 3840	Accounting Information Systems and Analytics	
MIS 4360	Introduction to Business Analytics #	3

Elective Courses (6 credits):

Choose at least two 3-credit courses from the list below		
ACCT 4840	Advanced Accounting Information Systems	3
FIN 4260	Quantitative Investment Analysis	3
FIN 4500	Analytical Methods in Finance	3
MGMT 4730	Evidence-Based Decision Making in Human Resource Management	3
MIS 3070	Intermediate Business Programming	3
MIS 3116X	Data Visualization and Storytelling	3
MIS 3150	Business Data Streams and Issues	3
MIS 4100	Blockchain and Cryptocurrency	3
MIS 4460	Advanced Business Analytics #	3

MIS 4680	Analytics for Marketing Strategies	3
MKT 3610	Social Media Marketing Strategy	3
MKT 3670	Consultative Problem Solving	3
MKT 4450	Customer Relationship Management	3
SCM 4300	Supply Chain Analytics	3
SCM 4600	Decision Tools for Logistics and Operations Management	3

* If both MIS 3200 and ACCT 3840 are taken, one will count for 3 elective credits in the minor.

STAT 3260 is a prerequisite for these courses.

Students are limited to three business majors/degrees/certificates/minors within the Ivy College of Business. This limit is on business majors/degrees/certificates/minors only and does not apply to multiple majors/degrees/certificates/minors taken outside the Ivy College of Business.

The X designation after a course number indicates this is an experimental course offered by the Department. Although in an experimental phase, these courses are open for registration just the same as permanent courses listed in the course catalog and count as elective choices in the major.

For more information on the undergraduate minor in Business Analytics, please visit: <https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/minors-and-certificates/>. (<https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/minors-and-certificates/>)

The Department of Information Systems and Business Analytics participates in the Applied AI Minor that is available to all undergraduate students at Iowa State University by providing electives in Business Analytics.

Concurrent Degrees

The Department of Information Systems and Business Analytics offers three concurrent degree programs that allow qualified students to be admitted to the following master's programs while completing their undergraduate degree. Students can double count up to 6 credits of coursework between the degrees, allowing them to complete both a bachelor's and a master's degree in as little as five years. The concurrent degree programs offered include:

- B.S. Business Analytics (BUSAN) and Master of Business Analytics (MBAN)
- B.S. Business Analytics (BUSAN) and Master of Science in Information Systems (MSIS)

- B.S. Management Information Systems (MIS) and Master of Business Analytics (MBAN)

For more information on any of the concurrent programs listed above, please visit: <https://www.ivybusiness.iastate.edu/academics/graduate-programs/concurrent-degree-options/>. (<https://www.ivybusiness.iastate.edu/academics/graduate-programs/concurrent-degree-options/>)

Graduate Programs

Master of Business Analytics (MBAN)

The Master of Business analytics (MBAN) is an interdisciplinary program that addresses the challenges of dealing with data analytics and business intelligence in the "Big Data" environment. The goal is to develop managers who will master analytics in ways that lead to increased profits for their company. This blended program offers both online and face-to-face education in a comprehensive approach that draws from Business, Computer Science, Electrical and Computer Engineering, Statistics, and Industrial and Manufacturing Systems Engineering. It provides a foundation in data analytics project management, statistical and predictive modeling, consumer sentiment analysis, knowledge discovery, analytical reporting, segmentation analysis and data visualization. The program requires 30 credits of graduate level courses over a 21-month period. Students start the program with a one-week on-campus initiation class. Students then revisit campus once during the middle and once at the end of the program, while taking online classes during the rest of the time.

Student Learning Outcomes

Upon graduation, Master of Business analytics (MBAN) students will:

1. Be analytics modelers.
2. Be problem solvers in analytics.
3. Be evaluators of analytics.
4. Be critical thinkers in analytics.
5. Be collaborators in big data and analytics.
6. Be effective communicators.

For more information about the Master of Business Analytics program, please visit: <https://www.ivybusiness.iastate.edu/academics/graduate-programs/master-of-business-analytics/>. (<https://www.ivybusiness.iastate.edu/academics/graduate-programs/master-of-business-analytics/>)

Master's in Healthcare Analytics and Operations (MHAO)

Graduates of the Master's in Healthcare Analytics and Operations (MHAO) program will leverage data and advanced analytical models to evaluate operations and supply chains, generating actionable insights that enhance outcomes in the healthcare sector. This program emphasizes the use of both historical and real-time data to identify

trends and optimize processes, ultimately benefiting patients, healthcare professionals, and supply chain partners alike. With a requirement of 30 credit hours, the program is delivered entirely online, making it an excellent choice for full-time professionals in the healthcare industry. The MHAO program curriculum aligns with the competencies required for the Certified Health Data Analyst (CHDA) exam.

For more information about the Master of Healthcare Analytics and Operations program, please visit: <https://www.ivybusiness.iastate.edu/academics/graduate-programs/master-of-healthcare-analytics-and-operations/>.

Double Graduate Degrees

The Department of Information Systems and Business Analytics participates in two double degree programs at the graduate level. Students can simultaneously pursue a double degree in Master of Business Administration (MBA) and Master of Business Analytics (MBAN) or the Master of Business Administration (MBA) and Master of Healthcare Analytics and Operations (MHAO). The Double Degree plan allows students to share credits between the degrees. See the Director of Graduate Education for more details on sharing credits.

For more information on either double degree offered, please visit: <https://www.ivybusiness.iastate.edu/academics/graduate-programs/double-degree-options/>. (<https://www.ivybusiness.iastate.edu/academics/graduate-programs/double-degree-options/>)

Master of Business Administration (MBA)

The Department of Information Systems and Business Analytics participates in the full-time and part-time Master of Business Administration (MBA) program. The MBA is a 48-credit, non-thesis, non-creative component curriculum. Thirty of the 48 credits are core courses and the remaining 18 are graduate electives. Within the MBA program, students may develop an area of specialization in Business Analytics or Healthcare Analytics and Operations.

Student Learning Outcomes

Upon graduation, MBA students will:

1. Demonstrate effective communication skills.
2. Effectively lead and work in diverse teams.
3. Critically solve business problems.
4. Integrate ethical and global perspectives in decision making.

For more information about the MBA program with a specialization in Business Analytics or Healthcare Analytics and Operations, please visit: <https://www.ivybusiness.iastate.edu/academics/graduate-programs/ivy-mba/>. (<https://www.ivybusiness.iastate.edu/academics/graduate-programs/ivy-mba/>)

Graduate Certificates

Business Analytics

The graduate certificate in business analytics will address the challenges of dealing with issues of "big data" and its analysis to extract actionable insights, equips business professionals with the basic analytic concepts and techniques necessary in various areas of business such as marketing, supply chain, operations, forensics, and risk management. Students will have a foundation in data management, business analytics, modeling, and communicating through data visualization.

The certificate is for working professionals as well as students enrolled in graduate programs who are employed or seeking a career as business analysts, analytic systems designers, and data scientists to help improve business performance. The certificate is available online, on campus in Ames and at Capital Square in Des Moines.

For more information about the graduate certificate in business analytics, please visit: <https://www.ivybusiness.iastate.edu/academics/graduate-programs/graduate-certificates/business-analytics/>. (<https://www.ivybusiness.iastate.edu/academics/graduate-programs/graduate-certificates/business-analytics/>)

Digital Marketplace Analytics

A graduate certificate in digital marketplace analytics is jointly offered by the Ivy College of Business and the College of Human Sciences. The 15-credit certificate, which incorporates coursework from both colleges, provides an innovative program for individuals who want to build their data analytics skills and to apply analytics tools to problem-solving in the fashion, events, and hospitality industries.

For more information about the graduate certificate in digital marketplace analytics, please visit: <https://www.ivybusiness.iastate.edu/academics/graduate-programs/graduate-certificates/digital-marketplace-analytics/>. (<https://www.ivybusiness.iastate.edu/academics/graduate-programs/graduate-certificates/digital-marketplace-analytics/>)

Business Economics

The Ivy College of Business has partnered with the Department of Economics to offer a Business Economics major.

Where business studies the organizations and functions that deliver goods and services to customers, economics studies those good and services with respect to production, distribution, and consumption, and the choices we make about how to best utilize the resources we have.

Undergraduate Major in Business Economics

For undergraduate curriculum in business, major in business economics.

Through a partnership between the Ivy College of Business and the Department of Economics, a major in Business Economics is offered. Students will complete the general education requirements (including

business foundation courses), supporting courses/major prerequisites, business core requirements for the Bachelor of Science (B.S.) degree, and 19 additional credits in the major.

The objective of the Business Economics major is to provide a high-quality education with a balanced emphasis in both business and economics. Such an education should equip graduates with a unique set of skills distinguishing them from other graduates. In particular, they will have the ability to use both business and economic reasoning to think critically and address complex issues using tools and decision-making models of economics, business, mathematics, statistics, as well as concepts from the biological, physical, and social sciences; to make decisions and to communicate effectively.

For more information on the undergraduate major in Business Economics, please visit: <https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/business-economics/>. (<https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/business-economics/>)

Student Learning Outcomes

Upon graduation, undergraduate students majoring in Business Economics will:

1. Be effective communicators.
2. Be effective collaborators.
3. Be problem solvers.
4. Understand business concepts.
5. Recognize ethical and legal responsibilities to organizations.

Curriculum:

In addition to the basic business degree requirements (<https://catalog.iastate.edu/collegeofbusiness/#curriculuminbusinesstext>), business economics majors must also complete:

Required Courses (10 credits):

ECON 3010	Intermediate Microeconomics	4
ECON 3530	Money, Banking, and Financial Institutions	3
ECON 4310	Managerial Economics	3
ECON 4920	Graduating Senior Survey	R

Elective Courses (9 credits):

Select one course of ECON 2300-2890, 3000-3890, or 4000-4890	3
Select two additional 4000-4890 level ECON courses	6

NOTES:

Business Economic majors must take STAT 3260 Introduction to Business Statistics II as part of the supporting courses.

Business Economic majors take MATH 1600 and ECON 2070 instead of MATH 1500 and MATH 1510.

Students majoring in business economics are not permitted to take agricultural business or economics as a double major, or economics as a minor.

Students are limited to three business majors/degrees/certificates/minors within the Ivy College of Business. This limit is on business majors/degrees/certificates/minors only and does not apply to multiple majors/degrees/certificates/minors taken outside the Ivy College of Business.

Business Economics, B.S.

Sample 4-Year Plan (Your plan may differ)

Freshman

Fall	Credits Spring	Credits
BUSAD 1020 or 1030	1 ACCT 2840	3
ECON 1010	3 STAT 2260	3
COMS 1130	3 ENGL 2500	3
ENGL 1500	3 ECON 1020	3
MATH 1600	4 HUM/SOC SCI	3
LIB 1600	1 BUSAD 2030	1
	15	16

Sophomore

Fall	Credits Spring	Credits
ECON 2070	3 PHIL 2300	3
SPCM 3120	3 STAT 3260	3
ACCT 2850	3 Business Core Course	3
Business Core Course	3 ECON 3010	4
Natural Science	3 Global/International Perspective [@]	3
	15	16

Junior

Fall	Credits Spring	Credits
ACCT 2150	3 ECON Elective (2000+ level or above)	3
ECON 3530	3 ECON Elective (4000-level)	3
Business Core Courses	6 Business Core Courses	6
General Elective	3 U.S. Cultures and Communities [#]	3
	15	15

Senior

Fall	Credits Spring	Credits
ECON 4310	3 ECON 4920	R

ENGL 3020	3 ECON Elective (4000-level)	3
HUM/SOC SCI	3 HUM/SOC SCI	3
Global/International Perspective [@]	3 MGMT 4780 [*]	3
Business Core Course	3 General Electives	6
	15	15

Total Credits: 122

@ Courses in these requirements may also be used as Global Perspective.

U.S. Cultures and Communities courses may be used to satisfy HUM/SOC SCI.

* Must have credit or enrollment in all core courses listed above, except for MGMT 3720, plus senior standing, in order to enroll in MGMT 4780.

Graduation Requirements:

1. Grade of "C" or higher in at least 30 credits of Core and Major courses.
2. 42 credits of 3000+ level courses from a four-year institution.
3. 50% of required Business courses must be earned at ISU.
4. At least 32 credits and the LAST 32 credits must be earned at ISU (exceptions for study abroad and internship may be requested).
5. 122 Credits minimum and a Cumulative GPA of at least 2.00 with no quality point deficiencies.
6. A grade of C or better in ENGL 2500 required, and also in one other required ENGL course.
7. All 3000-level and higher business credits must be earned at a four-year college.
8. Multiple business **majors** must have at least 15 distinct credits in each of the major requirements; when applicable, one course can be shared between business majors; see your advisor regarding multiple business **degree requirements**.

Entrepreneurship

Success in entrepreneurship requires a broad base of conceptual knowledge, personal skills, and competencies. By majoring in entrepreneurship, you will sharpen your creative thinking and problem-solving skills, and develop your entrepreneurial mindset to start your own business, develop a new product, or become an innovator in an established company. The required courses in the major provide a variety of rich developmental experiences that include applied learning, case analysis, research projects, team-based learning, and guest speakers, in addition to traditional classroom lectures and discussions. The Entrepreneurship major places a strong emphasis on written and oral

communication skills, teamwork, creativity, leadership, and personal initiative.

Undergraduate Major in Entrepreneurship

For undergraduate curriculum in business, major in entrepreneurship.

The Department of Management and Entrepreneurship offers a major in Entrepreneurship. Students will complete the general education requirements (including business foundation courses), business core requirements for the Bachelor of Science (B.S.) degree, and 18 additional credits in the major.

The Entrepreneurship major is designed to prepare students for the field of entrepreneurship. Upon graduation, students will be prepared to identify and exploit business opportunities, start their own business, or lead venture-creation and innovative initiatives at established for-profit and non-profit organizations.

The Entrepreneurship Major rests on three pillars:

- **Business Startup and Small Business Management.** The major focuses on starting and managing new and small businesses, including family businesses, which present different challenges that require knowledge of various models of leadership, market research, fundraising, risk management, and other activities with increasingly digital components.
- **Corporate Entrepreneurship, Innovation, and Technology Management.** Today's highly sought-after employees are those with entrepreneurial mind and skill sets that allow them to create, lead, and contribute to innovative projects and initiatives within their organizations. Thus, this major prepares students for leadership positions at established innovative firms.
- **Social Entrepreneurship.** A major emphasis is given to managing non-profit ventures to initiate and support positive social and environmental changes. Entrepreneurship principles and tools have proven their relevance and value for both small and large non-profit ventures and organizations. Thus, this major prepares students who are interested in making a difference by supporting positive social and environmental causes.

The Entrepreneurship Major includes a wide range of opportunities for experiential learning through elective courses and offers a variety of robust extracurricular activities through collaboration with the Pappajohn Center for Entrepreneurship. Entrepreneurship is also an attractive second major for students with interests in any other business field.

Students majoring in Entrepreneurship are not permitted to take Entrepreneurship as a minor.

For more information on the undergraduate major in Entrepreneurship, please visit: <https://www.ivybusiness.iastate.edu/academics/>

[undergraduate-programs/entrepreneurship/](https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/entrepreneurship/). (<https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/entrepreneurship/>)

Student Learning Outcomes

Upon graduation, undergraduate students majoring in Entrepreneurship will:

1. Be effective communicators.
2. Be effective collaborators.
3. Be problem solvers.
4. Understand business concepts.
5. Recognize ethical and legal responsibilities to organizations.

Curriculum:

In addition to the basic business degree requirements (<https://catalog.iastate.edu/collegeofbusiness/#curriculuminbusinesstext>), Entrepreneurship majors are required to complete 18 credit hours of entrepreneurship or management department-approved courses. Included in these 18 credits are four required courses:

Required Courses (12 credits):

ENTSP 3130	Feasibility Analysis for New Ventures	3
ENTSP 3200	Corporate Entrepreneurship	3
ENTSP 4100	Social Entrepreneurship	3
ENTSP 4800	Applied Entrepreneurship: Executing New Ventures	3

Elective Courses (6 credits):

Select two courses from the following list:

ENTSP 3670	International Entrepreneurship	3
ENTSP 3810	Managing Family Businesses	3
ENTSP 4610	Entrepreneurship and Accounting Information	3
ENTSP 4310	New Venture Financing	3
ENTSP 4540	Entrepreneurial Marketing	3
ENTSP 4600X	Franchising Strategy	3
MGMT 4710	Introduction to Human Resource Management	3
MGMT 4720	Diversity, Equity, and Inclusion in Organizations	3
ACCT 3830	Intermediate Managerial Accounting	3
ACCT 4160	Business Law	3
FIN 3100	Corporate Finance	3
FIN 4350	Venture Capital, Private Equity, and Mergers and Acquisitions	3
MIS 3400	Project Management	3
MKT 3420	Foundation Of Personal Selling	3
MKT 3610	Social Media Marketing Strategy	3
MKT 3620	Digital Marketing	3

MKT 3630	Creative Tools for Digital Marketing	3
MKT 4470	Consumer Behavior	3
MKT 4580X	New Product Marketing	3
SCM 4240	Process Management, Analysis, and Improvement	3
SCM 4660	Global Trade Management	3
SCM 4950	Executive Analysis and Presentation [#]	3
AESHM 4740	Entrepreneurship in Human Sciences	3
AESHM 4760CX	Entrepreneurship Studio: Creating an Online Business	
DES 2300	Design Thinking [^]	3
DSNS 3400	Design Entrepreneurship	3
ECON 2340	Small Business Management [^]	3
ECON 3340	Entrepreneurship in Agriculture	3
ENGR 4300	Entrepreneurial Product Engineering	3
LDST 3700	Special Topics [*]	3

[^] 42 credits of 3000-level or higher coursework from a four-year institution is required to graduate. Students choosing 2000-level courses toward their major may be required to compensate for this requirement elsewhere in their curriculum.

^{*} Only sections of LDST 3700 with a topic of "Leadership, Entrepreneurship, and Innovation" may count as an elective for the major. Additionally, only 3 credits of LDST 3700 may count towards the entrepreneurship major electives.

[#] Only 3 credits of SCM 4950 may count as an Entrepreneurship major choice elective.

The X designation after a course number indicates this is an experimental course offered by the Department. Although in an experimental phase, these courses are open for registration just the same as permanent courses listed in the course catalog and count as elective choices in the major.

Students are limited to three business majors/degrees/certificates/minors within the Ivy College of Business. This limit is on business majors/degrees/certificates/minors only and does not apply to multiple majors/degrees/certificates/minors taken outside the Ivy College of Business.

Entrepreneurship, B.S.

Sample 4-Year Plan (Your plan may differ)

Freshman

Fall	Credits Spring	Credits
BUSAD 1020 or 1030	1 ECON 1020	3
ECON 1010	3 STAT 2260	3

COMS 1130	3 U.S. Cultures and Communities [#]	3
ENGL 1500	3 ACCT 2840	3
MATH 1500	3 ENGL 2500 [^]	3
LIB 1600	1 BUSAD 2030	1

14 16

Sophomore

Fall	Credits Spring	Credits
ACCT 2850	3 PHIL 2300	3
SPCM 3120	3 ACCT 2150	3
ENTSP 3100	3 MGMT 3710	3
Natural Science	3 Global/International Perspective [@]	3
MATH 1510	3 HUM/SOC SCI	3

15 15

Junior

Fall	Credits Spring	Credits
ENTSP 3130	3 ENTSP 3200	3
Business Core Courses	6 ENTSP 4100	3
General Electives	6 Business Core Courses	6
	HUM/SOC SCI	3

15 15

Senior

Fall	Credits Spring	Credits
ENTSP 4800	3 MGMT 4780 [*]	3
ENTSP Elective	3 ENTSP Elective	3
Global/International Perspective [@]	3 HUM/SOC SCI	3
ENGL 3020	3 General Electives	6
Business Core Course	3	
General Elective	2	

17 15

Total Credits: 122

[@] Courses in these requirements may also be used as Global Perspective.

[^] Students are encouraged to register for sections of ENGL 2500 that have topics focused on entrepreneurship and innovation.

[#] U.S. Cultures and Communities courses may be used to satisfy HUM/SOC SCI.

^{*} Must have credit or enrollment in all core courses listed above, except for MGMT 3720, plus senior standing, in order to enroll in MGMT 4780.

Graduation Requirements:

1. Grade of "C" or higher in at least 30 credits of Core and Major courses.
2. 42 credits of 3000+ level courses from a four-year institution.
3. 50% of required Business courses must be earned at ISU.
4. At least 32 credits and the LAST 32 credits must be earned at ISU (exceptions for study abroad and internship may be requested).
5. 122 Credits minimum and a Cumulative GPA of at least 2.00 with no quality point deficiencies.
6. A grade of C or better in ENGL 2500 required, and also in one other required ENGL course.
7. All 3000-level and higher business credits must be earned at a four-year college.
8. Multiple business **majors** must have at least 15 distinct credits in each of the major requirements; when applicable, one course can be shared between business majors; see your advisor regarding multiple business **degree requirements**.

Undergraduate Minor in Entrepreneurship

An Entrepreneurship minor for non-Entrepreneurship majors is also available. This university-wide undergraduate minor in Entrepreneurship is available to all undergraduate students at Iowa State University. The minor requires 15 credits from an approved list of courses, including at least 6 credits in courses numbered 3000 or above taken at Iowa State University with a grade of C or higher. The minor must include 3 credits that are not used to meet any other department, college, or university requirement. Students must follow college-specific rules in selecting courses for the minor. The college representatives to the supervisory committee for the minor will be responsible for advising students in their college and will inform students about the details of the college rules. Students with declared majors have priority over students with declared minors in courses with space constraints.

Non-business students with an Entrepreneurship minor are not permitted to major in Entrepreneurship. Business students interested in Entrepreneurship may choose to major in Entrepreneurship (<https://catalog.iastate.edu/collegeofbusiness/entrepreneurship/#undergraduatemajortext>) or pursue the Entrepreneurship minor.

A student seeking a minor in entrepreneurship must successfully complete a minimum of 15 credits in courses approved for use in the entrepreneurship program, including the following:

Required Courses (6 credits):

ENTSP 3100	Entrepreneurship and Innovation	3
ENTSP 3130	Feasibility Analysis for New Ventures	3

or ENTSP 3200 Corporate Entrepreneurship
or ENTSP 4100 Social Entrepreneurship

ENTSP 3100 Entrepreneurship and Innovation is the introductory course and provides an overview of the entire field.

ENTSP 3130 Feasibility Analysis for New Ventures emphasizes developing an idea for a new venture, conducting a feasibility study, researching the potential market, analyzing the competition, and preparing a formal business plan.

ENTSP 3200 Corporate Entrepreneurship introduces and examines state-of-the-art approaches to product innovation and technology development in today's large and established organizations.

ENTSP 4100 Social Entrepreneurship discusses issues related to the role of social entrepreneurship in helping to solve social problems, including innovation, opportunity recognition, planning and the launch of new non-profit organizations.

Elective Courses (6 credits):

Select TWO entrepreneurship-oriented electives from an approved course list (see below). Students are encouraged to take electives within their major college.

Experiential Learning (3 credits):

Students will engage in the process(es) of entrepreneurship to earn experiential learning credits. Students will either take a course that has been designated as an experiential learning course, or use some other experiential learning activity as the basis to receive credits through an independent study.

Detailed information about the Entrepreneurship minor, the list of approved electives, as well as information about the experiential learning options are available online at: <https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/minors-and-certificates/entrepreneurship-minor/>. (<https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/minors-and-certificates/entrepreneurship-minor/>)

Students are limited to three business majors/degrees/certificates/minors within the Ivy College of Business. This limit is on business majors/degrees/certificates/minors only and does not apply to multiple majors/degrees/certificates/minors taken outside the Ivy College of Business.

For more information on the undergraduate minor in Entrepreneurship, please visit: <https://catalog.iastate.edu/interdisciplinaryprograms/entrepreneurship/>.

Graduate Programs

Master of Entrepreneurship (MEP)

The Department of Management and Entrepreneurship offers a Master of Entrepreneurship (MEP) degree intended to convey entrepreneurial expertise that prepares graduates to launch successful startups and international ventures. The MEP is a non-thesis degree offering students the opportunity to develop strong conceptual and practical entrepreneurial skills. With a flexible curriculum covering a broad range of entrepreneurial topics and immersion in practically oriented experiential activities, the 30-credit hour program is built with aspirant entrepreneurs in mind. With both online and in-person course offerings and extensive list of elective and experiential credits to choose from, this program is designed to provide an educational experience tailored to your needs. With a focus on imparting advanced skills related to developing business ideas to start a new venture, taking an existing startup to the next level, and advancing innovation strategies in existing organizations, graduates will be prepared to be successful entrepreneurs in a variety of contexts.

Student Learning Outcomes

Upon graduation, MEP students will be able to:

1. Identify and explore entrepreneurial opportunities.
2. Develop and test business ideas.
3. Identify and secure key stakeholder relationships.
4. Strategically position and launch new ventures.
5. Design and implement strategic plans, processes and systems for innovation.
6. Identify and access resources for launching a startup.

For more information about the MEP program, please visit: <https://www.ivybusiness.iastate.edu/academics/graduate-programs/master-of-entrepreneurship/>. (<https://www.ivybusiness.iastate.edu/academics/graduate-programs/master-of-entrepreneurship/>)

Double Graduate Degree

The Department of Management and Entrepreneurship participates in one double degree program at the graduate level. Students can simultaneously pursue a double degree in Master of Business Administration (MBA) and Master of Entrepreneurship (MEP). The double degree plan allows students to share credits between the degrees. See the Director of Graduate Education for more details on sharing credits.

For more information on the double degree in Master of Business Administration (MBA) and Master of Entrepreneurship (MEP), please visit: <https://www.ivybusiness.iastate.edu/academics/graduate-programs/double-degree-options/mba-mep/>.

The Department of Management and Entrepreneurship participates in the full-time and part-time Master of Business Administration (MBA) and in the Ph.D. in Business and Technology programs.

Master of Business Administration (MBA)

The MBA is a 48-credit, non-thesis, non-creative component curriculum. Thirty of the 48 credits are core courses and the remaining 18 and graduate electives. Within the MBA program, students can obtain a specialization in entrepreneurship.

Student Learning Outcomes

Upon graduation, MBA students will:

1. Demonstrate effective communication skills.
2. Effectively lead and work in diverse teams.
3. Critically solve business problems.
4. Integrate ethical and global perspectives in decision making.

For more information about the MBA program with a specialization in entrepreneurship, please visit: <https://www.ivybusiness.iastate.edu/academics/graduate-programs/ivy-mba/>. (<https://www.ivybusiness.iastate.edu/academics/graduate-programs/ivy-mba/>)

PhD in Business and Technology

The PhD in Business and Technology with an Entrepreneurship (ENTSP) specialization is a 74-credit (minimum) curriculum that prepares students to conduct and publish scholarly research in entrepreneurship, including a focus on new business ventures, entrepreneurs, innovation, and technology. In addition to curriculum in these core areas, students will also take courses in research methods and the closely related areas of management, including strategy, organizational behavior, and human resources.

The goal of this program is to prepare students to compete for tenure-track positions at leading research universities in the United States and abroad. As a doctoral candidate, students will learn how to conduct impactful research, and they are expected to develop a research pipeline and publish their work in top academic journals before entering the job market.

Student Learning Outcomes

Upon graduation, PhD students will be able to:

1. Understand and advance knowledge.
2. Create knowledge through original research.
3. Teach effectively in an institution of higher education.

For more information about the PhD program with a specialization in Entrepreneurship, please visit: <https://www.ivybusiness.iastate.edu/academics/phd-program/entrepreneurship/>. ([https://](https://www.ivybusiness.iastate.edu/academics/phd-program/entrepreneurship/)

www.ivybusiness.iastate.edu/academics/phd-program/entrepreneurship/

Graduate Certificate

A graduate certificate in Entrepreneurship and Innovation offers post-undergraduate students the opportunity to learn the basics of starting a business. The certificate requires 4 courses (12 credits). The two required core courses are offered online by the Ivy College of Business. Elective courses are available across campus.

The graduate certificate in Entrepreneurship and Innovation focuses on strategies and resources for launching new ventures and helps students understand the role of innovation in entrepreneurship.

This interdisciplinary certificate provides a solid foundation in entrepreneurship and innovation through required core courses ENTSP 5660 Entrepreneurship and New Venture Startup and ENTSP 5830 Formulating and Implementing Innovation Strategies. At the same time, the program enables students to follow their own interests through electives offered by partners across campus.

For more information about the graduate certificate in Entrepreneurship and Innovation, please visit: <https://ivybusiness.iastate.edu/academics/graduate-programs/graduate-certificates/entrepreneurship-and-innovation/>.

Finance

Finance is a broad program of study designed to prepare students to make reasoned and empirically motivated financial decisions. Finance is also an excellent area for those who wish to become more knowledgeable consumers, particularly in the fields of investments, insurance, and real estate.

The study of finance encompasses corporate financial management, investment management, financial analytics, banking, insurance, and real estate. Upper-level courses include case studies, a student-managed investment portfolio, and opportunities to apply foundational skills from earlier courses into specific real-world investment and corporate settings.

Undergraduate Major in Finance

For undergraduate curriculum in business, major in finance.

The Department of Finance offers a major in finance. Students will complete the general education requirements (including business foundation courses), supporting courses/major prerequisites, business core requirements for the Bachelor of Science (B.S.) degree, and 21 additional credits in the major.

The instructional objective of the Finance program is to provide a well-rounded professional education in finance. Such an education should provide the student with:

1. A mastery of basic financial concepts and methods of analysis.
2. An understanding of financial operations in a global setting and of the role of financial institutions in the economy.
3. An ability to effectively communicate and work with others as the finance member of a team.
4. An ability to demonstrate leadership capabilities in financial analysis and portfolio management.

For more information on the undergraduate major in Finance, please visit: <https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/finance/>. (<https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/finance/>)

Student Learning Outcomes

Upon graduation, undergraduate students majoring in Finance will:

1. Be effective communicators.
2. Be effective collaborators.
3. Be problem solvers.
4. Understand business concepts.
5. Recognize ethical and legal responsibilities to organizations.

Curriculum:

In addition to the basic business degree requirements (<https://catalog.iastate.edu/collegeofbusiness/#curriculuminbusiness>), finance majors must also complete:

Required Courses (6 credits):

FIN 3100	Corporate Finance	3
FIN 3200	Investments	3

Elective Courses (15 credits):

Select five courses from the following (at least three must be 4000-level or above): *

FIN 3300	Financial Markets and Institutions	3
FIN 3340	Introduction to Financial Technologies and Cryptocurrencies	3
FIN 3610	Personal Risk Management and Insurance	3
FIN 3710	Real Estate Principles	3
FIN 4100	Corporate Financial Planning and Analysis	3
FIN 4150	Business Financing Decisions	3
FIN 4240	Financial Futures and Options	3
FIN 4250	Security Analysis and Portfolio Management	3
FIN 4260	Quantitative Investment Analysis	3
FIN 4270	Fixed Income Securities	3
FIN 4280	Advanced Fixed Income Analysis and Portfolio Management	3

FIN 4310	New Venture Financing	3
FIN 4350	Venture Capital, Private Equity, and Mergers and Acquisitions	3
FIN 4450	Bank Management Decisions	3
FIN 4500	Analytical Methods in Finance	3
FIN 4550	Risk Modeling	3
FIN 4560	Financial Modeling	3
FIN 4620	Corporate Risk Management and Insurance	3
FIN 4720	Real Estate Finance	3
FIN 4740	Real Estate Investment	3
FIN 4800	International Finance	3
FIN 4910	International Study Course in Global Capital Markets	3
FIN 4920	Case Studies in Strategic Financial Decision-Making	1

Total Credits: 21

* You may use one of the following accounting courses to count as a 3000-level Finance course elective:

ACCT 3830 Intermediate Managerial Accounting

ACCT 3860 Intermediate Financial Accounting I

OR...

You may use ACSCI 4010 Loss Models I to count as one of the Finance course electives.

NOTE: Finance majors must take STAT 3260 Introduction to Business Statistics II as part of the supporting courses.

NOTE: Students who are completing a double major in Actuarial Science and Finance can take STAT 3410 Introduction to the Theory of Probability and Statistics I in place of STAT 3260 Introduction to Business Statistics II.

Students are limited to three business majors/degrees/certificates/minors within the Ivy College of Business. This limit is on business majors/degrees/certificates/minors only and does not apply to multiple majors/degrees/certificates/minors taken outside the Ivy College of Business.

Finance, B.S.

Sample 4-Year Plan (Your plan may differ)

Freshman

Fall	Credits Spring	Credits
BUSAD 1020 or 1030	1 ECON 1020	3
ECON 1010	3 STAT 2260	3

COMS 1130	3 U.S. Cultures and Communities [#]	3
ENGL 1500	3 ACCT 2840	3
MATH 1500	3 SPCM 3120	3
LIB 1600	1 BUSAD 2030	1

14 16

Sophomore

Fall	Credits Spring	Credits
ACCT 2850	3 Core Business Course	3
FIN 3010	3 PHIL 2300	3
MATH 1510	3 STAT 3260	3
ENGL 2500	3 HUM/SOC SCI	3
Natural Science	3 Global/International Perspective [@]	3

15 15

Junior

Fall	Credits Spring	Credits
ACCT 2150	3 FIN Electives	6
FIN 3100	3 General Elective	3
FIN 3200	3 Core Business Course	3
Core Business Courses	6 HUM/SOC SCI	3

15 15

Senior

Fall	Credits Spring	Credits
FIN Electives	6 FIN Elective	3
Core Business Courses	6 MGMT 4780 [*]	3
HUM/SOC SCI	3 Global/International Perspective [@]	3
ENGL 3020	3 General Electives	5

18 14

Total Credits: 122

@ Courses in these requirements may also be used as Global Perspective.

U.S. Cultures and Communities courses may be used to satisfy HUM/SOC SCI.

* Must have credit or enrollment in all core courses listed above, except for MGMT 3720, plus senior standing, in order to enroll in MGMT 4780.

Graduation Requirements:

1. Grade of "C" or higher in at least 30 credits of Core and Major courses.
2. 42 credits of 3000+ level courses from a four-year institution.

3. 50% of required Business courses must be earned at ISU.
4. At least 32 credits and the LAST 32 credits must be earned at ISU (exceptions for study abroad and internship may be requested).
5. 122 Credits minimum and a Cumulative GPA of at least 2.00 with no quality point deficiencies.
6. A grade of C or better in ENGL 2500 required, and also in one other required ENGL course.
7. All 3000-level and higher business credits must be earned at a four-year college.
8. Multiple business **majors** must have at least 15 distinct credits in each of the major requirements; when applicable, one course can be shared between business majors; see your advisor regarding multiple business **degree** requirements.

Undergraduate Minor in Finance

The Department of Finance also offers a finance minor for non-finance majors in the Ivy College of Business. The minor requires 15 credits from an approved list of courses, including at least 6 credits in courses numbered 3000 or above taken at Iowa State University with a grade of C or higher. The minor must include at least 3 credits that are not used to meet any other department, college, or university requirement. Students with declared majors have priority over students with declared minors in courses with space constraints.

Required Course (3 credits):

FIN 3010	Principles of Finance	3

Elective Courses (12 credits):

Select twelve credit hours from 3000 or 4000 level Finance courses

Students are limited to three business majors/degrees/certificates/minors within the Ivy College of Business. This limit is on business majors/degrees/certificates/minors only and does not apply to multiple majors/degrees/certificates/minors taken outside the Ivy College of Business.

For more information on the undergraduate minor in Finance, please visit: <https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/minors-and-certificates/>. (<https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/minors-and-certificates/>)

Undergraduate Certificate in Real Estate Purpose

The Certificate in Real Estate is a course of study administered by the Department of Finance in the Ivy College of Business. This program provides students from any major or college with a comprehensive

understanding of the legal, economic, and financial dimensions of real estate. The certificate enables students with an interest in real estate to showcase their specialized knowledge to potential employers.

Learning Outcomes

After completing the Certificate in Risk Management and Insurance, students will be able to:

- Understand how properties are owned and operated as for-profit businesses,
- Understand how portfolios of real estate products and securities are structured and utilized as an investment tool,
- Understand the nature of real estate transactions and how they impact the various parties involved in the transaction.

Requirements

The certificate requires at least 21 credits from an approved list of courses. At least 12 credits should be taken at Iowa State University.

Required Courses (12 credits):

FIN 3010	Principles of Finance	3
FIN 3710	Real Estate Principles	3
FIN 4720	Real Estate Finance	3
FIN 4740	Real Estate Investment	3

Elective Courses (9 credits):

Select three electives from the list below:

ARCH 2200	Contemporary Architecture	3
ARCH 3210	History of the American City	3
ECON 2340	Small Business Management	3
ECON 3010	Intermediate Microeconomics	3-4
ECON 3340	Entrepreneurship in Agriculture	3
ECON 3370	Agricultural Marketing	3
ECON 3640	Rural Property Appraisal	3
ECON 3760	Rural, Urban and Regional Economics	3
ECON 4160	Industrial Organization	3
ECON 4310	Managerial Economics	3
FIN 3200	Investments	3
FIN 3610	Personal Risk Management and Insurance	3
FIN 4150	Business Financing Decisions	3
FIN 4270	Fixed Income Securities	3
FIN 4310	New Venture Financing	3
FIN 4350	Venture Capital, Private Equity, and Mergers and Acquisitions	3
FIN 4500	Analytical Methods in Finance	3
FIN 4560	Financial Modeling	3

CRP 4160	Urban Design and Practice	6
CRP 4170	Urban Revitalization	3
CRP 4210	Financing Historic Preservation Projects	3
CRP 4420	Site Development	3
CRP 4710	Real Estate Development	3
MKT 3400	Principles of Marketing	3
MKT 3420	Foundation Of Personal Selling	3
MKT 4100	Promotional Strategy	3
MKT 4420	Sales Management	3
MKT 4500	Advanced Professional Selling	3
MKT 4520	Sales Enablement Tools and Technology	3
ENTSP 3130	Feasibility Analysis for New Ventures	3
ENTSP 4540	Entrepreneurial Marketing	3
ENTSP 4610	Entrepreneurship and Accounting Information	3
ENTSP 4800	Applied Entrepreneurship: Executing New Ventures	3
LA 3710	History of Modern Landscapes, 1750 to Present	3
LA 3730	Gardens and Landscapes from Antiquity to 1750	3
MGMT 3200	Corporate Entrepreneurship	3
MGMT 3810	Managing Family Businesses	3
MGMT 4710	Introduction to Human Resource Management	3
MGMT 4730	Evidence-Based Decision Making in Human Resource Management	3
MGMT 4750	Employment Law for Human Resource Management	3

Undergraduate Certificate in Risk Management and Insurance

Purpose

The Certificate in Risk Management and Insurance (RMI) is a course of study administered by the Department of Finance in the Ivy College of Business. The certificate will give students, regardless of major or college, a deeper understanding of personal and corporate risk management and of the insurance industry. The certificate will allow students with an interest in risk management and insurance to signal their expertise and focused study to potential employers.

Learning Outcomes

After completing the Certificate in Risk Management and Insurance, students will be able to:

- Understand why insurance markets exist and how they function,
- Understand how insurance companies are structured,

- Understand the various roles that exist in insurance companies and related financial institutions, and
- Be competitive in filling these various roles.

Requirements

The Certificate in Risk Management and Insurance requires the completion of at least 7 courses, totaling 21 credit hours. At least 12 credits must be taken at Iowa State University.

Required Courses (12 credits):

FIN 3010	Principles of Finance	3
or MATH 2400	Mathematics of Investment and Credit	
FIN 3100	Corporate Finance	3
or FIN 3200	Investments	
FIN 3610	Personal Risk Management and Insurance	3
FIN 4620	Corporate Risk Management and Insurance	3

Elective Courses (9 credits):

Select three electives from the list below:

ECON 2340	Small Business Management	3
ECON 2350	Introduction to Agricultural Markets	3
ECON 3010	Intermediate Microeconomics	3-4
ECON 3340	Entrepreneurship in Agriculture	3
ECON 3370	Agricultural Marketing	3
ECON 3710	Introductory Econometrics	4
ECON 4160	Industrial Organization	3
ECON 4310	Managerial Economics	3
ECON 4370	Commodity Marketing and Risk Management	3
ECON 4660	Agricultural Finance	3
FIN 4240	Financial Futures and Options	3
FIN 4310	New Venture Financing	3
FIN 4450	Bank Management Decisions	3
FIN 4550	Risk Modeling	3
FIN 4560	Financial Modeling	3
ACCT 4010	Financial Management for Healthcare Organizations	3
ACCT 4610	Entrepreneurship and Accounting Information	3
ACSCI 4010	Loss Models I	3
ACSCI 4020	Credibility Theory	3
MATH 2650	Calculus III	4
MATH 3730	Introduction to Scientific Computing	3
MATH 3850	Introduction to Partial Differential Equations	3
MATH 4140	Analysis I	3
MATH 4150	Analysis II	3
MATH 4210	Logic for Mathematics and Computer Science	3

MATH 4410	Life Contingencies I	3
MATH 4420	Life Contingencies II	3
MKT 3420	Foundation Of Personal Selling	3
MKT 4100	Promotional Strategy	3
MKT 4420	Sales Management	3
MKT 4500	Advanced Professional Selling	3
MKT 4520	Sales Enablement Tools and Technology	3
ENTSP 3130	Feasibility Analysis for New Ventures	3
ENTSP 4540	Entrepreneurial Marketing	3
ENTSP 4800	Applied Entrepreneurship: Executing New Ventures	3
MGMT 3200	Corporate Entrepreneurship	3
MGMT 3810	Managing Family Businesses	3
MGMT 4710	Introduction to Human Resource Management	3
MGMT 4730	Evidence-Based Decision Making in Human Resource Management	3
MGMT 4750	Employment Law for Human Resource Management	3
HCM 3020	Economics for Healthcare Managers	3
STAT 3410	Introduction to the Theory of Probability and Statistics I	4
STAT 3420	Introduction to the Theory of Probability and Statistics II	4

Students are responsible for meeting the prerequisites or any enrollment restrictions when registering for the elective courses from the approved list.

Students are limited to three business majors/degrees/certificates/minors within the Ivy College of Business. This limit is on business majors/degrees/certificates/minors only and does not apply to multiple majors/degrees/certificates/minors taken outside the Ivy College of Business.

Students need to fulfill the course prerequisites set by the Ivy College of Business.

Courses taken for a certificate may not be taken on a pass/not-pass basis.

The certificate is intended for students enrolled in a baccalaureate degree program at Iowa State University or that currently hold a baccalaureate degree from an accredited institution. Students holding a baccalaureate degree from an accredited institution must meet admission requirements to be enrolled at Iowa State University.

A certificate is not awarded until baccalaureate requirements are fulfilled.

A cumulative grade point average of at least 2.0 is required in courses taken for a certificate.

For more information on the undergraduate certificates offered by the Ivy College of Business, please visit: <https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/minors-and-certificates/>.

Concurrent Programs

The Department of Finance offers one concurrent degree program that allows qualified students to be admitted to the Master of Finance (MFIN) program while completing their undergraduate degree in finance. Students can double count up to 6 credits of coursework between the degrees, allowing them to complete both a B.S. in Finance and a master's degree in as little as five years.

For more information about the concurrent B.S. in Finance and Master of Finance (MFIN) program, please visit: <https://www.ivybusiness.iastate.edu/academics/graduate-programs/concurrent-degree-options/>. (<https://www.ivybusiness.iastate.edu/academics/graduate-programs/concurrent-degree-options/>)

Graduate Programs

Master of Finance (MFIN)

The Finance Department offers a Master of Finance (MFIN) degree. The MFIN is a non-thesis, non-creative component curriculum designed to provide students with in-depth coverage of finance topics and a strong quantitative skill set. Students will learn financial analysis and valuation, advanced regression techniques and programming approaches for data analysis, time series analysis and forecasting, optimization techniques, modelling of financial and risk variables, simulation techniques, and tools for effective risk management. The 30-credit program requires 18 core credits. Another 12 credits of electives are required, six of which must be in finance courses.

Student Learning Outcomes

Upon graduation, Master of Finance (MFIN) students will:

1. Be critical thinkers in finance.
2. Have a broad understanding of financial concepts.
3. Have strong problem solving and decision-making skills.
4. Have a strong background in ethical development.

For more information about the MFIN program, please visit: <https://www.ivybusiness.iastate.edu/academics/graduate-programs/master-of-finance/>. (<https://www.ivybusiness.iastate.edu/academics/graduate-programs/master-of-finance/>)

Master of Real Estate Development (MRED)

The Finance Department also offers a Master of Real Estate Development (MRED) degree. Jointly created with the College of Design, and with

significant input and engagement from industry leaders, the MRED is a 30-credit non-thesis, non-creative component program. The MRED program offers academic training, networking opportunities and collaboration with leading academics and practitioners to solve real world problems. Areas of study include real estate market analysis, finance, investments, leadership and negotiation, fundamentals of the build environment, construction science and urban planning. The curriculum is offered in a convenient format of distance learning and brief campus residencies, making it ideal for the full-time working professional.

Student Learning Outcomes

Upon graduation, Master of Real Estate Development (MRED) students will:

1. Be knowledgeable in various aspects of real estate.
2. Be critical thinkers in real estate.
3. Be innovators in real estate.
4. Be leaders in real estate.

For more information about the MRED program, please visit: <https://www.ivybusiness.iastate.edu/academics/graduate-programs/master-of-real-estate-development/>. (<https://www.ivybusiness.iastate.edu/academics/graduate-programs/master-of-real-estate-development/>)

Double Graduate Degrees

The Finance Department participates in two double degree programs at the graduate level. Students can simultaneously pursue a double degree in Master of Finance (MFIN) and Master of Real Estate Development (MRED), or in Master of Business Administration (MBA) and Master of Real Estate Development (MRED). The double degree plan allows students to share credits between the degrees. See the Director of Graduate Education for more details on sharing credits.

For more information on the double degree in Master of Finance (MFIN) and Master of Real Estate Development (MRED), please visit: <https://www.ivybusiness.iastate.edu/academics/graduate-programs/double-degree-options/mfin-mred/>. (<https://www.ivybusiness.iastate.edu/academics/graduate-programs/double-degree-options/mfin-mred/>)

For more information on the double degree in Master of Business Administration (MBA) and Master of Real Estate Development (MRED), please visit: <https://www.ivybusiness.iastate.edu/academics/graduate-programs/double-degree-options/mba-mred/>. (<https://www.ivybusiness.iastate.edu/academics/graduate-programs/double-degree-options/mba-mred/>)

Master of Business Administration (MBA)

The Department of Finance also participates in the full-time and part-time Master of Business Administration (MBA) program as well as the Ph.D. in Business and Technology program. The MBA is a 48-credit, non-thesis, non-creative component curriculum. Thirty of the 48 credits are

core courses and the remaining 18 are graduate electives. Within the MBA program, students may develop an area of specialization in Finance or Real Estate.

Student Learning Outcomes

Upon graduation, MBA students will:

1. Demonstrate effective communication skills.
2. Effectively lead and work in diverse teams.
3. Critically solve business problems.
4. Integrate ethical and global perspectives in decision making.

For more information about the MBA program with a specialization in Finance or Real Estate, please visit: <https://www.ivybusiness.iastate.edu/academics/graduate-programs/ivy-mba/>. (<https://www.ivybusiness.iastate.edu/academics/graduate-programs/ivy-mba/>)

PhD in Business and Technology

The PhD in Business and Technology with a Finance (FIN) specialization is a 74-credit (minimum) curriculum designed to train students to teach at the university level, to do research that is publishable in top academic journals, and to analyze questions that are important to government agencies and the private sector. Successful students develop close working relationships with the ISU finance faculty, both in the classroom and on co-authored research. We strive for our students to publish their first research study before finishing the program, and to obtain jobs at research-oriented universities in the U.S. and abroad. We emphasize rigorous training and hands-on experience. Five semesters of coursework include a firm grounding in economic theory, thorough training in statistics and econometrics, and an immersion in the most important research studies in corporate finance, investments, and financial institutions.

Student Learning Outcomes

Upon graduation, PhD students will be able to:

1. Understand and advance knowledge.
2. Create knowledge through original research.
3. Teach effectively in an institution of higher education.

For more information about the PhD program with a specialization in Finance, please visit: <https://www.ivybusiness.iastate.edu/academics/phd-program/finance/>. (<https://www.ivybusiness.iastate.edu/academics/phd-program/finance/>)

Graduate Certificate

The graduate certificate in finance provides training in investment valuation and the skills necessary to value an entire company through

analysis of expected cash flows based on financial statements, growth characteristics, and risk.

The certificate is for graduate students and recent graduates seeking job opportunities as investors or professional money managers, who deal with efficient asset allocation in a portfolio setting, investment performance measurement, and performance evaluation. The certificate is available on campus in Ames.

For more information about the graduate certificate in Finance, please visit: <https://www.ivybusiness.iastate.edu/academics/graduate-programs/graduate-certificates/finance/>. (<https://www.ivybusiness.iastate.edu/academics/graduate-programs/graduate-certificates/finance/>)

Healthcare Management

Working in the healthcare sector provides an unparalleled opportunity to promote individual and societal well-being. Industry-specific issues associated with highly specialized human capital, extensive regulation, complex organizational structures, rapid technological change, etc. demand an education tailored to understanding and excelling in healthcare management. A degree in healthcare management prepares students to help facilitate the sustainable delivery of high-quality patient care in a variety of healthcare contexts. The healthcare management program incorporates a robust, industry-specific curriculum taught by recognized scholars and industry professionals, all designed to provide students with the business acumen needed to successfully manage in the healthcare industry. Accounting for more than 15% of GDP, the healthcare sector is a large and growing driver of U.S. economic activity, and the opportunities to make an impactful difference in healthcare management are immense. The healthcare management program is designed to ensure you're ready to capitalize on these possibilities.

Undergraduate Major in Healthcare Management

For undergraduate curriculum in business, major in healthcare management.

The department of Management and Entrepreneurship offers a major in healthcare management. Students will complete the general education requirements (including business foundation courses), supporting courses/major prerequisites, business core requirements for the Bachelor of Science (B.S.) degree, and 24 additional credits in the major, which includes an experiential learning requirement, such as an internship or co-op.

Our curriculum is designed to prepare you to make a positive impact in healthcare management. Built on a foundation of knowledge about the healthcare management field, our interdisciplinary learning environment is also designed to facilitate development of comprehensive business skills including leadership, teamwork, evidence-based decision-making,

and strategy formulation and implementation. The collaborative nature of the program provides a holistic approach to healthcare management issues and facilitates a diverse educational experience. A structured experiential learning component complements the classroom portion of the program by providing you with the opportunity to apply material from the HCM curriculum and build additional skills by gaining real work experience in a healthcare organization, helping ensure that you're ready to launch your career immediately upon graduation.

For more information on the undergraduate major in Healthcare Management, please visit: <https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/healthcare-management/>. (<https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/healthcare-management/>)

Student Learning Outcomes

Upon graduation, undergraduate students majoring in Healthcare Management will:

1. Be effective communicators.
2. Be effective collaborators.
3. Be problem solvers.
4. Understand business concepts.
5. Recognize ethical and legal responsibilities to organizations.

Curriculum:

In addition to the basic business degree requirements (<https://catalog.iastate.edu/collegeofbusiness/#curriculuminbusinesstext>), healthcare management majors must also complete:

Required Courses:

HCM 3010	Introduction to the US Healthcare Industry	3
HCM 3020	Economics for Healthcare Managers	3
HCM 3030	Healthcare Quality Management	3
HCM 4010	Financial Management for Healthcare Organizations	3
HCM 4020	Law and Regulatory Environment in Healthcare	3
HCM 4030	Healthcare Information Systems	3
Experiential Learning (choose one):		
HCM 3910	Internship in Healthcare Management	3
HCM 3980	Cooperative Education *	R
HCM 4900	Independent Study in Healthcare Management §	3

Elective Courses (choose one or two): *

ACCT 4880	Governmental and Non-profit Institution Accounting	3
HCM 4040X	Cost-Effectiveness Analysis in Healthcare	3
MGMT 4220	Negotiation and Conflict Resolution	3

MGMT 4700	Leadership and Change Management	3
MGMT 4710	Introduction to Human Resource Management	3
MGMT 4720	Diversity, Equity, and Inclusion in Organizations	3
ENTSP 4100	Social Entrepreneurship	3
MKT 3510	Services Marketing	3
SCM 4240	Process Management, Analysis, and Improvement	3
SCM 4860	Principles of Purchasing and Supply Management	3
COMST 4120	Health Communication	3
GLOBE 3300	Global Health Disparities	3
HS 3100	Community and Public Health	3
PSYCH 4850	Health Psychology	3

* If HCM 3980 is taken for your experiential learning component, you must choose TWO elective courses from the list to fulfill the requirements for the major.

§ Course not offered on a regular basis. Students should consult with their academic advisor about terms of offering.

Total Credits: 24

The X designation after a course number indicates this is an experimental course offered by the Department. Although in an experimental phase, these courses are open for registration just the same as permanent courses listed in the course catalog and count as elective choices in the major.

Students are limited to three business majors/degrees/certificates/minors within the Ivy College of Business. This limit is on business majors/degrees/certificates/minors only and does not apply to multiple majors/degrees/certificates/minors taken outside the Ivy College of Business.

Healthcare Management, B.S.

Sample 4-Year Plan (Your plan may differ)

Freshman

Fall	Credits Spring	Credits
BUSAD 1020 or 1030	1 ECON 1020	3
ECON 1010	3 STAT 2260	3
COMS 1130	3 HUM/SOC SCI	3
ENGL 1500	3 ACCT 2840	3
MATH 1500	3 Global/International Perspective [@]	3
LIB 1600	1 BUSAD 2030	1
	14	16

Sophomore

Fall	Credits Spring	Credits
ACCT 2850	3 SPCM 3120	3
MKT 3400	3 ACCT 2150	3
MATH 1510	3 PHIL 2300	3
ENGL 2500	3 MGMT 3710	3
Natural Science	3 ENTSP 3100	3
	15	15

Junior

Fall	Credits Spring	Credits
ENGL 3020	3 HCM 3030	3
FIN 3010	3 HCM 4010	3
SCM 3010	3 MIS 3010	3
HCM 3010	3 MGMT 3720	3
HCM 3020	3 U.S. Cultures and Communities [#]	3
	15	15

Senior

Fall	Credits Spring	Credits
HUM/SOC SCI	3 MGMT 4780 [*]	3
Global/International Perspective [@]	3 HUM/SOC SCI	3
HCM 4020	3 HCM 4030	3
HCM 3910	3 HCM Elective	3
General Elective	5 General Electives	3
	17	15

Total Credits: 122

[@] Courses in these requirements may also be used as Global Perspective.

[#] U.S. Cultures and Communities courses may be used to satisfy HUM/SOC SCI.

^{*} Must have credit or enrollment in all core courses listed above, except for MGMT 3720, plus senior standing, in order to enroll in MGMT 4780.

Graduation Requirements:

1. Grade of "C" or higher in at least 30 credits of Core and Major courses.

2. 42 credits of 3000+ level courses from a four-year institution.

3. 50% of required Business courses must be earned at ISU.

4. At least 32 credits and the LAST 32 credits must be earned at ISU (exceptions for study abroad and internship may be requested).

5. 122 Credits minimum and a Cumulative GPA of at least 2.00 with no quality point deficiencies.

6. A grade of C or better in ENGL 2500 required, and also in one other required ENGL course.

7. All 3000-level and higher business credits must be earned at a four-year college.

8. Multiple business **majors** must have at least 15 distinct credits in each of the major requirements; when applicable, one course can be shared between business majors; see your advisor regarding multiple business **degree requirements**.

Undergraduate Certificate in Healthcare Management

The Department of Management and Entrepreneurship also offers a certificate in healthcare management that is open to all Iowa State University students. The certificate provides students with access to the same sort of robust, interdisciplinary curriculum that comprises the major in a more approachable format. Students will still learn valuable healthcare management skills and knowledge that complements their primary area of study. Built around a foundation of four required classes, the certificate includes elective courses from a wide variety of healthcare-related programs across campus, making it synergistic for students from a wide variety of majors. For students who want to work in a healthcare related field and do not want to major in healthcare management, earning the healthcare management certificate provides a recognizable credential that can help position them for success upon graduation and beyond.

Requirements

The Healthcare Management Certificate requires a minimum of 20 credits, including 11-12 required credits and 8-9 electives. At least 12 credits must be taken at Iowa State University.

Required Courses: (11-12 credits)

HCM 3010	Introduction to the US Healthcare Industry	3
or FSHN 4300	U.S. Health Systems and Policy	
HCM 3020	Economics for Healthcare Managers	3
HCM 3030	Healthcare Quality Management	3
HCM 4020	Law and Regulatory Environment in Healthcare	3

Elective Courses: (8-9 credits)

BIOL 2550	Fundamentals of Human Anatomy	3
BIOL 2560	Fundamentals of Human Physiology	3
BIOL 3280	Molecular and Cellular Biology of Human Diseases	3
BIOL 3350	Principles of Human and Other Animal Physiology	3
BIOL 3440	Human Reproduction	3
BIOL 4210	Biological Principles of Aging	3
BIOL 4230	Developmental Biology	3

BBMB 1210	Medicines, Drugs and You	2
BME 3520	Molecular, Cellular and Tissue Biomechanics	3
BME 4400	Biomedical Applications of Chemical Engineering	3
COMST 4120	Health Communication	3
ENTSP 3100	Entrepreneurship and Innovation	3
FSHN 3600	Advanced Nutrition and the Regulation of Metabolism in Health and Disease	3
FSHN 3640	Nutrition and Prevention of Chronic Disease	3
FSHN 3650	Obesity and Health	3
FSHN 3670	Medical Terminology for Health Professionals	1
FSHN 4600	Global Nutrition, Health and Sustainability	3
FSHN 4610	Medical Nutrition and Disease I	4
FSHN 4630	Community Nutrition and Health	3
GEN 3400	Human Genetics	3
GEN 3490	The Genome Perspective in Biology	4
GEN 4620	Evolutionary Genetics	3
GLOBE 3300	Global Health Disparities	3
GLOBE 3600	Global Health	3
HDFS 3670	Family Stress, Abuse, and Resilience	3
HDFS 3730	Death as a Part of Living	3
HDFS 3770	Aging and the Family	3
HDFS 3870	Trauma-Informed Practice	3
HDFS 3950	Children, Families, and Public Policy	3
HDFS 4860	Human Services Management II	3
HS 3100	Community and Public Health	3
HS 3500	Human Diseases	3
HS 3800	Worksite Health Promotion	3
HS 4300	Community Health Program Development	3
KIN 3450	Management of Health-Fitness Programs and Facilities	3
KIN 3650	Sport Psychology	3
or KIN 3660	Exercise Psychology	
MGMT 3700	Managing Organizations	3
MGMT 3710	Organizational Behavior	3
MGMT 3720	Ethical and Responsible Management	3
MICRO 4280	Principles of Epidemiology and Population Health	3
NRS 3600	Nursing Leadership and Management	3
NRS 4200	Promoting a Culture of Health and Wellness	3
NRS 4400	Population Health Nursing	3
PHIL 3310	Moral Problems in Medicine	3
POLS 3370X	Health Politics and Policy	3
PSYCH 2500	Psychology of the Workplace	3
PSYCH 3100	Brain and Behavior	3

PSYCH 3140	Motivation	3
PSYCH 3150	Drugs and Behavior	3
PSYCH 3160	Cognitive Psychology	3
PSYCH 3500	Human Factors in Technology	3
PSYCH 3600	Personality Psychology	3
PSYCH 4850	Health Psychology	3
RELIG 3610X	Religion, Health, and Medicine	3
SOC 2350	Social Problems and American Values	3
SOC 3050	Social Psychology: A Sociological Perspective	3
SOC 3270	Gender and Sexualities in Society	3
SOC 3300	Ethnic and Race Relations	3
SOC 3310	Social Class and Inequality	3
SOC 3450	Population and Society	3
SOC 3480	Global Poverty, Resources and Sustainable Development	3
SOC 4100	Human Trafficking	3

Students are responsible for meeting the prerequisites or any enrollment restrictions when registering for the elective courses from the approved list.

The X designation after a course number indicates this is an experimental course offered by the Department. Although in an experimental phase, these courses are open for registration just the same as permanent courses listed in the course catalog and count as elective choices in the major.

Students are limited to three business majors/degrees/certificates/minors within the Ivy College of Business. This limit is on business majors/degrees/certificates/minors only and does not apply to multiple majors/degrees/certificates/minors taken outside the Ivy College of Business.

Students need to fulfill the course prerequisites set by the Ivy College of Business.

A student may not receive both an undergraduate major and a certificate of the same name (ie. healthcare management majors cannot pursue the healthcare management certificate and the major at the same time).

Courses taken for the certificate may not be taken on a pass/not-pass basis.

The certificate is intended for students enrolled in a baccalaureate degree program at Iowa State University or that currently hold a baccalaureate degree from an accredited institution. Students holding a baccalaureate degree from an accredited institution must meet admission requirements to be enrolled at Iowa State University.

A certificate is not awarded until baccalaureate requirements are fulfilled.

A cumulative grade point average of at least 2.0 is required in courses taken for the certificate.

For more information on the undergraduate certificate in healthcare management, please visit: <https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/minors-and-certificates/healthcare-management-certificate/>

Human Resource Management

The last few years have shown that effective human resource management (HRM) is critical to the ongoing growth and success of organizations. As organizations have dealt with a stream of challenges including evolving workforce priorities - including new modalities of work, geopolitical issues, and the emergence of generative AI in the workplace, ensuring that their human capital was up to the challenge has been critical. Effective HRM ensures that organizations have the right people with the right skills working in the right systems to drive current and future organizational success. To educate future HR professionals capable of delivering on this promise, our HRM program is built around a robust curriculum integrating relevant HR content knowledge and professional skills with a contemporary data-driven perspective that organizations value.

Undergraduate Major in Human Resource Management

For undergraduate curriculum in business, major in human resource management.

The Department of Management and Entrepreneurship offers a major in human resource management. Students will complete the general education requirements (including business foundation courses), supporting courses/major prerequisites, business core requirements for the Bachelor of Science (B.S.) degree, and 21 additional credits in the major.

The HRM program is designed to deliver a well-rounded professional education by equipping students with technical expertise in key functional areas such as talent acquisition, learning and development, continuous performance management, compliance and risk management, and strategic and integrated rewards. Additionally, the program focuses on developing essential soft skills, including professionalism, relationship management, business partnering, teamwork and collaboration, listening, and leadership. Furthermore, it enhances students' critical and analytical thinking, data interpretation, and communication skills, ensuring they are well-prepared for the dynamic field of contemporary human resource management.

For more information on the undergraduate major in Human Resource Management, please visit: <https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/human-resource-management/>.

(<https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/human-resource-management/>)

Student Learning Outcomes

Upon graduation, undergraduate students majoring in Human Resource Management will:

1. Be effective communicators.
2. Be effective collaborators.
3. Be problem solvers.
4. Understand business concepts.
5. Recognize ethical and legal responsibilities to organizations.

Curriculum:

In addition to the basic business degree requirements (<https://catalog.iastate.edu/collegeofbusiness/#curriculuminbusinesstext>), human resource management majors must also complete:

Required Courses (18 credits):

MGMT 4710	Introduction to Human Resource Management	3
MGMT 4720	Diversity, Equity, and Inclusion in Organizations	3
MGMT 4730	Evidence-Based Decision Making in Human Resource Management	3
MGMT 4750	Employment Law for Human Resource Management	3
MGMT 4740	Compensation and Benefits	3
MGMT 4760	Applied Projects in Human Resource Management	3

Elective Courses (3 credits):

MGMT 3200	Corporate Entrepreneurship	3
MGMT 4700	Leadership and Change Management	3
MGMT 4220	Negotiation and Conflict Resolution	3
MIS 4360	Introduction to Business Analytics	3

Total Credits: 21

Students are limited to three business majors/degrees/certificates/minors within the Ivy College of Business. This limit is on business majors/degrees/certificates/minors only and does not apply to multiple majors/degrees/certificates/minors taken outside the Ivy College of Business.

Human Resource Management, B.S.

Sample 4-Year Plan (Your plan may differ)

Freshman

Fall	Credits Spring	Credits
BUSAD 1020 or 1030	1 ECON 1020	3
ECON 1010	3 STAT 2260	3
COMS 1130	3 PHIL 2300	3
ENGL 1500	3 ACCT 2840	3
MATH 1500	3 Global/International Perspective [@]	3
LIB 1600	1 BUSAD 2030	1
	14	16

Sophomore

Fall	Credits Spring	Credits
ACCT 2850	3 SPCM 3120	3
MGMT 3710	3 ACCT 2150	3
MATH 1510	3 ENTSP 3100	3
ENGL 2500	3 Core Business Course	3
Natural Science	3 HUM/SOC SCI	3
	15	15

Junior

Fall	Credits Spring	Credits
ENGL 3020	3 MGMT 4730	3
Core Business Course	6 MGMT 4750	3
MGMT 4710	3 Core Business Course	6
MGMT 4720*	3 HUM/SOC SCI	3
	15	15

Senior

Fall	Credits Spring	Credits
MGMT 4740	3 MGMT 4780 [#]	3
HRM Elective	3 MGMT 4760	3
Global/International Perspective [@]	3 HUM/SOC SCI	3
General Electives	8 General Electives	6
	17	15

Total Credits: 122

[@] Courses in these requirements may also be used as Global Perspective.

* MGMT 4720 satisfies the U.S. Cultures and Communities requirement

[#] Must have credit or enrollment in all core courses listed above, except for MGMT 3720, plus senior standing, in order to enroll in MGMT 4780.

Graduation Requirements:

1. Grade of "C" or higher in at least 30 credits of Core and Major courses.

2. 42 credits of 3000+ level courses from a four-year institution.
3. 50% of required Business courses must be earned at ISU.
4. At least 32 credits and the LAST 32 credits must be earned at ISU (exceptions for study abroad and internship may be requested).
5. 122 Credits minimum and a Cumulative GPA of at least 2.00 with no quality point deficiencies.
6. A grade of C or better in ENGL 2500 required, and also in one other required ENGL course.
7. All 3000-level and higher business credits must be earned at a four-year college.
8. Multiple business **majors** must have at least 15 distinct credits in each of the major requirements; when applicable, one course can be shared between business majors; see your advisor regarding multiple business **degree** requirements.

Graduate Programs

The Department of Management and Entrepreneurship participates in the PhD in Business and Technology program.

PhD in Business and Technology

The PhD in Business and Technology with a Management (MGMT) specialization is a 74-credit (minimum) curriculum that will prepare students to conduct and publish scholarly research in management, including the sub-fields of strategy, organizational behavior, and human resource management. In addition to curriculum in these core areas, students will also take courses in research methods and the closely related area of entrepreneurship.

The goal of this program is to prepare students to compete for tenure-track positions at leading research universities in the United States and abroad. As a doctoral candidate, students will learn how to conduct impactful research, and they are expected to develop a research pipeline and publish their work in top academic journals before entering the job market.

Student Learning Outcomes

Upon graduation, PhD students will be able to:

1. Understand and advance knowledge.
2. Create knowledge through original research.
3. Teach effectively in an institution of higher education.

For more information about the PhD program with a specialization in Management, please visit: <https://www.ivybusiness.iastate.edu/academics/phd-program/management/>. (<https://www.ivybusiness.iastate.edu/academics/phd-program/management/>)

International Business

The secondary major in International Business will be discontinued Fall 2025 pending Board of Regents State of Iowa approval.

International business is a multidisciplinary field dedicated to understanding how to successfully formulate and execute commercial activity that spans national borders. Contemporary issues related to environmental concerns, political instability, and human rights have made international business decisions more complicated for organizations, leading to a global re-evaluation of how business should be conducted internationally. Whether you desire a career working internationally or simply want to understand how the broader business environment affects fundamental organizational decisions for domestic firms, our International Business program provides a broad global perspective to inform your world view and help you develop business acumen through an exploration of how business intersects with politics, economic considerations, and culture.

Undergraduate Secondary Major in International Business

For undergraduate curriculum in business, secondary major in International Business.

Administered by the Department of Management and Entrepreneurship.

The major is designed to provide a strong common foundation in international business with two required international overview courses. In addition, students are encouraged to take additional coursework with relevance to their business and career interests, with business-specific courses spanning numerous functional areas and general cultural classes covering numerous regions of the world. Students also have the opportunity to shape their international exposure via multiple study abroad options or via additional coursework at Iowa State.

For information on the secondary major in International Business, make an appointment (<https://cyclones.campus.eab.com/pal/AG7HsCRKhM/>) through Navigate to see the Ivy College of Business International Programs Coordinator, located in 2139 Gerding Business Building or email ivyintl@iastate.edu.

For more information on the undergraduate secondary major in International Business, please visit: <https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/international-business/>. (<https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/international-business/>)

Student Learning Outcomes

Upon graduation, undergraduate students with a secondary major in international business will:

1. Understand the global business environment and how it connects to their primary major.
2. Be effective communicators in intercultural and international settings.
3. Understand how culture, history, politics, and economics connect to business practices and operations both domestically and internationally.
4. Develop intercultural skills required for success in business.

The secondary major in International Business will be discontinued Fall 2025 pending Board of Regents State of Iowa approval.

Secondary Major in International Business

In addition to the basic business degree requirements (<https://catalog.iastate.edu/collegeofbusiness/#curriculuminbusinesstext>), the requirements for the secondary major in International Business are met by successful completion of the following:

International Overview (6 credits)

BUSAD 3010 Introduction to International Business. This course focuses on the principles and practice of international business across functional areas, with an emphasis on comparing the legal, political, economic, and cultural dimensions of domestic and international business.

MGMT 4140 International Management . The nature and economic role of the multinational firm and entrepreneurial ventures, including the impact of legal, political, and cultural variables upon firm performance and managerial activity; case studies illustrate interdependent nature of functional areas of business projected across national boundaries.

Business Focus (6 credits)*

Select two courses from the list below:

ACCT 4960	Accounting in the Global Economy	3
ENTSP 3670	International Entrepreneurship	3
ECON 3550	International Trade and Finance	3
ECON 3850	Economic Development	3
ECON 4550	International Trade	3
ECON 4570	International Finance	3
FIN 4800	International Finance	3
FIN 4910	International Study Course in Global Capital Markets	3
MGMT 4720	Diversity, Equity, and Inclusion in Organizations	3
MIS 4950	Executive Analysis and Presentation	3
MKT 4480	Global Marketing	3
MKT 4920	Comparative Marketing	3
SCM 4660	Global Trade Management	3
SCM 4910	International Live Case and Study Tour	3
SCM 4730	War and Peace and Supply Chains	3

* Additional business-focused courses incorporating an international travel component may be able to be applied towards fulfilling this requirement with approval of the Ivy International Programs Coordinator.

Global Engagement, Awareness, and Regional Perspective Requirement

Students can fulfill this portion of the IBUS major by completing **one** of the three options outlined below:

- Option 1:
 - One semester abroad, earning at least 12 credits AND
 - BUSAD 3920X: Contextualizing Your International Experience (3 cr.), taken the semester after returning from abroad[^] AND
 - One course from the approved Global Awareness courses below[§]
- Option 2:
 - One faculty-led study abroad program (may use a course from the Business Focus to meet this) AND
 - One Regional Focus course from the list below with relevance to the chosen study-abroad program AND
 - One course from the approved Global Awareness courses below[§]
- Option 3:
 - Plan of study approved by the Ivy International Programs Coordinator
 - Please note, in some instances international travel may not be required to fulfill the IBUS major—see the Ivy International Programs Coordinator for more information.

[^] In the event that students complete their semester abroad during their final semester, this class may be taken concurrently.

[§] Course(s) may be taken while studying abroad.

Global Awareness (3 credits)

Select 3 credits from the list below:

ANTHR 2200	Globalization and Sustainability	3
ANTHR 2300	Globalization and the Human Condition	3
ANTHR 3360	Culture and Capitalism	3
CRP 2910	World Cities and Globalization	3
CRP 3760	Rural, Urban and Regional Economics	3
CRP 4290	Planning in Developing Countries	3
DSNS 3040	Global Challenges: Intro to UN Sustainable Development Goals	3
INTST 2350	Introduction to International Studies	3

INTST 2500	The World's Regions in a Global Context	3
INTST 3500	Topics in International Studies	2-4
MKT 4840	Technology, Globalization and Culture	3
POLS 3810	International Political Economy	3
SOC 3480	Global Poverty, Resources and Sustainable Development	3
SOC 4110	Social Change in Developing Countries	3
WGS 4350	Gender, Globalization and Development	3
WLC 1190	Introduction to World Languages	3
WLC 2700	Cultures in Transition	3

Regional Focus****Africa***

Language*: WLC 1070 Introduction to Swahili

AFAM 3100	Africa to 1880	3
AFAM 3110	Africa under Colonial Rule	3
AFAM 3550	Understanding Sub-Saharan Africa	3
RELIG 3580	Islam	3

Mid-East

Language*: Arabic

ARABC 3750	Arab Culture	3
ANTHR 3350	Anthropology of the Middle East	3
HIST 4350	History of the Modern Middle East	3
POLS 3500	Politics of the Middle East	3
RELIG 3580	Islam	3
RELIG 3590	The Quran	3

China

Language*: Chinese

CHIN 3720	Introduction to Chinese Culture	3
CHIN 3750	China Today	3-4
ECON 3870	Economies of China and India	3
HIST 2070	Chinese Civilization	3
HIST 3360	Ancient China	3
HIST 3370	Modern China	3
POLS 3420	Chinese Politics	3

India

WLC 3520	Religions of India	3
ECON 3870	Economies of China and India	3
RELIG 3580	Islam	3

Japan

See the Ivy College International Programs Coordinator for options.

Russia

Language*: Russian

HIST 4210	History of Russia I	3
HIST 4220	History of Russia II	3
POLS 3490	Politics of Russia and Eastern Europe	3
RUS 3750	Russia Today	3

Southern Europe

POLS 3460	European Politics	3
RELIG 3320	Catholicism	

Spain

Language*: Spanish

SPAN 3210	Spanish Civilization	3
SPAN 3230	Spain Today	3

Italy

Language*: ITAL 1070 Intensive Beginning Italian

CLST 4030	Roman Civilization	3

France

Language*: French

FRNCH 3200	France Today	3
FRNCH 4760	French Culture and Society in English	3-4
HIST 4190	History of Modern France	3

Northern Europe

POLS 3460	European Politics	3

German

Language*: German

GER 3200	Germany Today	3
GER 3300	German Literature and Culture	3
GER 4760	Topics in German Cultural Studies	3-4
HIST 4240	History of Modern Germany	3

UK

HIST 3270	History of the British Empire	3
POLS 3480	British Government and Politics	3

Latin America

Language*: Spanish or Portuguese

HIST 3400	Colonial Latin America	3
HIST 3410	Modern Latin America	3
HIST 4410	History of Modern Mexico and Central America	3
POLS 3430	Latin American Government and Politics	3
PORT 3750	Brazil Today	3

RELIG 3320	Catholicism	3
SPAN 3220	Latin American Civilization	3
SPAN 3240	Latin America Today	3

* Relevant university-level foreign language courses can be used to satisfy a Regional Focus requirement. Please note that sign language courses are not considered an approved foreign language.

Fifteen of the 18 credits required for the International Business secondary major must not be used for the primary major.

Students are limited to three business majors/degrees/certificates/minors within the Ivy College of Business. This limit is on business majors/degrees/certificates/minors only and does not apply to multiple majors/degrees/certificates/minors taken outside the Ivy College of Business.

Undergraduate Minor in International Business

Students with a major in the Ivy College of Business may earn a minor in International Business by completing 15 credits of approved coursework. The minor requires one course from the approved International Overview courses, two courses from the approved Business Focus courses, and by completing the Faculty-Led Global Awareness track, or the Foreign Language Global Awareness track, or through a plan of study approved by the Ivy International Programs Office. The minor must include at least six credits in courses numbered 3000 or above taken at Iowa State University with a grade of C or higher. The minor must include at least 3 credits that are not used to meet any other department, college, or university requirement. Students with declared majors have priority over students with declared minors in courses with space constraints.

International Overview (3 credits)

Choose one course from the list below:

BUSAD 3010 Introduction to International Business. This course focuses on the principles and practice of international business across functional areas, with an emphasis on comparing the legal, political, economic, and cultural dimensions of domestic and international business.

MGMT 4140 International Management. The nature and economic role of the multinational firm and entrepreneurial ventures, including the impact of legal, political, and cultural variables upon firm performance and managerial activity; case studies illustrate interdependent nature of functional areas of business projected across national boundaries.

Business Focus (6 CREDITS) *

Select two courses from the list below:

ACCT 4960	Accounting in the Global Economy	3
ENTSP 3670	International Entrepreneurship	3
ECON 3550	International Trade and Finance	3

ECON 3850	Economic Development	3
ECON 4550	International Trade	3
ECON 4570	International Finance	3
FIN 4800	International Finance	3
FIN 4910	International Study Course in Global Capital Markets	3
MGMT 4720	Diversity, Equity, and Inclusion in Organizations	3
MIS 4950	Executive Analysis and Presentation	3
MKT 4480	Global Marketing	3
MKT 4920	Comparative Marketing	3
SCM 4660	Global Trade Management	3
SCM 4910	International Live Case and Study Tour	3
SCM 4730	War and Peace and Supply Chains	3

* Additional business-focused courses incorporating an international travel component may be able to be applied towards fulfilling this requirement with approval of the Ivy International Programs Coordinator.

Global Awareness

Complete one of the two options below:

- Option 1:
 - One faculty-led study abroad program (may use a course from the Business Focus to meet this) AND
 - One Regional Focus course[†] from the list found below with relevance to the chosen study-abroad program AND
 - One course from the approved Global Awareness courses[#] found below.
- Option 2:
 - Plan of study approved by the Ivy International Programs Coordinator
 - Please note, in some instances international travel may not be required to fulfill the IBUS minor—see the Ivy International Programs Coordinator for more information.

Regional Focus[†]

Africa

Language[§]: WLC 1070 Introduction to Swahili

AFAM 3100	Africa to 1880	3
AFAM 3110	Africa under Colonial Rule	3
AFAM 3550	Understanding Sub-Saharan Africa	3
RELIG 3580	Islam	3

Mid-East

Language[§]: Arabic

ARAB 3750	Arab Culture	3
ANTHR 3350	Anthropology of the Middle East	3
HIST 4350	History of the Modern Middle East	3
POLS 3500	Politics of the Middle East	3
RELIG 3580	Islam	3
RELIG 3590	The Quran	3

ChinaLanguage[§]: Chinese

CHIN 3720	Introduction to Chinese Culture	3
CHIN 3750	China Today	3-4
ECON 3870	Economies of China and India	3
HIST 2070	Chinese Civilization	3
HIST 3360	Ancient China	3
HIST 3370	Modern China	3
POLS 3420	Chinese Politics	3

India

WLC 3520	Religions of India	3
ECON 3870	Economies of China and India	3
RELIG 3580	Islam	3

Japan

See the Ivy College International Programs Coordinator for options.

RussiaLanguage[§]: Russian

HIST 4210	History of Russia I	3
HIST 4220	History of Russia II	3
POLS 3490	Politics of Russia and Eastern Europe	3
RUS 3750	Russia Today	3

Southern Europe

POLS 3460	European Politics	3
RELIG 3320	Catholicism	

SpainLanguage[§]: Spanish

SPAN 3210	Spanish Civilization	3
SPAN 3230	Spain Today	3

ItalyLanguage[§]: ITAL 1070 Intensive Beginning Italian

CLST 4030	Roman Civilization	3

FranceLanguage[§]: French

FRNCH 3200	France Today	3
FRNCH 4760	French Culture and Society in English	3-4
HIST 4190	History of Modern France	3

Northern Europe

POLS 3460	European Politics	3

GermanLanguage[§]: German

GER 3200	Germany Today	3
GER 3300	German Literature and Culture	3
GER 4760	Topics in German Cultural Studies	3-4
HIST 4240	History of Modern Germany	3

UK

HIST 3270	History of the British Empire	3
POLS 3480	British Government and Politics	3

Latin AmericaLanguage[§]: Spanish or Portuguese

HIST 3400	Colonial Latin America	3
HIST 3410	Modern Latin America	3
HIST 4410	History of Modern Mexico and Central America	3
POLS 3430	Latin American Government and Politics	3
PORT 3750	Brazil Today	3
RELIG 3320	Catholicism	3
SPAN 3220	Latin American Civilization	3
SPAN 3240	Latin America Today	3

§ Relevant university-level foreign language courses can be used to satisfy a Regional Focus requirement. Please note that sign language courses are not considered an approved foreign language.

Global Awareness (3 credits) #

Select 3 credits from the list below:

ANTHR 2200	Globalization and Sustainability	3
ANTHR 2300	Globalization and the Human Condition	3
ANTHR 3360	Culture and Capitalism	3
CRP 2910	World Cities and Globalization	3
CRP 3760	Rural, Urban and Regional Economics	3
CRP 4290	Planning in Developing Countries	3
DSNS 3040	Global Challenges: Intro to UN Sustainable Development Goals	3
INTST 2350	Introduction to International Studies	3
INTST 2500	The World's Regions in a Global Context	3
INTST 3500	Topics in International Studies	2-4

MKT 4840	Technology, Globalization and Culture	3
POLS 3810	International Political Economy	3
SOC 3480	Global Poverty, Resources and Sustainable Development	3
SOC 4110	Social Change in Developing Countries	3
WGS 4350	Gender, Globalization and Development	3
WLC 1190	Introduction to World Languages	3
WLC 2700	Cultures in Transition	3

Students are limited to three business majors/degrees/certificates/minors within the Ivy College of Business. This limit is on business majors/degrees/certificates/minors only and does not apply to multiple majors/degrees/certificates/minors taken outside the Ivy College of Business.

For more information on the undergraduate minor in International Business, please visit: <https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/minors-and-certificates/>. (<https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/minors-and-certificates/>)

Management

Management is a broadly defined discipline encompassing a diverse set of activities that span all business functions. Managers are pivotal in nearly all business aspects, from crafting strategic plans to embodying leadership and overseeing daily operations. Sound management ensures effective and integrated resource utilization that is essential for organizational success.

Designed around learning critical conceptual, technical, and human skills valued by contemporary organizations, the management major is structured to prepare students to be successful organizational leaders. Whether taken as a stand-alone major or as a complement to another technical skill set, this skills-based approach ensures management majors have both the theoretical and practical background to excel in a wide range of organizational settings.

Undergraduate Major in Management

For undergraduate curriculum in business, major in management.

The Department of Management and Entrepreneurship offers a major in management. Students will complete the general education requirements (including business foundation courses), supporting courses/major prerequisites, business core requirements for the Bachelor of Science (B.S.) degree, and 18 additional credits in the major.

The required courses at the core of the management major build foundational managerial skills with broad applicability (e.g. leadership, conflict mitigation, and strategic-thinking skills). Elective courses provide additional contextual knowledge (e.g. managing in a family or

international business) as well as complementary managerial skills (e.g. motivational, analytic, project management and sales skills), allowing students to accentuate their skill set in areas best aligned with their career objectives.

The major is designed to help students gain an understanding of the role of evidence, inclusiveness, ethics and technology in business decision-making and the impact of external forces and global issues on organizations. Students are challenged to think critically, communicate effectively and contribute constructively to effective team performance. To prepare students for professional success, required courses in the major provide a variety of rich developmental experiences that include applied learning, case analysis, research projects, team-based active learning projects, and interaction with guest speakers, in addition to traditional classroom lectures and discussions.

For more information on the undergraduate major in Management, please visit: <https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/management/>. (<https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/management/>)

Student Learning Outcomes

Upon graduation, undergraduate students majoring in Management will:

1. Be effective communicators.
2. Be effective collaborators.
3. Be problem solvers.
4. Understand business concepts.
5. Recognize ethical and legal responsibilities to organizations.

Curriculum:

In addition to the basic business degree requirements (<https://catalog.iastate.edu/collegeofbusiness/#curriculuminbusinesstext>) the Management major requires students to take 18 credit hours in the Management area, including 12 credit hours of required core courses and 6 credit hours of electives.

Required Courses (12 credits):

MGMT 3700	Managing Organizations	3
MGMT 4220	Negotiation and Conflict Resolution	3
MGMT 4700	Leadership and Change Management	3
MGMT 4720	Diversity, Equity, and Inclusion in Organizations	3

Elective Courses (6 credits):

Select two courses from the following list:

ENTSP 4600X	Franchising Strategy	3
MGMT 3200	Corporate Entrepreneurship	3
MGMT 3810	Managing Family Businesses	3
MGMT 4140	International Management	3

MGMT 4210X	Personality and Management	3
MGMT 4710	Introduction to Human Resource Management	3
MGMT 4730	Evidence-Based Decision Making in Human Resource Management	3
MGMT 4810X	Nonprofit Management	3
MIS 3400	Project Management	3
MKT 3420	Foundation Of Personal Selling	3
MKT 3670	Consultative Problem Solving	3

* Course not offered on a regular basis. Students should consult with their academic advisor about terms of offering.

The X designation after a course number indicates this is an experimental course offered by the Department. Although in an experimental phase, these courses are open for registration just the same as permanent courses listed in the course catalog and count as elective choices in the major.

Students are limited to three business majors/degrees/certificates/minors within the Ivy College of Business. This limit is on business majors/degrees/certificates/minors only and does not apply to multiple majors/degrees/certificates/minors taken outside the Ivy College of Business.

Management, B.S.

Sample 4-Year Plan (Your plan may differ)

Freshman

Fall	Credits Spring	Credits
BUSAD 1020 or 1030	1 ECON 1020	3
ECON 1010	3 STAT 2260	3
COMS 1130	3 PHIL 2300	3
ENGL 1500	3 ACCT 2840	3
MATH 1500	3 Global/International Perspective [@]	3
LIB 1600	1 BUSAD 2030	1
	14	16

Sophomore

Fall	Credits Spring	Credits
ACCT 2850	3 SPCM 3120	3
MGMT 3710	3 ACCT 2150	3
MATH 1510	3 HUM/SOC SCI	3
ENGL 2500	3 Business Core Course	3
Natural Science	3 General Elective	3
	15	15

Junior

Fall	Credits Spring	Credits
MGMT 3700	3 MGMT 4220	3
Business Core Courses	6 MGMT 4720 [#]	3
HUM/SOC SCI	3 Business Core Courses	6
General Elective	3 General Elective	3
	15	15

Senior

Fall	Credits Spring	Credits
MGMT 4700	3 MGMT 4780 [*]	3
MGMT Elective	3 MGMT Elective	3
General Elective	5 HUM/SOC SCI	3
ENGL 3020	3 Global/International Perspective [@]	3
Business Core Course	3 General Electives	3
	17	15

Total Credits: 122

@ Courses in these requirements may also be used as Global Perspective.

MGMT 4720 satisfies the US Cultures and Communities requirement.

* Must have credit or enrollment in all core courses listed above, except for MGMT 3720, plus senior standing, in order to enroll in MGMT 4780.

Graduation Requirements:

1. Grade of "C" or higher in at least 30 credits of Core and Major courses.
2. 42 credits of 3000+ level courses from a four-year institution.
3. 50% of required Business courses must be earned at ISU.
4. At least 32 credits and the LAST 32 credits must be earned at ISU (exceptions for study abroad and internship may be requested).
5. 122 Credits minimum and a Cumulative GPA of at least 2.00 with no quality point deficiencies.
6. A grade of C or better in ENGL 2500 required, and also in one other required ENGL course.
7. All 3000-level and higher business credits must be earned at a four-year college.
8. Multiple business **majors** must have at least 15 distinct credits in each of the major requirements; when applicable, one course can be shared between business majors; see your advisor regarding multiple business **degree requirements**.

Undergraduate Minor in Management

The Department of Management and Entrepreneurship also offers a minor for non-Management majors in the Ivy College of Business. The minor requires 15 credits from an approved list of courses, including at least 6 credits in courses numbered 3000 or above taken at Iowa State University with a grade of C or higher. The minor must include at least 3 credits that are not used to meet any other department, college, or university requirement. Students with declared majors have priority over students with declared minors in courses with space constraints.

Required Courses (6 credits):

MGMT 3710	Organizational Behavior	3
MGMT 4780	Strategic Management	3

Elective Courses (9 credits):

Select nine credit hours from 3000- or 4000-level Management courses (excluding MGMT 3720).

Students are limited to three business majors/degrees/certificates/minors within the Ivy College of Business. This limit is on business majors/degrees/certificates/minors only and does not apply to multiple majors/degrees/certificates/minors taken outside the Ivy College of Business.

For more information on the undergraduate minor in Management, please visit: <https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/minors-and-certificates/>. (<https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/minors-and-certificates/>)

Graduate Programs

The Department of Management and Entrepreneurship participates in the full-time and part-time Master of Business Administration (MBA) and in the PhD in Business and Technology programs.

Master of Business Administration (MBA)

The MBA is a 48-credit, non-thesis, non-creative component curriculum. Thirty of the 48 credits are core courses and the remaining 18 are graduate electives. Within the MBA program, students can obtain a specialization in Leadership.

Student Learning Outcomes

Upon graduation, MBA students will:

1. Demonstrate effective communication skills.
2. Effectively lead and work in diverse teams.
3. Critically solve business problems.
4. Integrate ethical and global perspectives in decision making.

For more information about the MBA program with a specialization in Leadership, please visit: <https://www.ivybusiness.iastate.edu/academics/graduate-programs/ivy-mba/>. (<https://www.ivybusiness.iastate.edu/academics/graduate-programs/ivy-mba/>)

PhD in Business and Technology

The PhD in Business and Technology with a Management (MGMT) specialization is a 74-credit (minimum) curriculum that will prepare students to conduct and publish scholarly research in management, including the sub-fields of strategy, organizational behavior, and human resource management. In addition to curriculum in these core areas, students will also take courses in research methods and the closely related area of entrepreneurship.

The goal of this program is to prepare students to compete for tenure-track positions at leading research universities in the United States and abroad. As a doctoral candidate, students will learn how to conduct impactful research, and they are expected to develop a research pipeline and publish their work in top academic journals before entering the job market.

Student Learning Outcomes

Upon graduation, PhD students will be able to:

1. Understand and advance knowledge.
2. Create knowledge through original research.
3. Teach effectively in an institution of higher education.

For more information about the PhD program with a specialization in Management, please visit: <https://www.ivybusiness.iastate.edu/academics/phd-program/management/>. (<https://www.ivybusiness.iastate.edu/academics/phd-program/management/>)

Management Information Systems

Management Information Systems is the analysis and use of information systems and technologies to support problem solving and decision making within and across organizations. Organizations and companies use data, most often in digital form, to conduct nearly every part of their businesses and functions. The program provides students with the core knowledge related to every dimension of information systems and technologies, including the creation and implementation of software and databases, to information security, analytics, and the user interface. The program takes a balanced approach with both technical and managerial coursework.

Undergraduate Major in Management Information Systems

For undergraduate curriculum in business, major in management information systems.

The Department of Information Systems and Business Analytics offers a major in management information systems. Students will complete the general education requirements (including business foundation courses), business core requirements for the Bachelor of Science (B.S.) degree, and 18 additional credits in the major.

The instructional objective of the Management Information Systems major is to prepare students for professional careers with a wide variety of firms and roles, ranging from small start-up firms to large multinational corporations. Common job titles include business analyst and systems analyst. Students are also pursuing careers in Information Technology consulting.

For more information on the undergraduate major in Management Information Systems, please visit: <https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/management-information-systems/>. (<https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/management-information-systems/>)

Student Learning Outcomes

Upon graduation, undergraduate students majoring in Management Information Systems will:

- 1. Be effective communicators.
- 2. Be effective collaborators.
- 3. Be problem solvers.
- 4. Understand business concepts.
- 5. Recognize ethical and legal responsibilities to organizations.

Curriculum:

In addition to the basic business degree requirements (<https://catalog.iastate.edu/collegeofbusiness/#curriculuminbusinesstext>) the Management Information Systems major requires students to take 18 credit hours in the management information systems area, including 12 credit hours of required core courses and 6 credit hours of electives.

Required Courses (12 credits):

MIS 3070	Intermediate Business Programming	3
MIS 3100	Information Systems Analysis	3
MIS 3200	Database Management Systems	3
MIS 3400	Project Management	3

Elective Courses (6 credits):

Select 6 credits of MIS department courses from the list below:

MIS 3116X	Data Visualization and Storytelling	3
MIS 3150	Business Data Streams and Issues	3
MIS 3670	Consultative Problem Solving	3
MIS 4001X	Technology Entrepreneurship	3
MIS 4030	Healthcare Information Systems	3

MIS 4070	Advanced Business Programming	3
MIS 4100	Blockchain and Cryptocurrency	3
MIS 4350	Cybersecurity in Business	3
MIS 4360	Introduction to Business Analytics #	3
MIS 4400	Supply Chain Information Systems	3
MIS 4420X	Generative AI in Business Decision-Making	3
MIS 4450	Enterprise Cybersecurity	3
MIS 4460	Advanced Business Analytics #	3
MIS 4470	Information Systems Development	3
MIS 4500	Enterprise Resource Planning Systems in Supply Chain	3
MIS 4680	Analytics for Marketing Strategies	3
MIS 4950	Executive Analysis and Presentation *	3

STAT 3260 is a prerequisite for these courses.
* Only 3 credits of MIS 4950 may count as a Management Information Systems major choice elective.

NOTE: Management Information Systems majors must take MIS 2070 Fundamentals of Programming for Business and Analytics as part of the supporting courses.

The X designation after a course number indicates this is an experimental course offered by the Department. Although in an experimental phase, these courses are open for registration just the same as permanent courses listed in the course catalog and count as elective choices in the major.

Students are limited to three business majors/degrees/certificates/minors within the Ivy College of Business. This limit is on business majors/degrees/certificates/minors only and does not apply to multiple majors/degrees/certificates/minors taken outside the Ivy College of Business.

Management Information Systems, B.S.

Sample 4-Year Plan (Your plan may differ)

Freshman			
Fall	Credits Spring		Credits
BUSAD 1020 or 1030	1 ECON 1020		3
ECON 1010	3 STAT 2260		3
COMS 1130	3 PHIL 2300		3
ENGL 1500	3 ACCT 2840		3
MATH 1500	3 Global/International Perspective@		3
LIB 1600	1 BUSAD 2030		1
	14		16

Sophomore

Fall	Credits Spring	Credits
ACCT 2850	3 MIS 3070	3
MIS 3010	3 SPCM 3120	3
ENGL 2500	3 Natural Science	3
MIS 2070	3 HUM/SOC SCI	3
MATH 1510	3 General Elective	3
	15	15

Junior

Fall	Credits Spring	Credits
MIS 3100	3 MIS 3200	3
Business Core Courses	6 MIS 3400	3
ACCT 2150	3 Business Core Courses	6
U.S. Cultures and Communities [#]	3 ENGL 3020	3
	15	15

Senior

Fall	Credits Spring	Credits
MIS Elective	3 MIS Elective	3
HUM/SOC SCI	3 HUM/SOC SCI	3
Global/International Perspective [@]	3 MGMT 4780 [*]	3
Business Core Courses	6 General Electives	6
General Electives	2	
	17	15

Total Credits: 122[@] Courses in these requirements may also be used as Global Perspective.[#] U.S. Cultures and Communities courses may be used to satisfy HUM/SOC SCI.^{*} Must have credit or enrollment in all core courses listed above, except for MGMT 3720, plus senior standing, in order to enroll in MGMT 4780.**Graduation Requirements:**

1. Grade of "C" or higher in at least 30 credits of Core and Major courses.
2. 42 credits of 3000+ level courses from a four-year institution.
3. 50% of required Business courses must be earned at ISU.
4. At least 32 credits and the LAST 32 credits must be earned at ISU (exceptions for study abroad and internship may be requested).
5. 122 Credits minimum and a Cumulative GPA of at least 2.00 with no quality point deficiencies.

6. Grade of C or better in ENGL 2500 required, and also in one other required ENGL course.

7. All 3000-level and higher business credits must be earned at a four-year college.

8. Multiple business **majors** must have at least 15 distinct credits in each of the major requirements; when applicable, one course can be shared between business majors; see your advisor regarding multiple business **degree requirements**.

Undergraduate Minor in Management Information Systems

The Department of Information Systems and Business Analytics also offers a minor for non-Management Information Systems majors in the Ivy College of Business. The minor requires 15 credits from an approved list of courses, including at least 6 credits in courses numbered 3000 or above taken at Iowa State University with a grade of C or higher. The minor must include at least 3 credits that are not used to meet any other department, college, or university requirement. Students with declared majors have priority over students with declared minors in courses with space constraints.

Required Course (3 credits):

MIS 3010	Management Information Systems	3

Elective Courses (12 credits):

Select twelve credit hours from 3000 or 4000 level MIS courses ^{*}

^{*} Only 3 credits of MIS 4950 Executive Analysis and Presentation may count as a MIS minor choice elective.

Students are limited to three business majors/degrees/certificates/minors within the Ivy College of Business. This limit is on business majors/degrees/certificates/minors only and does not apply to multiple majors/degrees/certificates/minors taken outside the Ivy College of Business.

For more information on the undergraduate minor in Management Information Systems, please visit: <https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/minors-and-certificates/>. (<https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/minors-and-certificates/>)

The Department of Information Systems and Business Analytics participates in the Applied AI Minor that is available to all undergraduate students at Iowa State University by providing electives in Business Analytics.

Concurrent Degrees

The Department of Information Systems and Business Analytics offers four concurrent degree programs that allow qualified students to be admitted to the following master's programs while completing their undergraduate degree. Students can double count up to 6 credits of coursework between the degrees, allowing them to complete both a bachelor's and a master's degree in as little as five years. The concurrent degree programs offered include:

- B.S. Management Information Systems (MIS) and Master of Science in Information Systems (MSIS)
- B.S. Management Information Systems (MIS) and Master of Business Analytics (MBAN)
- B.S. Business Analytics (BUSAN) and Master of Science in Information Systems (MSIS)
- B.S. Software Engineering (S E) and Master of Science in Information Systems (MSIS)

For more information on any of the concurrent programs listed above, please visit: <https://www.ivybusiness.iastate.edu/academics/graduate-programs/concurrent-degree-options/>. (<https://www.ivybusiness.iastate.edu/academics/graduate-programs/concurrent-degree-options/>)

Graduate Programs

The Department of Information Systems and Business Analytics participates in the MS in Information Systems (MSIS), the M.S. in Healthcare Analytics and Operations (MHAO), the full-time and part-time Master of Business Administration (MBA) and the PhD in Business and Technology programs. The department also participates in an interdepartmental MS in Cyber Security as well as in a master's and PhD program in Human Computer Interaction.

Master of Science Information Systems (MSIS)

The MSIS is a 30-credit (minimum) curriculum designed around three interrelated areas – business foundation, IS core, and electives. All students are expected to be familiar with basic computing skills before entering the program. The MSIS program will educate students on applying IS theory and concepts to modern IS development through classes that enable them to learn and use the latest software in application projects. Students graduating from the program will have advanced technical and managerial skills to develop and manage information systems projects.

Student Learning Outcomes

Upon graduation, MSIS students will:

1. Work effectively in teams.
2. Be critical thinkers in the field of information systems.

3. Develop an awareness of the ethical dimensions and consequences of business decisions.
4. Have strong written communication skills.
5. Have strong oral communication skills.

For more information about the MSIS program, please visit: <https://www.ivybusiness.iastate.edu/academics/graduate-programs/master-of-science-in-information-systems/>. (<https://www.ivybusiness.iastate.edu/academics/graduate-programs/master-of-science-in-information-systems/>)

Masters in Healthcare Analytics and Operations (MHAO)

Graduates of the Master's in Healthcare Analytics and Operations (MHAO) program will leverage data and advanced analytical models to evaluate operations and supply chains, generating actionable insights that enhance outcomes in the healthcare sector. This program emphasizes the use of both historical and real-time data to identify trends and optimize processes, ultimately benefiting patients, healthcare professionals, and supply chain partners alike. With a requirement of 30 credit hours, the program is delivered entirely online, making it an excellent choice for full-time professionals in the healthcare industry. The MHAO program curriculum aligns with the competencies required for the Certified Health Data Analyst (CHDA) exam.

Student Learning Outcomes

Upon graduation, MHAO students will:

1. Demonstrate understanding of healthcare operations, including process and performance improvement
2. Use data and analytical models to analyze complex healthcare issues
3. Communicate effectively
4. Lead and collaborate within diverse healthcare teams.
5. Integrate legal and regulatory considerations into patient-centered decision-making.

For more information about the Master of Healthcare Analytics and Operations program, please visit: <https://www.ivybusiness.iastate.edu/academics/graduate-programs/master-of-healthcare-analytics-and-operations/>. (<https://www.ivybusiness.iastate.edu/academics/graduate-programs/master-of-healthcare-analytics-and-operations/>)

Double Graduate Degree

The Department of Information Systems and Business Analytics participates in one double degree program at the graduate level. Students can simultaneously pursue a double degree in Master of Business Administration (MBA) and Master of Healthcare Analytics and Operations (MHAO). The Double Degree plan allows students to share credits between the degrees. See the Director of Graduate Education for more details on sharing credits.

For more information on the double degree in Master of Business Administration (MBA) and Master of Healthcare Analytics and Operations (MHAO), please visit: <https://www.ivybusiness.iastate.edu/academics/graduate-programs/double-degree-options/>. (<https://www.ivybusiness.iastate.edu/academics/graduate-programs/double-degree-options/>)

Master of Business Administration (MBA)

The MBA program is a 48-credit, non-thesis, non-creative component curriculum. Thirty of the 48 credits are core business courses, and the remaining 18 credits are graduate electives. Within the MBA program, students may obtain a specialization in information systems or healthcare analytics and operations.

Student Learning Outcomes

Upon graduation, MBA students will:

1. Demonstrate effective communication skills.
2. Effectively lead and work in diverse teams.
3. Critically solve business problems.
4. Integrate ethical and global perspectives in decision making.

For more information about the MBA program with a specialization in Information Systems or Healthcare Analytics and Operations, please visit: <https://www.ivybusiness.iastate.edu/academics/graduate-programs/ivy-mba/>. (<https://www.ivybusiness.iastate.edu/academics/graduate-programs/ivy-mba/>)

PhD in Business and Technology

The PhD in Business and Technology with an Information Systems and Business Analytics (ISBA) specialization is a 74-credit (minimum) curriculum which includes a 12-credit dissertation designed around four interrelated areas—core, specialization, minor, and research methods—and the dissertation. Information systems form the digital foundation of modern enterprises; business analytics involves the strategic analysis of data to extract meaningful insights. The ISBA specialization focuses on issues related to the development, management, use, and impact of digital technology and business analytics. Students in the ISBA specialization will examine topics such as human computer interaction, artificial intelligence, machine learning, information security and privacy, healthcare analytics, and digital platforms. Students will gain a solid research foundation and learn the skills needed to conduct impactful research on how to leverage technology and analytics to achieve business success.

Student Learning Outcomes

Upon graduation, PhD students will be able to:

1. Understand and advance knowledge.
2. Create knowledge through original research.
3. Teach effectively in an institution of higher education.

For more information about the PhD program with a specialization in ISBA, please visit: <https://www.ivybusiness.iastate.edu/academics/phd-program/information-systems-and-business-analytics/>. (<https://www.ivybusiness.iastate.edu/academics/phd-program/information-systems-and-business-analytics/>)

Graduate Certificates

Enterprise Cybersecurity Management

The graduate certificate in enterprise cybersecurity management will equip business professionals with basic concepts and techniques in cybersecurity and the management of information assets, including understanding cyber threat and choosing appropriate protections, enterprise cyber risk management, budgeting for cybersecurity, policies, procedures, human relations issues, and compliance and legal issues present in the modern organization.

The certificate is for working professionals as well as students enrolled in graduate programs. The certificate is available on campus in Ames and at Capital Square in Des Moines.

For more information about the graduate certificate in Enterprise Cybersecurity Management, please visit: <https://www.ivybusiness.iastate.edu/academics/graduate-programs/graduate-certificates/enterprise-cybersecurity-management/>. (<https://www.ivybusiness.iastate.edu/academics/graduate-programs/graduate-certificates/enterprise-cybersecurity-management/>)

Business Analytics

The graduate certificate in business analytics will address the challenges of dealing with issues of "big data" and its analysis to extract actionable insights, equips business professionals with the basic analytic concepts and techniques necessary in various areas of business such as marketing, supply chain, operations, forensics, and risk management. Students will have a foundation in data management, business analytics, modeling, and communicating through data visualization.

The certificate is for working professionals as well as students enrolled in graduate programs who are employed or seeking a career as business analysts, analytic systems designers, and data scientists to help improve business performance. The certificate is available online, on campus in Ames and at Capital Square in Des Moines.

For more information about the graduate certificate in business analytics, please visit: <https://www.ivybusiness.iastate.edu/academics/graduate-programs/graduate-certificates/business-analytics/>. (<https://www.ivybusiness.iastate.edu/academics/graduate-programs/graduate-certificates/business-analytics/>)

Marketing

Marketing serves as the bridge between organizations and consumers. As a marketing major, you will gain insights into customer needs and preferences, utilizing this knowledge to formulate effective marketing strategies that contribute to organizational success. The curriculum will include an in-depth study of consumer behavior, strategic marketing development, and data analysis for informed decision-making. Course topics encompass product management, pricing strategies, promotional activities, and distribution decisions. Additionally, professional B2B sales techniques are covered, with supplementary courses focused on managing sales teams and leveraging sales technology. For those interested in business consulting, specialized courses are also available.

Undergraduate Major in Marketing

For undergraduate curriculum in business, major in marketing.

The Department of Marketing offers a major in marketing. Students will complete the general education requirements (including business foundation courses), supporting courses/major prerequisites, business core requirements for the Bachelor of Science (B.S.) degree, and 18 additional credits in the major.

The instructional objective of the Marketing major is to provide knowledge of the marketing process and an understanding of its functions. Students are expected to develop decision-making skills, computational skills, and communication skills with appreciation for global marketplace and ethical concerns.

For more information on the undergraduate major in Marketing, please visit: <https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/marketing/>. (<https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/marketing/>)

Student Learning Outcomes

Upon graduation, undergraduate students majoring in Marketing will:

- 1. Be effective communicators.
- 2. Be effective collaborators.
- 3. Be problem solvers.
- 4. Understand business concepts.
- 5. Recognize ethical and legal responsibilities to organizations.

Curriculum:

Required and elective marketing major courses can be combined into two distinct tracks: marketing analytics, and marketing management.

NOTE: If you are interested in sales, the Marketing department offers an undergraduate certificate in Professional Sales. The Professional Sales Certificate has different required Marketing courses, and a host of different electives that are available from departments around campus.

For more information on the undergraduate certificate in Professional Sales, please visit: <https://catalog.iastate.edu/collegeofbusiness/marketing/#undergraduatecertificate>. (<https://catalog.iastate.edu/collegeofbusiness/marketing/#undergraduatecertificate>)

In addition to the basic business degree requirements (<https://catalog.iastate.edu/collegeofbusiness/#curriculuminbusiness>), marketing majors must also complete the following:

Required Courses (9 credits):

MKT 4440	Fundamentals of Marketing Analytics	3
MKT 3420	Foundation Of Personal Selling [#]	3
MKT 4430	Strategic Marketing Management	3

Elective Courses (9 credits):

Select 9 credits of Marketing department courses, OR select one of the two Marketing elective TRACKS described below.

Optional Digital Marketing and Marketing Analytics Track (9 credits)

Select 9 credits:		
MKT 3610	Social Media Marketing Strategy	3
MKT 3620	Digital Marketing	3
MKT 3630	Creative Tools for Digital Marketing	3
MKT 4450	Customer Relationship Management	3
MKT 4520	Sales Enablement Tools and Technology	3
MKT 4560X	Digital Marketing Analytics	3
MKT 4680	Analytics for Marketing Strategies	3

Optional Marketing Management Track (9 credits)

Select 9 credits:		
MKT 3510	Services Marketing	3
MKT 3610	Social Media Marketing Strategy	3
MKT 3620	Digital Marketing	3
MKT 3670	Consultative Problem Solving	3
MKT 4100	Promotional Strategy	3
MKT 4420	Sales Management [#]	3
MKT 4470	Consumer Behavior	3
MKT 4480	Global Marketing	3
MKT 4500	Advanced Professional Selling [#]	3
MKT 4510	Omnichannel Marketing	3
MKT 4530	Brand Management	3
MKT 4540	Entrepreneurial Marketing	3
MKT 4580X	New Product Marketing	3
MKT 4600X	Franchising Strategy	3
MKT 4840	Technology, Globalization and Culture	3

MKT 4920	Comparative Marketing	3
MKT 4950	Live Cases in Marketing *	3

* Only 3 credits of MKT 4950 may count as a Marketing major choice elective.

Required courses for the undergraduate certificate in Professional Sales. See the Undergraduate Certificate tab above for more information.

The X designation after a course number indicates this is an experimental course offered by the Department. Although in an experimental phase, these courses are open for registration just the same as permanent courses listed in the course catalog and count as elective choices in the major.

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Marketing, B.S.

Sample 4-Year Plan (Your plan may differ)

Freshman

Fall	Credits Spring	Credits
BUSAD 1020 or 1030	1 ECON 1020	3
ECON 1010	3 STAT 2260	3
COMS 1130	3 HUM/SOC SCI	3
ENGL 1500	3 ACCT 2840	3
MATH 1500	3 SPCM 3120	3
LIB 1600	1 BUSAD 2030	1
	14	16

Sophomore

Fall	Credits Spring	Credits
ACCT 2850	3 MKT 3420	3
MKT 3400	3 Core Business Course	3
MATH 1510	3 ACCT 2150	3
ENGL 2500	3 Global/International Perspective [@]	3
Natural Science	3 HUM/SOC SCI	3
	15	15

Junior

Fall	Credits Spring	Credits
PHIL 2300	3 MKT Elective	3
MKT 4440	3 Core Business Courses	6

Core Business Course	3 Global/International Perspective [@]	3
U.S. Cultures and Communities [#]	3 General Elective	3
MKT Elective	3	
	15	15

Senior

Fall	Credits Spring	Credits
MKT Elective	3 MKT 4430	3
ENGL 3020	3 MGMT 4780 [*]	3
Core Business Courses	6 HUM/SOC SCI	3
General Elective	5 General Electives	6
	17	15

Total Credits: 122

[@] Courses in these requirements may also be used as Global Perspective.

[#] U.S. Cultures and Communities courses may be used to satisfy HUM/SOC SCI.

^{*} Must have credit or enrollment in all core courses listed above, except for MGMT 3720, plus senior standing, in order to enroll in MGMT 4780.

Graduation Requirements:

1. Grade of "C" or higher in at least 30 credits of Core and Major courses.
2. 42 credits of 3000+ level courses from a four-year institution.
3. 50% of required Business courses must be earned at ISU.
4. At least 32 credits and the LAST 32 credits must be earned at ISU (exceptions for study abroad and internship may be requested).
5. 122 Credits minimum and a Cumulative GPA of at least 2.00 with no quality point deficiencies.
6. A grade of C or better in ENGL 2500 required, and also in one other required ENGL course.
7. All 3000-level and higher business credits must be earned at a four-year college.
8. Multiple business **majors** must have at least 15 distinct credits in each of the major requirements; when applicable, one course can be shared between business majors; see your advisor regarding multiple business **degree requirements**.

Undergraduate Minor in Marketing

The Department of Marketing offers a minor for non-Marketing majors in the Ivy College of Business. The minor requires 15 credits from an

approved list of courses, including at least 6 credits in courses numbered 3000 or above taken at Iowa State University with a grade of C or higher. The minor must include at least 3 credits that are not used to meet any other department, college, or university requirement. Students with declared majors have priority over students with declared minors in courses with space constraints.

Required Courses (6 credits):

MKT 3400	Principles of Marketing	3
MKT 3420	Foundation Of Personal Selling	3

Elective Courses (9 credits):

Select nine credit hours from 3000- or 4000-level Marketing courses.
*

* Only 3 credits of MKT 4950 may count as a Marketing minor choice elective.

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For more information on the undergraduate minor in Marketing, please visit: <https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/minors-and-certificates/>. (<https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/minors-and-certificates/>)

Undergraduate Minor in Business and Technology Consulting

The Department of Marketing also offers a minor in Business and Technology Consulting, which is available to all undergraduate students at Iowa State University.

Management consulting is a profession that constantly attracts top talents across the world. By working with different clients to solve complex problems every day, consultants have many exclusive opportunities to interact with senior executives, build a broad range of business expertise in different industries, and drive influential decision-making. As a result, many consultants experience faster career progression and end up becoming influential leaders or successful entrepreneurs. To prepare students for this exciting and challenging career, our business and technology consulting minor will guide you through a set of core courses, the majority of which contain significant experiential learning components. This training ensures that students leave the minor ready to become adaptable consultants equipped with robust problem-solving, communication, and leadership skills.

The minor requires 15 credits from an approved list of courses, including at least 6 credits in courses numbered 3000 or above taken at Iowa State University with a grade of C or higher. The minor must include at least 3 credits that are not used to meet any other department, college, or university requirement. Students with declared majors have priority over students with declared minors in courses with space constraints.

Required Courses (6 credits):

MKT 3670	Consultative Problem Solving	3
MIS 3100	Information Systems Analysis [^]	3
	or MKT 3420 Foundation Of Personal Selling	

Required Experiential Learning Course (3 credits):

Choose one of the following courses...

MIS 4950	Executive Analysis and Presentation	3
SCM 4950	Executive Analysis and Presentation	3
MKT 4950	Live Cases in Marketing	3

OR...complete 150 hours of successful work experience at an approved organization as the basis to receive credits through a graded independent study.

BUSAD 4900C	Independent Study: Consulting, Investment Banking and Related Industries [#]	3

Elective Courses (6 credits):

Select TWO elective courses from the list below. Students are encouraged to take electives that best align with their chosen course of study or projected career path.

SCM 3400	Project Management	3
SCM 4240	Process Management, Analysis, and Improvement	3
SCM 4400	Supply Chain Information Systems	3
SCM 4500	Enterprise Resource Planning Systems in Supply Chain	3
MIS 3200	Database Management Systems	3
MIS 4350	Cybersecurity in Business	3
MIS 4360	Introduction to Business Analytics [*]	3
MKT 4450	Customer Relationship Management	3
MKT 4680	Analytics for Marketing Strategies	3
MGMT 3200	Corporate Entrepreneurship	3
MGMT 4730	Evidence-Based Decision Making in Human Resource Management	3
FIN 4150	Business Financing Decisions	3
FIN 4350	Venture Capital, Private Equity, and Mergers and Acquisitions	3
ACCT 3150	Business Data Streams and Issues	3
ACCT 4610	Entrepreneurship and Accounting Information	3
ACCT 3840	Accounting Information Systems and Analytics	3

IE 3050	Engineering Economic Analysis	3
IE 4200	Engineering Problem Solving with R	3
IE 4410	Industrial Engineering Design	3
IE 4520	Introduction To Systems Engineering And Analysis	3
IE 4700	Systems Engineering and Project Management	3
IE 4810	e-Commerce Systems Engineering	3
IE 4830	Data Mining	3
ME 4120	Ethical Responsibilities of a Practicing Engineer	3
ME 4150	Mechanical Systems Design	3
ME 4160	Mechanism Design and Analysis	3
ME 4750	Modeling and Simulation	3
ME 4840	Technology, Globalization and Culture	3
STAT 3320	Visual Communication of Quantitative Information	3
STAT 4212	Experimental Design and Data Analysis	3
STAT 4730	Introduction to Survey Sampling	3
STAT 4750	Introduction to Multivariate Data Analysis	3
STAT 4820	Regression for Social and Behavioral Research	3
ECON 4010	Topics in Microeconomics	3
ECON 4160	Industrial Organization	3
ECON 4180	Introduction to Game Theory	3
ECON 4310	Managerial Economics	3
COMS 2950	Programming-Based Problem Solving Practices	1
COMS 3190	Construction of User Interfaces	3
COMS 3630	Introduction to Database Management Systems	3
COMS 4720	Principles of Artificial Intelligence	3
COMS 4740	Introduction to Machine Learning	3
CPRE 3290	Software Project Management	3
CPRE 3310	Application of Cryptographic Concepts to Cyber Security	3
CPRE 4140	Introduction to Software Systems for Big Data Analytics	4
CPRE 4310	Basics of Information System Security	3

[^] MIS majors should take MIS 4350 instead of MIS 3100 as the required course for the minor.

[#] To obtain the registration form for BUSAD 4900C, you can either visit the Ivy College of Business website regarding the Business and Technology Consulting minor (<https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/minors-and-certificates/>) or email Dr. Wei Zhang at: wtzhang@iastate.edu.

^{*} STAT 3260 is a prerequisite for this course.

Students are limited to three business majors/degrees/certificates/minors within the Ivy College of Business. This limit is on business

majors/degrees/certificates/minors only and does not apply to multiple majors/degrees/certificates/minors taken outside the Ivy College of Business.

NOTE: Students must follow college-specific rules in selecting courses. The college representatives will be responsible for advising students in their college and will inform students about the details of the college rules.

For more information on the undergraduate minor in Business and Technology Consulting, please visit: <https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/minors-and-certificates/>. (<https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/minors-and-certificates/>)

Undergraduate Certificate in Professional Sales Purpose

The certificate in professional sales is a course of study administered by the Department of Marketing in the Ivy College of Business. It is designed for all undergraduate majors who wish to enhance their degree and employment possibilities by adding expertise in professional selling. The certificate program will equip students with knowledge and skills related to developing and managing mutually beneficial relationships with customers. The certificate program is built on a strong theoretical background but emphasizes applications and practice. The certificate provides students with an opportunity to learn about the ethical, technological, analytical, and global aspects of professional sales.

Learning Outcomes

After completing the certificate in professional sales, students will be able to:

- Identify and describe the steps in a relational selling process to create value and achieve customer satisfaction,
- Apply the sales technology, skills and knowledge to business problems,
- Enhance oral communication skills and basic business writing skills,
- Build a network and develop professional relationships through corporate participation in the sales program, and
- Enhance career management options by gaining a better understanding of sales as a career option.

Requirements

The certificate in professional sales requires the completion of at least 7 courses, totaling 21 credit hours. At least 12 credits should be taken at Iowa State University.

Required Courses (12 credits):

MKT 3400	Principles of Marketing	3
MKT 3420	Foundation Of Personal Selling	3
MKT 4420	Sales Management	3

MKT 4500	Advanced Professional Selling	3	ECON 3340	Entrepreneurship in Agriculture	3
or MKT 4520	Sales Enablement Tools and Technology		ECON 3370	Agricultural Marketing	3
Elective Courses (9 credits):			ENGL 3090	Proposal and Report Writing	3
Select 9 credits of electives from the following list:			ENGL 3140	Technical Communication	3
FDM 2750	Retail Merchandising	3	ENGL 3320	Visual Communication of Quantitative Information	3
FDM 3770	Visual Presentation and Promotions	3	ENTSP 3100	Entrepreneurship and Innovation	3
ACCT 4610	Entrepreneurship and Accounting Information	3	ENTSP 3670	International Entrepreneurship	3
ADVRT 3360	Advertising Account Management	3	ENTSP 4100	Social Entrepreneurship	3
AESHM 2220	Creativity on Demand	3	ENTSP 4800	Applied Entrepreneurship: Executing New Ventures	3
AESHM 2380	Human Resource Management	3	ENTSP 4850	Trends in Entrepreneurship	3
AESHM 2700F	Supervised Work Experience II: Event Management	1-2	EVENT 1710	Introduction to Event Management	3
AESHM 2720	Fashion Show Production and Promotion	2-3	EVENT 2770	Digital Promotion in the Service Industry	3
AESHM 2870	Principles of Management in Human Sciences	3	EVENT 2780	Sustainability Essentials for Service-Related Businesses	3
AESHM 3400	Hospitality and Apparel Marketing Strategies	3	EVENT 3280	Incentive Meeting Management	3
AESHM 3650	Event, Hospitality, and Retail Risk Management	3	EVENT 3330	Entertainment Venue Management	3
AESHM 4210	Developing Global Leadership: Maximizing Human Potential	3	EVENT 3670	Event Sales	3
AESHM 4720	Fashion Show Management	2-3	EVENT 3730	Wedding Planning and Management	3
AESHM 4740	Entrepreneurship in Human Sciences	3	EVENT 3790	Nonprofit Fundraising Event Planning	3
AGEDS 3110	Presentation and Sales Strategies for Agricultural Audiences	3	EVENT 3830	Sports Event Management	3
ARTID 2500	Fundamentals of Interior Design	2	EVENT 4710	Event Production	3
ARTID 2510	Human Factors in Interior Design	3	FIN 3340	Introduction to Financial Technologies and Cryptocurrencies	3
ARTID 2610	Graphic Communication for Interior Design I	3	FIN 3710	Real Estate Principles	3
ARTID 2630	Graphic Communication for Interior Design II	3	FIN 4720	Real Estate Finance	3
CE 2060	Engineering Economic Analysis and Professional Issues in Civil Engineering	3	HCM 3010	Introduction to the US Healthcare Industry	3
COMST 2110	Interpersonal Communication	3	HCM 3020	Economics for Healthcare Managers	3
COMST 2140	Professional Communication	3	HORT 1310	Floral Design	2
COMST 2180	Communication and Conflict Management	3	HORT 1320	Wedding and Event Floral Design	2
COMST 3100	Intercultural Communication	3	HSPM 1010	Introduction to the Hospitality Industry	3
COMST 3110	Relational Communication	3	HSPM 2600	Global Tourism Management	3
COMST 3130	Leadership Communication Theories	3	HSPM 2800	Non-Alcoholic Beverages and Cafe Operations	3
COMST 3140	Organizational Communication	3	HSPM 2890	Contemporary Club Management	3
COMST 3170	Small Group Communication	3	HSPM 3200	Attractions and Amusement Park Administration	3
COMST 3190	Communication Training and Development	3	HSPM 3830	Wine and Spirits in Hospitality Management	2
COMST 3250	Nonverbal Communication	3	HSPM 3830L	Wine, Spirits, and Mixology Laboratory in Hospitality Management	2
COMST 3300	Communication in a Digital World	3	HSPM 3850	Beer and Brewed Beverages in Hospitality Management	1
COMST 4500A	Special Topics in Communication Studies: General	3	HSPM 4370	Hospitality Technology Applications	3
or COMST 412C	Health Communication		HSPM 4870	Fine Dining Management	3
ECON 2350	Introduction to Agricultural Markets	3	HSPM 5400	Strategic Marketing	3
ECON 2360	Agricultural Selling	3	IE 3050	Engineering Economic Analysis	3

IE 4300	Entrepreneurial Product Engineering	3
IE 4340X	Entrepreneurial Product Engineering Design Project	arr †
IE 4500	Technical Sales for Engineers	3
INTST 2950	International Experience Abroad	1-8
INTST 3500	Topics in International Studies	2-4
KIN 3990	Recreational Sport Management	3
MGMT 4220	Negotiation and Conflict Resolution	3
MGMT 4700	Leadership and Change Management	3
MGMT 4710	Introduction to Human Resource Management	3
MKT 4100	Promotional Strategy	3
MKT 4450	Customer Relationship Management	3
MKT 4510	Omnichannel Marketing	3
MKT 4560X	Digital Marketing Analytics	3
MKT 4600X	Franchising Strategy	3
PR 2200	Principles of Public Relations	3
PR 3050	Publicity Methods	3
PSYCH 2800	Social Psychology	3
PSYCH 3140	Motivation	3
PSYCH 3270	Persuasion and Social Influence	3
PSYCH 3800	Social Cognition	3
PSYCH 4500	Industrial Psychology	3
SCM 3400	Project Management	3
SCM 4400	Supply Chain Information Systems	3
SCM 4730	War and Peace and Supply Chains	3
SCM 4860	Principles of Purchasing and Supply Management	3
SPCM 1100	Listening	3
SPCM 3120	Business and Professional Speaking	3
SPCM 3230	Gender and Communication	3
WLC 1190	Introduction to World Languages	3

† Arranged with instructor.

In addition to the courses listed, independent study/special topics or other courses may count as electives for the certificate. Please contact the director of the Professional Sales Program or the chair of the Marketing Department for prior approval of an elective.

The X designation after a course number indicates this is an experimental course offered by the Department. Although in an experimental phase, these courses are open for registration just the same as permanent courses listed in the course catalog and count as elective choices in the major.

Students are limited to three business majors/degrees/certificates/minors within the Ivy College of Business. This limit is on business

majors/degrees/certificates/minors only and does not apply to multiple majors/degrees/certificates/minors taken outside the Ivy College of Business.

Students need to fulfill the course prerequisites set by the Ivy College of Business.

A certificate is not awarded until baccalaureate requirements are fulfilled.

Courses taken for the certificate may not be taken on a pass/not-pass basis.

A cumulative grade point average of at least 2.0 is required in courses taken for the certificate.

For more information on the undergraduate certificate in Professional Sales, please visit: <https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/minors-and-certificates/professional-sales-certificate/>. (<https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/minors-and-certificates/professional-sales-certificate/>)

Graduate Programs

The Department of Marketing participates in the full-time and part-time Master of Business Administration (MBA) and the PhD in Business and Technology programs.

Master of Business Administration (MBA)

The MBA is a 48-credit, non-thesis, non-creative component curriculum. Thirty of the 48 credits are core courses and the remaining 18 are graduate electives. Within the MBA program, students may develop an area of specialization in marketing.

Student Learning Outcomes

Upon graduation, MBA students will:

1. Demonstrate effective communication skills.
2. Effectively lead and work in diverse teams.
3. Critically solve business problems.
4. Integrate ethical and global perspectives in decision making.

For more information about the MBA program with a specialization in Marketing, please visit: <https://www.ivybusiness.iastate.edu/academics/graduate-programs/ivy-mba/>. (<https://www.ivybusiness.iastate.edu/academics/graduate-programs/ivy-mba/>)

PhD in Business and Technology

The PhD in Business and Technology with a Marketing (MKT) specialization is a 74 credit (minimum) curriculum designed around several interrelated areas (ie. foundational courses in the business disciplines, a major area of specialization, minor, and research methods) and dissertation. The specialization focuses on marketing issues related

to strategic decision-making, understanding consumer preferences and behaviors, and using data analytics to enhance theory, practice, and societal impact.

Student Learning Outcomes

Upon graduation, PhD students will be able to:

- 1. Understand and advance knowledge.
- 2. Create knowledge through original research.
- 3. Teach effectively in an institution of higher education.

For more information about the PhD program with a specialization in Marketing, please visit: <https://www.ivybusiness.iastate.edu/academics/phd-program/marketing/>. (<https://www.ivybusiness.iastate.edu/academics/phd-program/marketing/>)

Supply Chain Management

Supply chain management is an integrated program of study concerned with the efficient flow of information, materials, products, and capital within and among organizations. Supply chain management involves the integration of business processes across organizations, from material sources and suppliers through manufacturing and processing to the final customer. The program’s balanced approach includes courses in the three core areas of supply chain management: procurement, operations, and logistics. Students will develop knowledge related to a wide variety of supply chain activities, including demand planning, purchasing, transportation management, warehouse management, inventory control, material handling, product and service support, information technology, process management and improvement, and strategic supply chain management.

Undergraduate Major in Supply Chain Management

For undergraduate curriculum in business, major in supply chain management.

The Department of Supply Chain Management offers a major in supply chain management. Students will complete the general education requirements (including business foundation courses), business core requirements for the Bachelor of Science (B.S.) degree, and 18 additional credits in the major.

The instructional objective of the supply chain management major is to prepare students for professional careers in logistics analysis, plant management, procurement, warehouse management, sustainable supply chain management, and consulting. The curriculum provides the required theoretical and conceptual base and analytical methods for making sound operational and strategic business decisions related to all activities in a supply chain.

For more information on the undergraduate major in Supply Chain Management, please visit: <https://www.ivybusiness.iastate.edu/>

[academics/undergraduate-programs/supply-chain-management/](https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/supply-chain-management/). (<https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/supply-chain-management/>)

Student Learning Outcomes

Upon graduation, undergraduate students majoring in Supply Chain Management will:

- 1. Be effective communicators.
- 2. Be effective collaborators.
- 3. Be problem solvers.
- 4. Understand business concepts.
- 5. Recognize ethical and legal responsibilities to organizations.

Curriculum:

In addition to the basic business degree requirements (<https://catalog.iastate.edu/collegeofbusiness/#curriculuminbusinesstext>), Supply Chain Management majors must also complete:

Required Courses (15 credits):

SCM 4240	Process Management, Analysis, and Improvement	3
SCM 4530	Supply Chain Planning and Control	3
SCM 4600	Decision Tools for Logistics and Operations Management	3
SCM 4610	Principles of Transportation	3
SCM 4860	Principles of Purchasing and Supply Management	3

Elective Courses (3 credits):

Select one elective from the following list:

SCM 3400	Project Management	3
SCM 4280	Special Topics in Operations Management *	3
SCM 4300	Supply Chain Analytics	3
SCM 4500	Enterprise Resource Planning Systems in Supply Chain	3
SCM 4620	Transportation Carrier Management	3
SCM 4660	Global Trade Management	3
SCM 4710	Sustainable Supply Chain Management *	3
SCM 4730	War and Peace and Supply Chains	3
SCM 4910	International Live Case and Study Tour	3
SCM 4950	Executive Analysis and Presentation #	3

* Courses not offered on a regular basis. Students should consult with their academic advisor about terms of offering.
Only 3 credits of SCM 4950 may count as a Supply Chain Management major choice elective.

Students are limited to three business majors/degrees/certificates/minors within the Ivy College of Business. This limit is on business majors/degrees/certificates/minors only and does not apply to multiple majors/degrees/certificates/minors taken outside the Ivy College of Business.

Supply Chain Management, B.S.

Sample 4-Year Plan (Your plan may differ)

Freshman

Fall	Credits Spring	Credits
BUSAD 1020 or 1030	1 ECON 1020	3
ECON 1010	3 STAT 2260	3
COMS 1130	3 U.S. Cultures and Communities [#]	3
ENGL 1500	3 ACCT 2840	3
MATH 1500	3 SPCM 3120	3
LIB 1600	1 BUSAD 2030	1
	14	16

Sophomore

Fall	Credits Spring	Credits
ACCT 2850	3 SCM 4610	3
SCM 3010	3 Core Business Course	3
MATH 1510	3 ACCT 2150	3
ENGL 2500	3 PHIL 2300	3
Natural Science	3 HUM/SOC SCI	3
	15	15

Junior

Fall	Credits Spring	Credits
SCM 4860	3 SCM 4240	3
Core Business Courses	6 SCM 4600	3
Global/International Perspective [@]	3 Core Business Course	3
HUM/SOC SCI	3 Global/International Perspective [@]	3
	General Elective	3
	15	15

Senior

Fall	Credits Spring	Credits
SCM 4530	3 SCM Elective	3
Core Business Courses	6 HUM/SOC SCI	3
ENGL 3020	3 MGMT 4780 [*]	3

General Elective	5 General Electives	6
	17	15

Total Credits: 122

@ Courses in these requirements may also be used as Global Perspective.

U.S. Cultures and Communities courses may be used to satisfy HUM/SOC SCI.

* Must have credit or enrollment in all core courses listed above, except for MGMT 3720, plus senior standing, in order to enroll in MGMT 4780.

Graduation Requirements:

1. Grade of "C" or higher in at least 30 credits of Core and Major courses.
2. 42 credits of 3000+ level courses from a four-year institution.
3. 50% of required Business courses must be earned at ISU.
4. At least 32 credits and the LAST 32 credits must be earned at ISU (exceptions for study abroad and internship may be requested).
5. 122 Credits minimum and a Cumulative GPA of at least 2.00 with no quality point deficiencies.
6. A grade of C or better in ENGL 2500 required, and also in one other required ENGL course.
7. All 3000-level and higher business credits must be earned at a four-year college.
8. Multiple business **majors** must have at least 15 distinct credits in each of the major requirements; when applicable, one course can be shared between business majors; see your advisor regarding multiple business **degree requirements**.

Undergraduate Minor in Supply Chain Management

The Department of Supply Chain Management also offers a minor for non-Supply Chain Management majors in the Ivy College of Business. The minor requires 15 credits from an approved list of courses, including at least 6 credits in courses numbered 3000 or above taken at Iowa State University with a grade of C or higher. The minor must include at least 3 credits that are not used to meet any other department, college, or university requirement. Students with declared majors have priority over students with declared minors in courses with space constraints.

Required Courses (6 credits):

SCM 3010	Supply Chain Management	3
SCM 4860	Principles of Purchasing and Supply Management	3

Elective Courses (9 credits):

Select one elective course from:

SCM 4240	Process Management, Analysis, and Improvement
SCM 4500	Enterprise Resource Planning Systems in Supply Chain
SCM 4530	Supply Chain Planning and Control
Select one elective course from:	
SCM 4600	Decision Tools for Logistics and Operations Management
SCM 4610	Principles of Transportation
SCM 4620	Transportation Carrier Management
SCM 4660	Global Trade Management
SCM 4730	War and Peace and Supply Chains
Select one additional elective course from either section above.	

Students are limited to three business majors/degrees/certificates/minors within the Ivy College of Business. This limit is on business majors/degrees/certificates/minors only and does not apply to multiple majors/degrees/certificates/minors taken outside the Ivy College of Business.

For more information on the undergraduate minor in Supply Chain Management, please visit: <https://www.ivybusiness.iastate.edu/academics/undergraduate-programs/minors-and-certificates/>.

Graduate Programs

The Department of Supply Chain Management participates in the full-time and part-time Master of Business Administration (MBA) and in the PhD in Business and Technology programs.

Master of Business Administration (MBA)

The MBA program is a 48-credit, non-thesis, non-creative component curriculum. Thirty of the 48 credits are core courses and the remaining 18 are graduate electives. Within the MBA program, students can obtain a specialization in Supply Chain Management or Healthcare Analytics and Operations.

Student Learning Outcomes

Upon graduation, MBA students will:

1. Demonstrate effective communication skills.
2. Effectively lead and work in diverse teams.
3. Critically solve business problems.
4. Integrate ethical and global perspectives in decision making.

For more information about the MBA program with a specialization in Supply Chain Management or Healthcare Management and Operations, please visit: <https://www.ivybusiness.iastate.edu/academics/graduate-programs/ivy-mba/>. (<https://www.ivybusiness.iastate.edu/academics/graduate-programs/ivy-mba/>)

Masters in Healthcare Analytics and Operations (MHAO)

Graduates of the Master's in Healthcare Analytics and Operations (MHAO) program will leverage data and advanced analytical models to evaluate operations and supply chains, generating actionable insights that enhance outcomes in the healthcare sector. This program emphasizes the use of both historical and real-time data to identify trends and optimize processes, ultimately benefiting patients, healthcare professionals, and supply chain partners alike. With a requirement of 30 credit hours, the program is delivered entirely online, making it an excellent choice for full-time professionals in the healthcare industry. The MHAO program curriculum aligns with the competencies required for the Certified Health Data Analyst (CHDA) exam.

Student Learning Outcomes

Upon graduation, MHAO students will:

1. Demonstrate understanding of healthcare operations, including process and performance improvement
2. Use data and analytical models to analyze complex healthcare issues
3. Communicate effectively
4. Lead and collaborate within diverse healthcare teams
5. Integrate legal and regulatory considerations into patient-centered decision-making

For more information about the Masters in Healthcare Analytics and Operations program, please visit: <https://www.ivybusiness.iastate.edu/academics/graduate-programs/master-of-healthcare-analytics-and-operations/>.

Double Graduate Degree

The Department of Supply Chain Management participates in one double degree program at the graduate level. Students can simultaneously pursue a double degree in Master of Business Administration (MBA) and Master of Healthcare Analytics and Operations (MHAO). The Double Degree plan allows students to share credits between the degrees. See the Director of Graduate Education for more details on sharing credits.

For more information on the double degree in Master of Business Administration (MBA) and Master of Healthcare Analytics and Operations (MHAO), please visit: <https://www.ivybusiness.iastate.edu/academics/graduate-programs/double-degree-options/>. (<https://www.ivybusiness.iastate.edu/academics/graduate-programs/double-degree-options/>)

PhD in Business and Technology

The PhD in Business and Technology is a 74-credit curriculum (minimum) that culminates in a dissertation. Students may select Supply Chain Management (SCM) as their major area of specialization. The primary objective of the SCM specialization is to prepare students for careers in research universities. The SCM domain is broad and includes the design,

development and control of business processes for the conversion of inputs into outputs and distribution of those outputs. The traditional focus of SCM was on integration of processes across multiple functions within the firm—operations management, logistics, and purchasing primarily, with elements of marketing and information systems also included. However, in today's world, with competition across supply chain networks, SCM also involves integrating business processes across firms. Research in this area is therefore interdisciplinary in nature and addresses both intra- and inter-organizational issues.

Student Learning Outcomes

Upon graduation, PhD students will be able to:

1. Understand and advance knowledge.
2. Create knowledge through original research.
3. Teach effectively in an institution of higher education.

For more information about the PhD program with a specialization in Supply Chain Management, please visit: <https://www.ivybusiness.iastate.edu/academics/phd-program/supply-chain-management/>. (<https://www.ivybusiness.iastate.edu/academics/phd-program/supply-chain-management/>)

Graduate Certificate

The online graduate certificate in Supply Chain Management will provide foundational concepts and applied technical skills that supply chain professionals need to effectively manage a global supply chain.

The certificate is for working professionals as well as students enrolled in graduate programs who are employed or seeking a career as a business analyst, supply chain analyst, or who want to move into a supply chain position.

For more information about the graduate certificate in Supply Chain Management, please visit: <https://www.ivybusiness.iastate.edu/academics/graduate-programs/graduate-certificates/supply-chain-management/>. (<https://www.ivybusiness.iastate.edu/academics/graduate-programs/graduate-certificates/supply-chain-management/>)

COLLEGE OF DESIGN

Luis Rico-Gutierrez - Dean

Seda McKilligan - Senior Associate Dean for Academic Personnel
Success and Strategic Initiatives

Rob Whitehead - Associate Dean for Academic Programs and Student
Success

www.design.iastate.edu/ (<http://www.design.iastate.edu/>)

Objectives of the Curricula in Design

The College of Design is among a small number of comprehensive design schools offering outstanding opportunities for both disciplinary and interdisciplinary education.

The College of Design strives to provide each student with a broad educational background and preparation in a specific design or art discipline. Each program is designed to develop knowledge and appreciation of the physical and cultural environment, to stimulate creative thinking and analysis, and to prepare students for participation in a wide variety of careers.

The college's programs also encompass many opportunities for individualized study and extracurricular activities such as visiting lectures and symposia, workshops, gallery exhibits, practicum and internship programs, field trips, and international study programs.

Graduates of the college are employed in private firms, government, industry, and education, or are self-employed as designers or artists. Opportunities for graduates include careers as architects, landscape architects, community and regional planners, graphic designers, industrial designers, interior designers, studio artists, arts administrators and environmental designers.

Organization of Curricula

All undergraduate programs in the College of Design share a common foundation curriculum, the Core Design Program, followed by degree-specific curricula. The Core Design Program grounds the undergraduate degree programs and provides a rich, rigorous, inclusive base for the college's professional and non-professional programs. It creates a shared language, experience, and community for programs, faculty, and students and exposes students to all design disciplines, allowing them to make more informed degree choices, apply to multiple degree programs, and experiment with interdisciplinary work.

The intense, discipline-specific professional curricula that follow the Core Design Program focus on developing students' ability and knowledge in their major. Within the major area, students advance creative and professional skills through classroom and studio work, critiques of

student projects, discussion with professional practitioners, and field studies.

General education, contained in both the Core Design Program and the degree programs, is composed to ensure that students receive a well-rounded undergraduate education.

High School Preparation

Courses in fine arts and design that develop visualization and freehand drawing abilities are highly recommended, though not required for entrance. Students planning to enroll in an academic program in the College of Design must complete the following high school requirements:

- 4 years of English, including coursework in composition and literature and up to 1 year of speech and/or journalism, to develop communication skills and critical reading/writing ability.
- 3 years of mathematics to develop problem-solving skills, including 1 year each of algebra, geometry, and advanced algebra.
- 3 years of science, including at least two of the following:
 - 1 year of biology, 1 year of chemistry, or 1 year of physics
- 2 years of social studies, including at least 1 year of U.S. history and 1 semester of U.S. government

Admission Standards to Enrollment-Managed Professional Programs

Admission into the enrollment-managed professional programs of Architecture, Art (B.F.A. only), Graphic Design, Industrial Design, Interior Design, and Landscape Architecture requires a separate application after completing the Core Design Program.

Students may apply directly to the professional program in Community and Regional Planning and to the programs in Art (B.A. only), Art History, and Interdisciplinary Design. Transfer students from two-year institutions also may apply directly to these three programs.

Advising

Each student receives personal assistance from an academic advisor within the student's curriculum area. Students enrolled in the college's Core Design Program are advised by professional advisors. Once admitted to professional programs, students are assigned to faculty advisors within the student's curriculum area. Advisors help students develop a program of study and access pertinent university resources and provide information on career choice.

The college's career services office works with students to develop their career goals as well as prepare and search for employment.

Honors Program

The College of Design participates in the Honors Program, which provides opportunities for outstanding students to individualize their programs of study. Honors students in the College of Design will work with the Honors Program chair or Honors academic advisor to choose from academic and

co-curricular experiences that offer breadth and depth in their learning, as well as opportunities for personal, community, and professional development.

See Honors Program.

Departments of the College

- Architecture
- Art and Visual Culture
- Community and Regional Planning
- Graphic Design
- Industrial Design
- Interior Design
- Landscape Architecture

Requirements in the College of Design

All students in the College of Design are expected to meet the following requirements.

Core Design Program

Cr. Fall/Spring

DSNS 1020	Design Studio I	4
DSNS 1150	Design Collaborative Seminar *	1
DSNS 1310	Drawing I	4
DSNS 1320	Digital Design Literacy	1
DSNS 1830	Design in Context	3
Social Science/Humanities Electives **		6
Math/Science Electives ***		6
Communications		7

* Students enrolled in the Design Exchange Learning Community take DSNS 1100 in place of DSNS 1150.

**General education credits in the Core Design Program may count toward the minimum credits.

***Students who intend to apply to the Architecture program must complete MATH 1450, PHYS 1310, and PHYS 1310L during their Core year. Students who intend to apply to the Landscape Architecture program are advised to take MATH 1400 during their Core year. Graphic Design applicants are advised to enroll in COMS 1060 during their Core year. Students who intend to apply to the Industrial Design program are advised to take PHYS 1010 and a math course during their Core year.

General Education

International Perspective: 3 cr.

U.S. cultures and communities: 3 cr.

Communications: 7 cr.

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3

LIB 1600	Introduction to College Level Research	1
Total Credits		7

According to the university-wide Communication Proficiency Grade Requirement, students must demonstrate their communication proficiency by earning a grade of C or better in ENGL 1500 and 2500 (or ENGL 2500H).

Mathematics, physical sciences, and biological sciences 6 cr.

Includes courses in the fields of agronomy, astronomy and astrophysics, biology, chemistry, civil engineering, computer science, geology, mathematics, physics, and statistics.

Humanities: 6 cr.

Includes courses in the fields of classical studies, English (literature), foreign languages, history, philosophy, religious studies, as well as history/theory/literature courses in dance, music, theater, journalism, African American studies, American Indian studies, environmental studies, Latino/a studies, women's studies, and university studies.

Social Sciences: 6 cr.

Includes courses in the fields of African American studies, American Indian studies, anthropology, economics, environmental studies, geography, human development and family studies, Latino/a studies, psychology and sociology, women's studies, and university studies.

General Education Electives: 9 cr.

9 cr. from any of the above areas, 6 cr. of course level 3000-4000.

Undergraduate Programs

Majors

- Art, B.A.
- Art, B.F.A.
- Art History, B.A.
- Architecture
- Community and Regional Planning
- Game Design
- Graphic Design
- Industrial Design
- Interior Design
- Landscape Architecture
- Scientific Illustration and Visualization*

*The College of Design participates in this interdepartmental major.

Secondary Majors

- Environmental Studies**
- Interdisciplinary Design
- International Studies**

Minors

- Critical Studies in Design
- Design Studies
- Digital Media
- Entrepreneurial Studies**
- Environmental Studies**
- Geographic Information Science**
- Gerontology**
- Illustration
- International Studies**
- Preservation and Cultural Heritage
- Sustainability**
- Textile Design**
- Urban Studies**

**The College of Design participates in these interdepartmental secondary majors and minors.

Minors in Design

The College of Design offers or participates in the following undergraduate minors:

- Critical Studies in Design
- Design Studies
- Digital Media
- Entrepreneurship
- Geographic Information Science (GIS)
- Illustration
- Preservation and Cultural Heritage
- Textile Design
- Urban Studies

Critical Studies in Design

The undergraduate minor in Critical Studies in Design offers students opportunities to engage the history, theory and criticism of visual and material culture and the built environment. In lectures and focused seminars, students explore:

- Historical and contemporary issues
- Cultural production
- Media and technology
- Design in everyday life
- Models of professional practice

Open to undergraduates in all university majors, this minor requires 15 credits of coursework. At least 6 of the 15 credits must be taken at Iowa State University in courses numbered 3000 or above. At least 3 of the

15 credits must not be used to meet any other department, college or university requirements except the credit requirement for graduation.

Requirements:

ARTH 2920	Introduction to Visual Culture Studies	3
DSNS 1830	Design in Context	3
or ARCH 2200	Contemporary Architecture	
or ARCH 2210	Histories and Theories of Architecture to 1750	
or ARTH 2800	History of Art I	
or ARTH 2810	History of Art II	
or CRP 2910	World Cities and Globalization	
or CRP 2930	Environmental Planning	
9 credits from approved list (at least 6 credits at 3000-level or above)		9
Total Credits		15

Design Studies

The undergraduate minor in Design Studies is constructed to facilitate design awareness among interested students and to provide a vehicle for interdisciplinary study within the College of Design. This minor is open to all undergraduate students at Iowa State University.

This minor requires 15 credits of course work: three (3) credits selected from College of Design history/theory course offerings (DSNS 1830 will not meet this requirement) and additional 12 credits selected from any College of Design course offerings*.

At least 9 credits must be 2000-level or above; 6 of those credits in must be taken at Iowa State University in courses numbered 3000-level or above. At least 3 of the 15 credits must not be used to meet any other department, college or university requirements except the credit requirement for graduation.

Students enrolled in the College of Design may not use courses required in their major degree programs or in the Core Design Program to satisfy this minor.

* The following courses **cannot** be used to meet the requirements for the Design Studies Minor: DSNS 1100, 1110, 1150, 3010, 3730, 3970, 4920.

Digital Media

Manipulation of digital media has emerged as an essential skill for design inquiry alongside traditional methods of building models and drawing sketches. To familiarize students with the use of digital media in the design process, the College of Design offers an undergraduate Minor in Digital Media. This minor is open to all undergraduate students at Iowa State University.

This minor requires 15 credits of coursework. At least three (3) credits of fundamental courses at the 2000 level must be taken in the student's primary major (see list below). At least 3 of the 15 credits must be taken

at Iowa State University in courses numbered 3000 or above and may not be used to meet any other department, college, or university requirement.

Fundamental Courses:

ARCH 2300	Design Communications I (for Architecture majors)	3
ARTGR 2750	Graphic Technology I (prereq: ARTGR 2700; for Graphic Design majors)	3
ARTGR 2760	Graphic Technology II (for Graphic Design majors)	3
ARTID 2630	Graphic Communication for Interior Design II (prereq: ARTID 2610; for Interior Design majors)	3
ART 2120	Studio Fundamentals: Digital Media	3
ART 2270	Introduction to Creative Digital Photography	3
CRP 2510	Fundamentals of Geographic Information Systems (for non-design majors)	3
DSNS 2320	Digital Design Communications (for non-design majors)	3
LA 2110	Digital Design Methods for Landscape Architecture (for Landscape Architecture and all majors)	3

Entrepreneurial Studies

The College of Design is an active participant in the Entrepreneurial Studies Minor for undergraduate students.

The minor requires at least 15 credits from an approved list of courses, including at least 9 credits numbered 2000-level or above; 6 credits of which in courses numbered 3000 or above taken at Iowa State University with a grade of C or higher.

Geographic Information Science (GISC)

The undergraduate minor in Geographic Information Science (GISC) is an interdisciplinary program that provides students with opportunities to engage the theory, processes, techniques and tools that use spatial data and computational technology to create cutting-edge analysis and mapping approaches for a wide range of fields, such as urban planning, architecture, landscape architecture, design, community development, agriculture, environmental sciences, natural resources, sociology, criminology, anthropology, political science, environmental studies and others.

The minor is open to undergraduates in all university majors with a minimum overall GPA of 2.0 prior to enrolling.

Students must complete a minimum of 15 undergraduate credits of GIS coursework to receive the minor. At least 6 of the 15 credits must be taken at Iowa State University in courses numbered 3000 or above with a grade of C or higher. At least 3 of the 15 credits must not be used to meet any other department, college or university requirements except the credit requirement for graduation.

Requirements:

Foundations of GIS - complete the following 2 courses: 6

CRP 2510	Fundamentals of Geographic Information Systems	
CRP 3510	Geospatial Analysis and Visualization	
GIS Tools and Techniques - choose 3 courses from the following:		9
ABE 4370	Watershed Modeling and Policy	
CRP 4490	Geodesign: Planning for Sustainable Futures	
CRP 4520	Geographic Data Management and Planning Analysis	
CRP 4540	Fundamentals of Remote Sensing and Spatial Analysis	3
CRP 4560	GIS Programming and Automation	
CRP 4570	Geogames for Civic Engagement	
GEOL 4520	Intro GIS for Geoscientists	
GEOL 4680	Applied Geostatistics for Geoscientists	
GEOL 4880	Raster GIS for Geoscientists	
NREM 3450	Natural Resource Photogrammetry and Geographic Information Systems	
NREM 4460	Integrating GPS and GIS for Natural Resource Management	

Total Credits 18

Illustration

The undergraduate minor in Illustration is ideal for students interested in illustration for books, graphic novels, magazine articles, advertising and concept art for game design and film. This minor provides the ability to tailor a curriculum that serves these varied career interests, whether you want to work in the industry or freelance as an independent studio practitioner.

Through this minor, students will:

- Develop conceptual skills directed toward communicating narrative content in sequential visual form.
- Demonstrate the ability for critical thinking through visual, verbal and written communication.
- Develop technical skills, working with a range of both traditional and digital media used in the field of illustration.
- Develop an awareness of historical and contemporary illustration.
- Strengthen individual portfolios to position themselves for success in their chosen field after graduation.

Requirements:

Students must complete two prerequisites prior to pursuing the Illustration minor.

Prerequisites:

DSNS 1310	Drawing I	4
ART 2300	Drawing II	3

After completion of the prerequisites, students must complete a minimum of 15 credits of Illustration coursework to receive the minor. At least 3 of the 15 credits must not be used to meet any other department, college or university requirements except the credit requirement for graduation.

Required Courses: 6

ART 3300	Drawing III: Life Drawing
ART 4320	Sequential Narrative Drawing

Elective Courses: 9

ARTGR 4640	Digital Imaging
ARTH 4890	History of Comics
ART 2330	Watercolor Painting
ART 3080	Computer Modeling, Rendering and Virtual Photography
ART 3380	Painting II
ART 3560	Relief Printmaking: Digital/Traditional
ART 3570	Intaglio and Monotype Printmaking: Digital / Traditional
ART 3580	Lithography: Digital / Traditional
ART 4080	Principles of 3D Animation
ART 4300	Drawing IV
ART 4380	Painting III
ART 4900F	Independent Study: Illustration
SCIVZ 3230	Scientific Illustration Principles and Techniques or ART 3230 Scientific Illustration Principles and Techniques
SCIVZ 3260	Digital Rendering
SCIVZ 3270	Illustration as Communication or ART 3270 Illustration as Communication
SCIVZ 3370	Application of Scientific Illustration Techniques

Preservation and Cultural Heritage

The undergraduate minor in Preservation and Cultural Heritage provides students with knowledge, skills, and credentials that complement undergraduate degrees in a wide variety of majors, but especially Architecture, Interior Design, Community & Regional Planning, Landscape Architecture, and History. To these ends, the Minor has two major curricular objectives:

- Provide student with a holistic understanding of historic preservation that draws from the various departments involved, yet allows for the development of expertise within a student's specific major.

- Provide a curriculum that conforms with the National Council for Preservation Education's pedagogical guidelines and the Federal government's Professional Qualification Standards for historic preservation under 36 Code of Federal Regulations (CFR) Part 61.

The minor requires a minimum of 15 credit hours. At least nine (9) credits must be numbered 2000-level or above; six (6) credits of which need to be taken at the 3000-level or above (see list below). At least 3 of the 15 credits must not be used to meet any other department, college or university requirement except the credit requirement for graduation.

For more information go to <https://www.preservation.design.iastate.edu/pch-undergraduate-minor/>

For any questions, please send an email to historicplaces@iastate.edu

Preservation & Cultural Heritage Minor Curriculum:

The Minor requirements are divided into three sections (see below).

Please choose six (6) credits from **Section 1 (Preservation Courses)**, three (3) credits from **Section 2 (General History)**, and six (6) credits from **Section 3 (History and Design of the Built Environment)**.

Section 1: Preservation Courses (choose two of the following) 6

ARCH 5670	Preservation, Restoration, Rehabilitation, Cultural Heritage, and Technology
ARCH 5680	Historic Preservation
ARTID 5720	Preservation & Cultural Heritage
CRP 5110	Documenting the Historic Built Environment

Section 2: General History (choose one of the following) 3

ARTH 3830	Greek and Roman Art
ARTH 3840	Art of Islam
ARTH 3850	Renaissance Art
ARTH 3860	American Art to 1945
HIST 3070	American Popular Culture
HIST 3200	History of Modern Europe, 1789 to Present
HIST 3620	Global Environmental History
HIST 3630	U. S. Environmental History
HIST 3860	History of Women in America
HIST 4880	American Stuff, Colonial Times to the Present

Section 3: History, Design, and Planning of the Built Environment 6
(choose two courses or one studio)

One of the two courses can be an independent study course that students can take with faculty teaching courses in the Minor in Preservation & Cultural Heritage Program

ARCH 2210	Histories and Theories of Architecture to 1750
ARCH 3220	Histories and Theories of Architecture after 1750
ARTH 2800	History of Art I
ARTH 2810	History of Art II

ARTH 5970	Green Art: Earthworks and Beyond
ARTID 3550	Interior Design History/Theory/Criticism I
ARTID 3560	Interior Design History/Theory/Criticism II
CRP 4210	Financing Historic Preservation Projects
CRP 5210	Historic Preservation Planning: Theory and Practice
DSNS 5460	Interdisciplinary Design Studio
INDD 3800	History and Culture of Objects
LA 3710	History of Modern Landscapes, 1750 to Present
LA 3730	Gardens and Landscapes from Antiquity to 1750

Textile Design

The undergraduate minor in Textile Design allows students to focus specifically on the design and creation of textiles - a practice with applications in the fine arts, fashion and related fields. Open to undergraduates at the sophomore level and above enrolled in any College of Design major or in the Apparel, Merchandising and Design major in the College of Health and Human Sciences.

Through this minor, students will:

- Learn historical and contemporary applications of textile production.
- Develop conceptual skills in textile media and techniques such as printing, dyeing and weaving for self-expression.
- Develop technical skills in both hand skills and digital tools.
- Demonstrate the ability for critical thinking through visual, verbal and written communications with an emphasis on what it means to be an artist/designer using textile media and techniques.
- Strengthen individual portfolios to position themselves for success in their chosen field after graduation.

Students must complete 16-18 credits of Textile Design coursework to receive the minor. At least nine (9) credits must be numbered 2000-level or above; six (6) credits of which need to be taken at the 3000-level or above. At least 3 of the 15 credits must not be used to meet any other department, college or university requirements except the credit requirement for graduation.

Requirements:

Required Core	6
FDM 2040	Textile Science
ART 2140	Studio Fundamentals: Textiles
History/Theory (choose one of the following)	3
FDM 3620	Cultural Perspectives of Global Dress
ARTH 2800	History of Art I
ARTH 2810	History of Art II
ARTH 2920	Introduction to Visual Culture Studies
Practice (choose two of the following)	6

FDM 1210	Apparel Assembly Processes
AMD 4900	Independent Study
ART 2080	Color
ART 3450	Introduction to Weaving
ART 3460	Natural Dyes
ART 3470	Dyed and Printed Textiles
ART 4480	Digital Textile Design
Electives (choose from the following)	3-5
FDM 3540	Fashion History I: Prehistoric to Mid-19th Century
FDM 3560	Fashion History II: Mid-19th Century to the Present
ART 2060	Studio Fundamentals: Printmaking
ART 2130	Studio Fundamentals: Painting
ART 3100	Sources and Methods of Visual Art
ARTH 3820	Art and Architecture of Asia
ARTH 3840	Art of Islam
DSNS 1310	Drawing I

Urban Studies

The undergraduate minor in Urban Studies is an interdisciplinary program that emphasizes urban life in a variety of settings and from different disciplinary and methodological approaches. The Urban Studies minor will allow students to explore varied and multiple dimensions of urban and community life through differing conceptual and analytical frameworks. Students can pursue interests in:

- Urban history
- Urban design
- Neighborhood revitalization
- Economic development
- Social movements
- Global urbanization

The minor is open to undergraduates in all university majors except Community & Regional Planning.

This minor requires 15 credit hours of coursework. At least 6 of the 15 credits must be taken at Iowa State University in courses numbered 3000 or above. At least 9 of the 15 credits must not be used to meet any other department, college or university requirements except the credit requirement for graduation.

Requirements:

CRP 2010	The North American Metropolis	3
CRP 2910	World Cities and Globalization	3
Nine (9) credits in three other courses from the approved list **		9
Total Credits		15

** Approved list of elective courses for Urban Studies Minor (<https://www.design.iastate.edu/programs-minors/minors/urban-studies/>)

Graduate Programs

The College of Design offers graduate study in the areas shown below. Graduate study is conducted through the Graduate College. Details are found in the Graduate College section of this catalog.

Majors

- Architecture
- Community and Regional Planning
- Graphic Design
- Industrial Design
- Integrated Visual Arts
- Interior Design
- Landscape Architecture
- Sustainable Environments*
- Transportation* (<http://catalog.iastate.edu/interdisciplinaryprograms/transportation/>)
- Urban Design*

Double Degree Programs

- Architecture / Business Administration
- Architecture / Community and Regional Planning
- Architecture / Sustainable Environments
- Architecture / Urban Design
- Community and Regional Planning / Business Administration
- Community and Regional Planning / Landscape Architecture
- Community and Regional Planning / Sustainable Agriculture
- Community and Regional Planning / Sustainable Environments
- Community and Regional Planning / Urban Design
- Industrial Design / Human Computer Interaction (HCI)
- Integrated Visual Arts / Sustainable Environments
- Landscape Architecture / Sustainable Environments
- Landscape Architecture / Urban Design

Certificates

- Geographic Information Systems (GIS)
- Gerontology*
- Preservation and Cultural Heritage

* The College of Design participates in this interdepartmental graduate program.

Architecture OVERVIEW

<http://www.design.iastate.edu/architecture> (<https://www.design.iastate.edu/architecture/>)

The Department of Architecture is committed to the study of architecture as a cultural discipline in which issues of practice, of the multiplicity of social formations in which buildings exist, and of environmental effects are integrated with building design through construction, space, material, form and use. Architecture arises from the aspirations that diverse individuals and groups have for their physical environment, and from the social enterprise of designing and fabricating the landscape we inhabit. It involves individual and multiple buildings, the spaces within them, and the exterior landscape.

The undergraduate program in architecture is an accredited 165-credit five-year undergraduate professional program, including the 31-credit Core Design Program, leading to the Bachelor of Architecture degree (B. Arch). The program provides opportunities for general education as well as preparation for professional practice and/or graduate study. An optional one-semester foreign study program is offered to fourth-year students. Other study abroad opportunities are also available for short-term and semester-long duration.

The undergraduate curriculum includes one year of the college's Core Design Program followed by a four-year professional program. Admission to the professional degree program is based on the applicant's performance in the completed pre-professional curriculum; previous high school record (or transfer record where applicable); portfolio and essay evaluations; and on available departmental resources. Information on admission criteria is posted each year on the College of Design website.

Students completing their bachelor's degree may opt to include a wide range of minor option as part of their course of study. A number of minors related to design, including digital media, critical studies, urban studies, and sustainability, can be integrated within their regular course of study; for details, please refer to the College of Design website.

For students entering the professional program after completion of the Core Design Program, the department requires purchase on their own or through the college of a laptop/notebook computer and appropriate software. Information is provided to students about computer requirements at the time of acceptance to the program.

The department offers two graduate degrees in architecture: a 90-credit graduate professional program leading to the Master of Architecture (M.Arch.) and a 30-credit interdisciplinary graduate program leading to the Master of Science in Architecture (M.S. Arch.). Both degrees offer options for interdisciplinary study within the College of Design and across related fields within the university. Double-degree programs are offered

with a number of other graduate programs of study within the college. Financial support in the form of teaching and research assistantships is available competitively.

Students who complete their Bachelor of Architecture Degree at Iowa State University may have 6 approved credit hours of their undergraduate study applied towards their Graduate Standing, permitting them to complete the M.S.Arch with 24 additional credit hours of study. In addition to graduate studies in Architecture, Bachelor of Architecture students may opt to pursue a one-year program of master's studies from other departments or programs in the College and the University. For complete current graduate program descriptions (many of which can apply 6 transfer credits from undergrad study), please see the College website undergraduate programs.

Student Learning Outcomes

Our program prepares students for careers in architecture and related disciplines, emphasizing a diverse and holistic approach whereby graduates obtain:

- Rigorous, research-driven, and creative design skills.
- A broad, inclusive, and nuanced appreciation for the historic and theoretical frameworks that inform practice today.
- An array of graphic, computational and presentation skills needed to both design and convey design intent.
- An understanding of contemporary technical and performance criteria used to model, analyze, and construct projects, so as to responsibly evaluate the technical and environmental impact of design decisions; and
- A grounding in the critical, aesthetic, and ethical role of the profession and its relationship to public health, safety, well-being, and environmental stewardship.

Program Accreditation

Iowa State University Department of Architecture offers programs accredited by the National Architectural Accrediting Board, which requires the inclusion of the following statement:

"In the United States, most registration boards require a degree from an accredited professional degree program as a prerequisite for licensure. The National Architectural Accrediting Board (NAAB), which is the sole agency authorized to accredit professional degree programs in architecture offered by institutions with U.S. regional accreditation, recognizes three types of degrees: the Bachelor of Architecture, the Master of Architecture, and the Doctor of Architecture. A program may be granted an eight-year term, an eight-year term with conditions, or a two-year term of continuing accreditation, or a three-year term of initial accreditation, depending on the extent of its conformance with established education standards.

Doctor of Architecture and Master of Architecture degree programs may require a nonaccredited undergraduate degree in architecture for admission. However, the non-accredited degree is not, by itself, recognized as an accredited degree."

Iowa State University Department of Architecture offers the following NAAB-accredited degree programs:

- Bachelor of Architecture (165 cr.)
- Master of Architecture (90 cr.; prerequisite: undergraduate degree in a discipline other than architecture or a four-year pre-professional degree in architecture)

Degree Requirements

Total B. Arch. Requirement: 165 cr.

Only 65 cr. from a two-year institution may apply which may include up to 16 technical cr.; 9 P-NP cr. of free electives; 2.00 minimum GPA.

International Perspective: 3 cr.

U.S. Cultures and Communities: 3 cr.

Communications: 7 cr.

(C or better grade in ENGL 1500 and ENGL 2500)

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
LIB 1600	Introduction to College Level Research	1
Total Credits		7

Humanities: 6 cr.

6 cr. from approved list.

Social Sciences: 6 cr.

6 cr. from approved list.

Math and Physical Sciences: 8 cr.

MATH 1450	Applied Trigonometry	3
PHYS 1310	General Physics I	4
PHYS 1310L	General Physics I Laboratory	1
Total Credits		8

Design Core 13 cr.

DSNS 1020	Design Studio I	4
DSNS 1150	Design Collaborative Seminar	1
or DSNS 1100	Design Exchange Seminar I	
DSNS 1310	Drawing I	4
DSNS 1320	Digital Design Literacy	1
DSNS 1830	Design in Context	3
Total Credits		13

Design Communications: 6 cr.

ARCH 2300	Design Communications I	3
ARCH 2310	Advanced Design Representation	3

Total Credits 6

Design: 48 cr.

ARCH 2010	Architectural Design I	6
ARCH 2020	Architectural Design II	6
ARCH 3010	Architectural Design III	6
ARCH 3020	Architectural Design IV	6
ARCH 4010	Architectural Design V	6
ARCH 4020	Architectural Design VI	6
ARCH 4030	Architectural Design VII	6
DSNS 5460	Interdisciplinary Design Studio	6

Total Credits 48

Building Technologies: 21 cr.

ARCH 3450	Building Science and Technology I	2
ARCH 3450L	Building Science and Technology I Lab	1
ARCH 3460	Building Science and Technology II	3
ARCH 3460L	Building Science and Technology II Lab	2
ARCH 3470	Building Science and Technology III	3
ARCH 3470L	Building Science and Technology III Lab	2
ARCH 3480	Building Science and Technology IV	3
ARCH 3480L	Building Science and Technology IV Lab	2
ARCH 4450	Building Science and Technology V	2
ARCH 4450L	Building Science and Technology V Lab	1

Total Credits 21

Studies in History, Theory, and Culture: 18 cr.

ARCH 2200	Contemporary Architecture	3
ARCH 2210	Histories and Theories of Architecture to 1750	3
ARCH 3220	Histories and Theories of Architecture after 1750	3
Nine credits from approved HTC Option list.		9

Total Credits 18

Behavioral Studies/Practice: 6 cr.

ARCH 3710	Human Behavior and Environmental Theory	3
ARCH 4820	Professional Practice	3

Total Credits 6

Professional Options: 9 cr.

6 cr. 3000-5000 level Arch; 3 cr. from ARCH, ART, ARTH, ARTID, ARTGR, ARTIS, CRP, DES, DSNS, or LA, SUSE, or URBD.

Electives: 17 cr.

2 cr. KIN or ATH allowed; 4 cr. AFAS, MS, or NS allowed; 9 cr. ARCH allowed (no P/NP).

Architecture, B.Arch.

First Year

Fall	Credits Spring	Credits
DSNS 1020 or 1310	4 DSNS 1020 or 1310	4
DSNS 1100 or 1150	1 DSNS 1830 or ENGL 1500	3
DSNS 1830 (or General Elective)	3 PHYS 1310	4
DSNS 1320	1 PHYS 1310L	1
ENGL 1500 or LIB 1600 (or General Elective)	1-3 Social Science/Humanities Elective	3
MATH 1450	3 LIB 1600 or ENGL 2500*	1-3
Social Science/Humanities Elective	3 *LIB 1600 is taken once.	

16-18

16-18

Second Year

Fall	Credits Spring	Credits
ARCH 2010	6 ARCH 2020	6
ARCH 2200	3 ARCH 3460	3
ARCH 2300	3 ARCH 3460L	2
ARCH 3450	2 ARCH 3710	3
ARCH 3450L	1 ARCH 2310	3
ENGL 2500*	3	

*If not taken the first year.

18

17

Third Year

Fall	Credits Spring	Credits
ARCH 2210	3 ARCH 3020	6
ARCH 3010	6 ARCH 3220	3
ARCH 3470	3 ARCH 3480	3
ARCH 3470L	2 ARCH 3480L	2
Social Sciences/Humanities Elective	3 HTC Elective	3

17

17

Fourth Year

Fall	Credits Spring	Credits
ARCH 4010	6 ARCH 4020	6
ARCH 4450	2 HTC Elective	3
ARCH 4450L	1 General Elective	3
ARCH 4820	3 General Elective	3

HTC Elective	3	
Social Science/Humanities Elective	3	
	18	15

Fifth Year

Fall	Credits Spring	Credits
ARCH 4030	6 DSNS 5460	6
Professional Elective	3 Professional Elective	3
Professional Elective	3 General Elective	3
General Elective	3 General Elective	2
	15	14

Total Credits: 165

Admission into the Bachelor of Architecture Program requires the completion of the Core Design Program. Admission depends upon available resources; admission criteria are posted on the College of Design website. Transfer students are considered on a case-by-case basis.

Graduate Programs

Master of Architecture (M.Arch.)

Our 90-credit M.Arch. is an accredited professional degree in architecture designed for students with undergraduate degrees in disciplines other than architecture as well as for students who hold a four-year pre-professional degree in architecture. Applicants holding B.S. or B.A. degrees in Architecture or other affiliated design fields may be given advanced standing in the M.Arch. program.

The M.Arch. program engages with architecture as a form of knowledge, practice and production situated in relation to contemporary concerns and issues. Students gain the knowledge, skills and experience with which to professionally practice architecture, while also developing a critical awareness of the discipline's wider social, political, economic, environmental and cultural implications.

M.Arch. is accredited by the National Architectural Accreditation Board (NAAB) and leads to a professional Master of Architecture degree over three years. The curriculum commences with an intensive sequence of classes that establish the foundations for the study and practice of architecture. Equal emphasis is placed on each of the three study areas: studios in architectural design and media, laboratories and lectures on science and technology, and lectures and seminars on history and theory. Building on these foundations, students are supported in developing their own particular interests and agendas as they progress through the subsequent two years of study. This is facilitated through options in

studying abroad, undertaking specialized studio options both within and outside of the department, and opportunities for independent study.

In addition to architecture, students previously admitted to the full three-year program have held undergraduate degrees in a broad range of fields, including art history, history, literature, interior design, economics, mathematics, computer science, anthropology, medicine and philosophy. This diverse range of previous study and experience is brought to bear on the study of architecture, collectively enriching the range and depth of our program.

While students with undergraduate degrees in other disciplines, must complete the full three years of the curriculum, students with undergraduate degrees in architecture or other related design fields may, on consideration, be given advanced standing in the program. Advanced standing students may waive up to the whole first year.

Master of Architecture (M.Arch.)

Studio Courses: 36 cr.

ARCH 5050	Architectural Design and Media I: Mapping, Programming, Building	6
ARCH 5060	Architectural Design and Media II: Materiality and Representation	6
ARCH 6010	Sustainable Building Design	6
ARCH 6020	Communities, Architecture and the Environment	6
ARCH 6030	Integrative Design	6
ARCH 6040	Design Studio Options	6

Technology and Practice: 18 cr.

ARCH 5430	Building Science and Technology I	6
ARCH 5440	Building Science and Technology II	3
ARCH 5820	Professional Practice	3
ARCH 6410	Building Science and Technology III	3
ARCH 6420	Building Science and Technology IV	3

History and Theory: 12 cr.

ARCH 5950	Seminar on the Built Environment I: History	3
ARCH 5960	Seminar on the Built Environment II: Landscape and Society	3
ARCH 5970	Seminar on the Built Environment III: Theory	3
ARCH 5980	Seminar on the Built Environment IV: Topical Study	3

Electives: 24 cr.

Total Credits: 90

Master of Science in Architecture (M.S.)

M.S. in Arch. is a 30-credit research degree with a required graduate thesis. As a research degree, this program is not subject to NAAB accreditation.

M.S. in Arch. is open for applicants who hold a professional degree in architecture or other related design fields. Applicants are required to submit a research proposal that lies within one of the study areas listed on the program's webpage. The degree is also open for applicants with non-professional degrees in various fields depending on the research proposed by the applicant.

Master of Science In Architecture (M.S.)

History and Theory: 6 cr. (Choose two seminars from this list)

ARCH 5950	Seminar on the Built Environment I: History	3
ARCH 5960	Seminar on the Built Environment II: Landscape and Society	3
ARCH 5970	Seminar on the Built Environment III: Theory	3
ARCH 5980	Seminar on the Built Environment IV: Topical Study	3

Thesis: 9 cr.

ARCH 6990	Research	9

Area of Study: 9 cr.

Electives: 6 cr.

Total Credits: 30

Dual degree

Double degree programs are offered with a number of graduate programs in other college departments. Information about our programs and how to apply can be obtained from the department's web page at: <https://www.design.iastate.edu/architecture/>. (<https://www.design.iastate.edu/architecture/>)

Financial support in the form of teaching and research assistantships is available.

Art, B.A.

The Department of Art and Visual Culture offers degree programs focused on fine arts and art history, including the Bachelor of Arts (B.A.) in Art, Bachelor of Arts (B.A.) in Art History, Bachelor of Fine Arts (B.F.A.) in Art, and the Master of Fine Arts (M.F.A.) in Integrated Visual Arts. Course offerings include studio arts, art history, art education, and scientific illustration and visualization.

B.A. in Art

The Bachelor of Arts in Art (formerly Art & Design, Art & Culture Option) is a four-year degree program for students seeking an inclusive, flexible program of study that encompasses studio art, art history and visual culture, and a complementary focus area of their choosing from within or outside of the College of Design. Working with an advisor, students design their own course of study; many students create a degree path that allows them to pursue the B.A. in Art together with another major or minor in journalism, advertising, business, entrepreneurship, history, or psychology.

Students in the program can gain real-world experience through one or more internships in a museum or gallery prior to graduation. Local possibilities include the Brunnier Art Museum and Christian Petersen Art Museum on campus, the Octagon Center for the Arts downtown, and the Des Moines Art Center. Summers are a great time for internships in more distant locales.

Students are also encouraged (but not required) to study abroad to gain first-hand knowledge of another culture. The College's Rome Program is a frequent choice for those wanting to spend a semester in Europe.

Summer excursions are also available, with ISU faculty regularly leading multi-week trips to Europe, Asia, and Central America.

The B.A. in Art offers students the opportunity to individualize their studies in studio art and tailor their degree paths to align with complementary fields of study. This flexible degree can serve as a springboard into a wide array of career and graduate school opportunities, including solo studio art practice, art criticism, art history, art sales, art conservation, and working with corporate art collections, galleries and museums, and art therapy. Since the program is highly customizable and includes courses in entrepreneurship and professional development, students create a personal course of study that targets post-B.A. careers.

Student Learning Outcomes

Students will:

- Develop traditional and innovative technical skills and artmaking practices;
- Foster creative problem-solving abilities through design, research, and creative processes;
- Understand and express the relationship between objects, aesthetics, and meaning;
- Exhibit an awareness of their roles as artists and thinkers in regard to the ethical, cultural, and ecological impacts of what they do;
- Express through visual, verbal, and written means an awareness of global art movements and a meaningful understanding of historic and contemporary art;
- Engage with local, national, and global communities where they can participate in a broad exchange of ideas;
- Prepare for diverse careers through professional development seminars, internships, study abroad, and service-learning opportunities.

B.A. in Art degree requirements

Total Degree Requirements: 122-123 credits

Only 65 credits from a two-year institution can apply and may include up to 16 technical credits; 9 P-NP credits of free electives; 2.00 minimum GPA.

International Perspectives: 3 credits**U.S. Cultures and Communities: 3 credits****Communication: 10 credits**

(C or better grade in ENGL 1500 and ENGL 2500)

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
LIB 1600	Introduction to College Level Research	1
One course from the following:		3
COMST 1010	Introduction to Communication Studies	
COMST 2110	Interpersonal Communication	
SPCM 1100	Listening	
SPCM 2120	Fundamentals of Public Speaking	

Total Credits 10**Humanities: 6 credits**

6 credits from College of Design General Education Approved Course List

Social Sciences: 6 credits

6 credits from College of Design General Education Approved Course List

Math/Physics/Biol. Sciences: 6 credits

6 credits from College of Design General Education Approved Course List

General Education Courses: 9 credits

6 credits at level 3000-4000 from College of Design General Education Approved Course List 6

3 credits from College of Design General Education Approved Course List 3

Total Credits 9**College of Design Core: 13 credits**

DSNS 1020	Design Studio I	4
DSNS 1150	Design Collaborative Seminar	1
or DSNS 1100	Design Exchange Seminar I	
DSNS 1310	Drawing I	4
DSNS 1320	Digital Design Literacy	1
DSNS 1830	Design in Context	3

Total Credits 13**Art History and Theory: 15 credits**

ARTH 2800	History of Art I	3
ARTH 2810	History of Art II	3
Six credits from 3000-level or above from ARTH		6
Three credits from courses in ARTH, or approved history courses in ARCH, CRP, or LA		3

Total Credits 15**Art Concentration: 12 credits**

12 credits from 2000-level or above in College of Design studio courses.

Complementary Area of Concentration: 30 credits

30 credits from an approved area of concentration, including 6 credits at 3000-4000 level.

Electives: 15 credits

1 credit from DSNS 3010 Study Abroad Preparation Seminar (Rome option only)

B.A. in Art**First Year**

Fall	Credits Spring	Credits
DSNS 1020 or 1310	4 DSNS 1310 or 1020	4
DSNS 1100 or 1150	1 DSNS 1830 (or General Education)	3
DSNS 1320	1 ENGL 1500 (or General Education)	3
DSNS 1830 (or General Education)	3 General Education	3
ENGL 1500 (or General Education)	3 General Education	3
General Education	3 LIB 1600	1
General Education	3	
18		17

Second Year

Fall	Credits Spring	Credits
Studio Option	3 Studio Option	3
Approved course in area of concentration	3 Approved course in area of concentration	3
General Education	3 General Education	3
ARTH 2800 (fall only)	3 ARTH 2810 (spring only)	3
ENGL 2500 (or General Education)	3 ENGL 2500 (or General Education)	3
15		15

Third Year

Fall	Credits Spring	Credits
Studio Option	3 Studio Option	3
Approved course in area of concentration	3 Approved course in area of concentration	3
Approved course in area of concentration	3 Approved course in area of concentration	3
General Education	3 Elective	3
ARTH 3000-level or above	3 ARTH 3000-level or above	3

	DSNS 3010 (Rome option only)	1
	15	16
Fourth Year		
Fall	Credits Spring	Credits
Approved course in area of concentration	3 Approved course in area of concentration	3
Approved course in area of concentration	3 Approved course in area of concentration	3
Elective	3 Elective	3
Elective	3 Elective	3
Art History or Design History	3	
	15	12

Art, B.F.A. Overview

<https://www.design.iastate.edu/academics/departments/art-visual-culture/>

The Department of Art and Visual Culture offers degree programs focused on fine arts and visual culture, including the Bachelor of Arts (B.A.) in Art, Bachelor of Arts (B.A.) in Art History, Bachelor of Fine Arts (B.F.A.) in Art, and Master of Fine Arts (M.F.A.) in Integrated Visual Arts. Course offerings include studio arts, art history, art education, and scientific illustration and visualization.

B.F.A. in Art

The Bachelor of Fine Arts in Art (formerly Integrated Studio Arts) is an enrollment-managed, four-year program for students seeking an immersive degree in studio arts with an emphasis on crossing conceptual and media boundaries. In their sophomore year, students complete rotations in our eight media areas: ceramics, textiles, jewelry and metalsmithing, furniture design and woodworking, painting, printmaking, digital media, and photography. Classes in color theory and drawing round out the year.

Junior and senior-level studios provide focused investigation in specific media areas and help prepare students for professional practice and/or graduate study toward a Master of Fine Arts (M.F.A.) degree. Art history courses enhance the studio environment by providing a strong context as students develop their ideas and technical abilities.

Over their four-year course of study, students develop a portfolio and prepare for a professional practice in the visual arts. This concentration engages aesthetics, conceptual development and visual problem-solving, critical thinking, and technical-skill development, using historical and cultural theory, contemporary trends, and studio practice. The B.F.A.

degree culminates in a professional exhibition in the College of Design's Gallery 181.

Transfer students with studio credits from other colleges and universities may present a portfolio of work created in those courses to determine if these credits can be applied toward specific studio requirements.

Students will present this portfolio upon admission and prior to registration for classes. Arrangements for this process should be made with the department's academic advisors.

The department offers an undergraduate minor in Illustration and participates in the undergraduate minors in Classical Studies, Critical Studies in Design, Design Studies, Digital Media, and Textile Design

Student Learning Outcomes

Students will:

- Develop traditional and innovating technical skills and artmaking practices;
- Foster conceptual development and creative problem-solving abilities through design, research, and creative processes;
- Understand and express in multiple media the relationship between objects, aesthetics, and meaning;
- Exhibit an awareness of their roles as artists and thinkers regarding the ethical, cultural, and ecological impacts of what they do;
- Express through visual verbal, and written means an awareness of global art movements and a meaningful understanding of historic and contemporary art;
- Use their understanding and practice of art to engage with local, national, and global communities where they can participate in a broad exchange of ideas;
- Prepare for careers in the visual arts through professional development seminars, internships, study abroad, and service-learning opportunities.

Degree Requirements

The curriculum in leads to a 128 credit undergraduate Bachelor of Fine Arts in Art. Admission into the program requires the completion of at least 31.0 credits, including the following courses: DSNS 1020, DSNS 1100 or 1150, DSNS 1310, DSNS 1320, and DSNS 1830; 6 credits of Social Sciences/Humanities; 6 credits of Math/Science; ENGL 1500 (or test-out credit); LIB 1600. Information on admission criteria is posted each year on the College of Design website.

Total Degree Requirement: 128 cr.

Only 65 credits from a two-year institution can apply and may include up to 16 technical credits; 9 P-NP credits of free electives; 2.00 minimum GPA.

International Perspective: 3 credits
U.S. Cultures and Communities: 3 credits
Communication: 10 credits

(C or better grade ENGL 1500 and ENGL 2500)

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
LIB 1600	Introduction to College Level Research	1
One course from the following:		3
COMST 1010	Introduction to Communication Studies	
COMST 2110	Interpersonal Communication	
SPCM 2120	Fundamentals of Public Speaking	
Total Credits		10

Humanities: 6 credits

6 credits from College of Design General Education Approved Course list.

Social Sciences: 6 credits

6 credits from College of Design General Education Approved Course list.

Math/Physics/Biol. Sciences: 6 credits

6 credits from College of Design General Education Approved Course list.

General Education Courses: 9 credits

6 credits at level 3000-4000 from College of Design General Education Approved Course List	6
3 credits from College of Design General Education Approved Course list	3
Total Credits	9

College of Design Core: 13 credits

DSNS 1020	Design Studio I	4
DSNS 1150	Design Collaborative Seminar	1
or DSNS 1100	Design Exchange Seminar I	
DSNS 1310	Drawing I	4
DSNS 1320	Digital Design Literacy	1
DSNS 1830	Design in Context	3
Total Credits		13

ART Core: 31 credits

ART 2020	Studio Fundamentals: Wood	2
ART 2030	Studio Fundamentals: Jewelry/Metalsmithing	2
ART 2040	Studio Fundamentals: Ceramics	2
ART 2060	Studio Fundamentals: Printmaking	2
ART 2080	Color	2
ART 2100	Studio Fundamentals: Photo	2
ART 2120	Studio Fundamentals: Digital Media	3
ART 2130	Studio Fundamentals: Painting	2
ART 2140	Studio Fundamentals: Textiles	2

ART 2300	Drawing II	3
ART 3100	Sources and Methods of Visual Art	3
ARTH 2800	History of Art I	3
ARTH 2810	History of Art II	3

Total Credits 31

ART Concentration: 24 credits

Eight courses from ART studio offerings. Faculty advisors will assist students in developing their studio concentration plan.

Art History: 9 credits

At least 6 credits from ARTH 3000+ course level.

Professional Practice: 3 credits

ART 3990	BFA Professional Practice	2
ART 4990	BFA Exhibition	1
Total Credits		3

Electives: 11 credits

DSNS 3010 Rome Predeparture (Rome option only)

Art, B.F.A.

First Year

Fall	Credits Spring	Credits
DSNS 1020 or 1310	4 DSNS 1020 or 1310	4
DSNS 1100 or 1150	1 DSNS 1830 (or General Education)	3
DSNS 1320	1 ENGL 1500 (or General Education)	3
DSNS 1830 (or General Education)	3 General Education	3
ENGL 1500 (or General Education)	3 General Education	3
General Education	3 LIB 1600	1
General Education	3	
18		17

Second Year

Fall	Credits Spring	Credits
ARTH 2800 (fall only)	3 ARTH 2810 (spring only)	3
ART 2120 or 2300	3 ART 2300 or 2120	3
ART Studio Fundamentals	2 ART Studio Fundamentals	2
ART Studio Fundamentals	2 ART Studio Fundamentals	2
ART Studio Fundamentals	2 ART Studio Fundamentals	2
ART Studio Fundamentals	2 ART Studio Fundamentals	2
ENGL 2500 (or General Education)	3 ENGL 2500 (or General Education)	3
17		17

Third Year

Fall	Credits Spring	Credits
ART 3100	3 ART Studio Option	3
ART Studio Option	3 ART Studio Option	3
ART Studio Option	3 ART Studio Option	3
ARTH 3000 level or above	3 ARTH 3000 level or above	3
General Education	3 ART 3990	2
	DSNS 3010 (Rome option only)	1
	15	15

Fourth Year

Fall	Credits Spring	Credits
ART Studio Option	3 ART Studio Option	3
ART Studio Option	3 ART Studio Option	3
ARTH 3000 level or above	3 ART 4990	1
General Education or Elective	3 General Education	3
Elective	3 Elective	5
	15	15

Post-Baccalaureate Undergraduate Certificate

Iowa State's Post-Baccalaureate Undergraduate Certificate program in Art prepares students for either graduate study or career advancements by providing a focused environment for deepening aesthetic, technical, creative, and conceptual skills. While a bachelor's degree in visual or fine arts is not necessary, a strong portfolio of creative work and a written statement of purpose are required for admission.

Curriculum

Post-baccalaureate students will work with a faculty advisor to create a tailored 25-credit program of study including:

- 15 credits of 3000/4000-level art courses (ART);
- Six (6) credits of 3000/4000-level art history courses (ARTH);
- Three-credit elective selected from a list of options;
- ART 4910: One-credit capstone exhibition course.

For the capstone experience, you will be expected to produce an artist's statement and a written assessment of your learning that will be reviewed, along with your art, by the faculty.

This certificate program must be completed within two years. Students interested in developing a body of work for admission to graduate school or to focus on further skill development prior to moving into professional practice will be ideal candidates.

Application Requirements

To apply for this program, please submit the following materials.

1. Digital portfolio:
 - Twenty (20) images of recent work with no more than four (4) of the images being details.
 - Descriptions on each image need to include title, date, size and medium
2. One-page statement of intent.
3. Current resume.
4. Name and contact information of three (3) references.

Graduate Program

The department offers the Master of Fine Arts (MFA) in Integrated Visual Arts (IVA). The MFA curriculum in IVA requires a minimum of 60 credits. This MFA is a unique interdisciplinary program offering integrative study among a combination of media areas including ceramics, computer applications, drawing, textiles, illustration, jewelry/metalsmithing, painting, printmaking, photography, furniture/wood design and areas outside of AVC. The IVA program offers an innovative curriculum aligned with emerging art and design markets.

IVA graduates link traditional studio disciplines with interdisciplinary studies. Graduates are prepared as visual artists to enter studio practice, business, higher education, or new interdisciplinary fields. The MFA is recognized as the terminal degree. A required thesis exhibition is composed of two parts: a substantial solo exhibition; and a written thesis statement that describes the development of the work in the exhibition, its objectives, and its historical and cultural points of reference. A written thesis with no exhibition component may be an appropriate alternative, but some portion of the work should entail an element of creative problem-solving in the form of a visual product.

Upon completion of the graduate program IVA graduates are expected to:

- Have developed a fully realized creative direction which provides a platform for continued professional research and growth, and visual expression;
- Have produced a body of work which demonstrates a high level of creative investigation and accomplishment;
- Have acquired a professional level of technical proficiency in one or more media areas;
- Effectively communicate their ideas verbally and in writing;
- Understand the context, both historical and current, within which their creative pursuits exist;
- Have developed a well-formed and informed personal creative philosophy and a strong studio skill set;

- Understand current and relevant ethical, ecological, and social issues; and
- Use relevant theory in pursuing creative university-level scholarship.

Studio Courses: 39 credits

Courses numbered ART	27
Studio Courses outside of ART	6
ART 6990A and ART 6990B	6

Seminar Courses: 6 credits

(Students take 2 sections of ART 5710, or 1 section of ART 5710 and ART 5110)

Graduate Seminar ART 5710	3 credits each section
ART 5710	Graduate Seminar: Professional Practice
ART 5720	Graduate Seminar: Critique and Creative Process
ART 5110	Seminar in Teaching

Art History/Theory/Criticism: 12 credits

ARTH 5010 required	3
Art History courses	9

Related Courses (outside of IVA program): 3 credits

Total: 60 Credits

Art History

Overview

<https://www.design.iastate.edu/academics/departments/art-visual-culture/>

The Department of Art and Visual Culture offers degree programs focused on fine arts and art history, including the Bachelor of Arts (B.A.) in Art, Bachelor of Arts (B.A.) in Art History, Bachelor of Fine Arts (B.F.A.) in Art, and the Master of Fine Arts (M.F.A.) in Integrated Visual Arts. Course offerings include studio arts, art history, art education, and scientific illustration and visualization.

B.A. in Art History

The Bachelor of Arts in Art History is a four-year program for students seeking a concentrated course of study in art history and visual culture, including theory, criticism, and museum studies. Students in the program gain a broad understanding of histories of art and visual culture, ranging from the prehistoric period to the present and including both western and non-western cultures. They then choose one or more areas—such as history of photography, 19th century, modern or contemporary art—for deeper study in advanced-level courses and seminars that

encourage critical thinking and the development of research, writing, and presentation skills.

Flexibility is a key feature of the B.A. in Art History. Working with an advisor, students design their own program of study, one that targets their personal interests and career goals. In addition to art history and visual culture courses taught by faculty within the program, students can take courses in the histories of architecture, graphic design, industrial design, interior design, and landscape architecture. For students interested in museum studies, courses may include up to nine (9) credits of museum or gallery internship. Many students also choose to add a second major or minor to complement their Art History degree, such as advertising, business, entrepreneurship, history, journalism, psychology, or a myriad of other possibilities.

Students in the program can gain real-world experience through one or more internships in a museum or gallery prior to graduation. Local possibilities include the Brunnier Art Museum and Christian Petersen Art Museum on campus, the Octagon Center for the Arts downtown, and the Des Moines Art Center. Summers are a great time for internships in more distant locales.

Students are also encouraged (but not required) to study abroad to gain first-hand knowledge of another culture. The College's Rome Program is a frequent choice for those wanting to spend a semester in Europe. Summer excursions are also available, with ISU faculty regularly leading multi-week trips to Europe, Asia, and Central America.

The B.A. in Art History offers students the opportunity to learn more about the world and themselves, and can serve as a springboard to a wide array of graduate school and career opportunities, including art criticism, art sales, conservation, and working with corporate art collections, galleries and museums, and art therapy. Further career possibilities include teaching at the college level and curating in major museum collections.

Student Learning Outcomes

Students will learn how to:

- Look at and think critically about art and visual culture, including both historical works and the images that surround them in daily life;
- Conduct research using digital and analog methods;
- Write and speak analytically and critically about art and visual culture;
- Express and defend positions on art and visual culture through written and verbal means.

Students will also learn to:

- Understand the relationship between art objects and the political, historical, and cultural contexts in which they were created;

- Respect and appreciate other cultures and perspectives, both historical and contemporary, through a study of their artistic production;
- Consider how art addresses the ethical, cultural, and ecological challenges we face today in a globalized world.

B.A. in Art History Degree Requirements

TOTAL DEGREE REQUIREMENTS: 121 credits

Only 65 credits from a two-year institution can apply and may include up to 16 technical credits; 9 P-NP credits of free electives; 2.00 minimum GPA.

INTERNational perspectives: 3 credits
u.s. cultures and communities: 3 credits
communication: 10 credits
(C or better grade)

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
LIB 1600	Introduction to College Level Research	1
One course from the following:		3
COMST 1010	Introduction to Communication Studies	
COMST 2110	Interpersonal Communication	
SPCM 1100	Listening	
SPCM 2120	Fundamentals of Public Speaking	
Total Credits		10

HUMANITIES: 6 CREDITS

6 credits from College of Design General Education Approved Course List

SOCIAL SCIENCES: 6 Credits

6 credits from College of Design General Education Approved Course List

Math/physics/ biol. sciences: 6 credits

6 credits from College of Design General Education Approved Course List

general education courses: 9 credits

6 credits at level 3000-4000 from College of Design General Education Approved Course List	6
3 credits from College of Design General Education Approved Course List	3

Total Credits 9

Art history Core: 12 credits

ARTH 2800	History of Art I	3
ARTH 2810	History of Art II	3
ARTH 4990	Visual Culture Studies Writing and Methods Seminar	3
Choose ONE from the following:		3
DSNS 1830	Design in Context	

ARTH 2920	Introduction to Visual Culture Studies
Total Credits	
	12

Art history program: 24 credits

24 credits from approved list of History/Theory/Criticism courses in the College of Design (this list includes ARTH courses and other history courses). May include up to 9 credits of Museum/Gallery Internship.

Art History/HTC credits	12
Art History/HTC credits at 3000-level or above	12
Total Credits	24

Foreign languagE

At least 6 credits total in a single language. Two semesters in ONE of the following languages: Arabic, Chinese, French, German, Latin, Portuguese, Russian, Spanish.

Area of concentration: 24 credits

24 credits from an approved area of concentration, including 6 credits at the 3000-level or above.

electives: 18 credits

DSNS 1310 Rome Predeparture (Rome option only)

Four Year Plan

First Year			
Fall	Credits	Spring	Credits
ARTH 2800	3	ARTH 2810	3
DSNS 1830 or ARTH 2920 (or General Education)	3	DSNS 1830 or ARTH 2920 (or General Education)	3
ENGL 1500 (or General Education)	3	ENGL 1500 (or General Education)	3
LIB 1600	1	General Education	3
General Education	3	General Education	3
General Education	3		
		16	15
Second Year			
Fall	Credits	Spring	Credits
Art History/HTC Course	3	Communications Option	3
Foreign Language or Approved Course in Area of Concentration	3	Foreign Language or Approved Course in Area of Concentration	3
General Education	3	Approved Course in Area of Concentration	3
General Education	3	Art History/HTC Course	3
ENGL 2500 (or General Education)	3	ENGL 2500 (or General Education)	3
		15	15

Third Year

Fall	Credits Spring	Credits
Art History/HTC Course	3 Art History/HTC Course	3
Art History/HTC Course	3 Art History/HTC Course	3
Foreign Language or	3 Foreign Language or	3
Approved Course in Area of Concentration	Approved Course in Area of Concentration	
Approved Course in Area of Concentration	3 Approved Course in Area of Concentration	3
Elective	3 Elective	3
	15	15

Fourth Year

Fall	Credits Spring	Credits
ARTH 4990	3 Approved Course in Area of Concentration	3
Art History/HTC Course	3 Approved Course in Area of Concentration	3
Approved Course in Area of Concentration	3 Art History/HTC Course	3
Elective	3 Elective	3
Elective	3 Elective	3
	15	15

Community and Regional Planning Overview

<https://www.design.iastate.edu/academics/departments/crp/>

Community and regional planning are a field of study aimed at understanding the ever-changing socioeconomic and physical environments of our communities and planning for their future. Planners evaluate and seize opportunities to solve problems. Planners work at multiple levels of government, as well as the private sector, and they are concerned with issues that affect every corner of the world: the preservation and enhancement of the quality of life in a community, the protection of the environment, the promotion of equitable economic opportunities; and the management of growth and change of all kinds.

Graduates of the Community and Regional Planning department are able to integrate planning knowledge and skills in a variety of practical applications and can communicate effectively in written and oral form. Graduates will be qualified for a variety of entry-level positions in the public, private, and not-for-profit sectors. They will also be well prepared for graduate study in a variety of fields, including urban planning, law, public policy, public health, environmental science, geography, sociology, urban design, historic preservation, data science, and architecture.

Graduates of the Community and Regional Planning department are expected to understand the structure and functions of urban settlements, including the history of planning and urban development and the processes for plan and policy making. Graduates should have skills in problem formulation, quantitative analysis, written/oral and graphic communications, and collaboration, and in synthesizing and applying knowledge to practice. Graduates are expected to be able to assess the impact of plans and alternatives based on principles of equity and social justice, economic welfare and efficiency, environmental sustainability, and cultural heritage in the context of citizen involvement in decision making.

The department is a member of the Association of Collegiate Schools of Planning. The curriculum is accredited by the Planning Accreditation Board of the American Institute of Certified Planners. Our students gain an education that, when combined with experience, supports eligibility for membership in the American Institute of Certified Planners.

The department administers two undergraduate minors: Urban Studies and Geographic Information Science (GIS). The department cooperates in the undergraduate minors in Design Studies, Digital Media, Critical Studies in Design, Environmental Studies, and Sustainability.

Student Learning Outcomes

We educate students to be *critical thinkers and engaged global citizens who have the ability to contribute to a better world*. Graduates of the Community and Regional Planning program at Iowa State University will be skilled in understanding and articulating community problems and issues and be able to apply planning knowledge in a diverse and democratic setting, to the standards of conduct outlined by the American Institute of Certified Planners.

Graduates of the program will:

- Demonstrate essential knowledge of the purpose and history of planning;
- Demonstrate knowledge of planning ethics, equity and social justice and be capable of making sound ethical judgments;
- Demonstrate knowledge of planning law and local government institutions regarding how plans and policies are developed and implemented;
- Be knowledgeable about the planning process; understand how social, cultural and economic forces influence land use changes; be able to develop alternative scenarios for the future; and have experience applying these ideas through active learning and real life experiences;
- Have a working knowledge of both qualitative and quantitative methods and demonstrate their ability to apply these methods in order to analyze a planning problem or situation;

- Engage communities, identify a range of tools that can be applied to different situations, and demonstrate their ability to expand participation, ensure inclusion, and give voice to diverse stakeholders;
- Demonstrate professional written, oral and visual communication skills within a variety of educational and community settings;
- Be knowledgeable about the natural environment and understand the factors that create sustainable and resilient communities;
- Be knowledgeable about diverse ideas, cultures and societies; and
- Have a basic knowledge about global issues that affect planning, urbanization, and societies.

Degree Requirements

The Department of Community and Regional Planning administers the 128-credit-hour undergraduate program leading to the Bachelor of Science. Students have the opportunity to work with their faculty advisors to define their own areas of interest, which may include a minor.

The B.S. in Community and Regional Planning program can be completed in two to four years. Students can declare a major in CRP at any time during their enrollment at Iowa State University. If applying by transfer from another program or institution, admission is based on the student's cumulative GPA and a departmental review of course work. Transfer applications from students in programs in anthropology, sociology, political science, history, geography, engineering, and other related disciplines are encouraged. Community and Regional Planning emphasizes responsibility and citizenship, writing and analytical ability, and critical thinking.

Total Degree Requirement: 128 credits

Only 65 credits from a two-year institution may apply which may include up to 16 technical credits; 9 P-NP credits of free electives; 2.00 minimum GPA; completion of all requirements listed below.

International Perspective: 3 credits

U.S. Cultures and Communities: 3 credits

Communication: 13 credits

(C or better grade in ENGL 1500 and ENGL 2500)

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
ENGL 3090	Proposal and Report Writing	3
or ENGL 3140	Technical Communication	
SPCM 2120	Fundamentals of Public Speaking	3
LIB 1600	Introduction to College Level Research	1
Total Credits		13

Humanities: 9 credits; 6 credits 3000-level or above

PHIL 2010	Introduction to Philosophy	3
or PHIL 2060	Introduction to Logic and Scientific Reasoning	

or PHIL 2300 Moral Theory and Practice

Six credits from program curriculum sheet	6
Total Credits	9

Social Sciences: 18 credits 3000-level or above

ECON 1010	Principles of Microeconomics	3
or ECON 1020	Principles of Macroeconomics	
POLS 1110	Introduction to American Government	3
SOC 1340	Introduction to Sociology	3
Nine credits from program curriculum sheet.		9
Total Credits		18

Math/Physics/Biol. Sciences: 13 credits

STAT 1010 Principles of Statistics, 6 credits in Natural Sciences, 3 credits in Math

Design Core: 3 credits

DSNS 1020	Design Studio I	3-4
or DSNS 1830	Design in Context	
Total Credits		3-4

Community and Regional Planning Core: 28 credits

CRP 2010	The North American Metropolis	3
CRP 2930	Environmental Planning	3
CRP 3010	Urban Analytical Methods	4
CRP 3020	Plan Analysis and the Development Process	3
CRP 3830	Theory of the Planning Process	3
CRP 3910	Field Travel	1
CRP 4320	Community Planning Studio	6
CRP 4920	Planning Law, Administration and Implementation	3
CRP 3310	Professional Practice Seminar	2
Total Credits		28

Planning Elective: 24 credits

24 credits from:

CRP 2510	Fundamentals of Geographic Information Systems	3
CRP 2910	World Cities and Globalization	3
CRP 3200	Urban Geography	3
CRP 3250	Introduction to Housing	3
CRP 3510	Geospatial Analysis and Visualization	3
CRP 3760	Rural, Urban and Regional Economics	3
CRP 4160	Urban Design and Practice	6
CRP 4170	Urban Revitalization	3
CRP 4210	Financing Historic Preservation Projects	3
CRP 4290	Planning in Developing Countries	3
CRP 4350	Planning in Small Towns	3

CRP 4360	Community Economic Development	3
CRP 4370	Public Participation in Planning	3
CRP 4420	Site Development	3
CRP 4450	Transportation Policy and Planning	3
CRP 4490	Geodesign: Planning for Sustainable Futures	3
CRP 4520	Geographic Data Management and Planning Analysis	3
CRP 4570	Geogames for Civic Engagement	3
CRP 4600	Social Justice and Planning	3
CRP 4710	Real Estate Development	3
CRP 4790	Public Finance and Planning	3
CRP 4840	Sustainable Communities	3
CRP 4910	Environmental Law and Planning	3
CRP 4940	Senior Seminar in Planning	3
CRP 5110	Documenting the Historic Built Environment	3-4
CRP 5210	Historic Preservation Planning: Theory and Practice	3

General Electives: 20 credits

20 credits of general electives from program curriculum sheet

Community and Regional Planning, B.S.

First Year

Fall	Credits Spring	Credits
DSNS 1020 or 1830	3-4 Math/Science	3
ENGL 1500	3 SPCM 2120	3
ECON 1010 or 1020	3 PHIL 2010, 2060, or 2300	3
SOC 1340	3 Natural Sciences	3
Elective	3 Elective	3
LIB 1600	1	
	16-17	15

Second Year

Fall	Credits Spring	Credits
CRP 2930	3 CRP 3010	4
CRP 2010	3 CRP 3910	1-2
STAT 1010	4 Soc. Science/Humanities Elective	6
ENGL 2500	3 Humanities Elective	3
POLS 1110	3 Elective	3
	16	17-18

Third Year

Fall	Credits Spring	Credits
CRP 3020	3 CRP 4920	3
CRP 3830	3 Planning Elective	6

ENGL 3090 or 3140	3 Soc. Science/Humanities Elective	3
Soc. Science/Humanities Elective	3 CRP 3310	2
Elective	3 CRP 3910	1
	15	15

Fourth Year

Fall	Credits Spring	Credits
CRP 4320	6 Planning Elective or Option Studio	6
Planning Elective	3 Planning Elective	3
3000-4000 Elective	3 Planning Elective	3
3000-4000 Elective	3 Planning Elective	3
	3000-4000 Elective	3
	15	18

Undergraduate Minors

The Department of Community and Regional Planning offers 15-credit minors in Urban Studies and Geographic Information Science (GISC).

Urban Studies

The Urban Studies minor is earned by completing both CRP 2010 (The North American Metropolis) and CRP 2910 (World Cities and Globalization), plus 9 additional credit hours from the approved list of courses. At least 6 credit hours must be in courses numbered 3000 or above at Iowa State. The College of Design requires students to earn a C or higher in at least 6 of the required 3000-level credits. The minor must include at least 3 credits that are not used to meet any other department, college or university requirement except the credit requirement for graduation. The Urban Studies minor is open to students from any college and any major.

Introduction to Urban Studies: 6 credits

CRP 2010	The North American Metropolis	3
CRP 2910	World Cities and Globalization	3

Advanced Urban Studies: 9 credits

ARCH 2210	Histories and Theories of Architecture to 1750	3
ARCH 3210	History of the American City	3
ARCH 4200	Topics in American Architecture	3
ARCH 4290	Topics in Italian Architecture	3
ARCH 5750	Contemporary Urban Design Theory	3
CE 4510	Urban Transportation Planning Models	3
CLST 2750	The Ancient City	3
CRP 2510	Fundamentals of Geographic Information Systems	3
CRP 2930	Environmental Planning	3
CRP 3010	Urban Analytical Methods	4

CRP 3200	Urban Geography	3
CRP 3250	Introduction to Housing	3
CRP 3510	Geospatial Analysis and Visualization	3
CRP 3760	Rural, Urban and Regional Economics	3
or ECON 3760	Rural, Urban and Regional Economics	
CRP 3830	Theory of the Planning Process	3
CRP 4170	Urban Revitalization	3
CRP 4210	Financing Historic Preservation Projects	3
CRP 4290	Planning in Developing Countries	3
CRP 4490	Geodesign: Planning for Sustainable Futures	3
CRP 4570	Geogames for Civic Engagement	3
CRP 4600	Social Justice and Planning	3
CRP 4710	Real Estate Development	3
CRP 4790	Public Finance and Planning	3
CRP 4840	Sustainable Communities	3
CRP 4920	Planning Law, Administration and Implementation	3
CRP 5730	Contemporary Issues in Global Housing	3
HIST 4290	Monstrous London: London's Histories 1500-1800	3-4
HIST 4650	The American West	3
LA 2740	The Social and Behavioral Landscape	3
LA 3710	History of Modern Landscapes, 1750 to Present	3
LA 3730	Gardens and Landscapes from Antiquity to 1750	3
POLS 2710	Public Organizations and Leadership	3
POLS 3100	State and Local Government	3
POLS 3340	Politics and Society	3
POLS 4800	Ethics and Public Policy	3
SOC 3100	Community	3
SOC 3310	Social Class and Inequality	3
SOC 3320	The Latino/Latina Experience in U.S. Society	3
URBD 5210	Foundations of Urban Design	3
URBD 5220	Contemporary Urban Design Practices	3

Geographic Information Science

The Geographic Information Science (GIS) minor is earned by taking CRP 2510, plus 12 additional credits from the approved list of courses. At least 9 credit hours must be in courses numbered 2000 or above at Iowa State, of which at least 6 credits are in courses numbered 3000 or above. The College of Design requires students to earn a C or higher in at least 6 of the required 3000-level credits. The minor must include at least 3 credits that are not used in any other department, college or university requirement except the credit requirement for graduation. The GIS minor is open to students in any college and any major.

INTROduction: 3 credits

CRP 5210	Historic Preservation Planning: Theory and Practice	3

GIS Tools and Techniques: 3 credits

CRP 3510	Geospatial Analysis and Visualization	3
LA 3020	Ecological Design	6
ENSCI 2700	Geospatial Technologies	3
GEOL 4520	Intro GIS for Geoscientists	3
NREM 3450	Natural Resource Photogrammetry and Geographic Information Systems	3

GIS Applications: 9 credits

ABE 4370	Watershed Modeling and Policy	3
CRP 4490	Geodesign: Planning for Sustainable Futures	3
or CRP 5490	Geodesign: Planning for Sustainable Futures	
CRP 4520	Geographic Data Management and Planning Analysis	3
CRP 4540	Fundamentals of Remote Sensing and Spatial Analysis	3
CRP 4550	Smart and Sustainable Cities	3
CRP 4560	GIS Programming and Automation	3
CRP 4570	Geogames for Civic Engagement	3
or CRP 5570	Geogames for Civic Engagement	
CRP 5580	Web Mapping and Spatial Data Visualization	3
GEOL 4680	Applied Geostatistics for Geoscientists	3
GEOL 4880	Raster GIS for Geoscientists	3
GEOL 4890	Survey of Remote Sensing Technologies	3
NREM 4460	Integrating GPS and GIS for Natural Resource Management	3

Graduate Programs

The Department of Community and Regional Planning (CRP) offers three different graduate degree options for individuals interested in engaging with communities and helping to shape their future: a Master of Community and Regional Planning (MCRP), an interdisciplinary Master of Science with an emphasis in Community Development (CDEV), and a Master of Real Estate Development (MRED).

Master of Community and Regional Planning

The primary focus of the MCRP degree is to prepare students with the education and practical skills to be leaders in the practice of planning. The program of graduate study is accredited by the Planning Accreditation Board of the American Institute of Certified Planners. The program is STEM-designated.

Degree requirements include completion of a 2-year, 49-credit program, including a required core (25 credits), electives (18-21 credits), and a

capstone component consisting of either a comprehensive exam (CRP 5980 Comprehensive Exam Preparation, 3 credits) or thesis (CRP 6990 Research, 6 credits). The required core consists of CRP 5010, 5320, 5610, 5630, 5640, 5660, 5680 and 5920. Students select electives in consultation with their Program of Study Committee (POSC). Students are encouraged to complete an internship in a planning office during their course of study.

CRP 5010	The Practice of Planning	1
CRP 5320	Community Planning Studio	6
CRP 5610	Planning Theory	3
CRP 5630	Planning the American Metropolis	3
CRP 5640	Introduction to Analytical Methods for Planning	3
CRP 5660	Policy Analysis and Planning	3
CRP 5680	Planning and Development	3
CRP 5920	Land Use and Development Regulation Law	3

Admission to the MCRP program is by application to the department and to the Graduate College. Students with a bachelor's degree in planning or students who have taken highly relevant coursework may be able to waive up to 9 credits of course requirements. Students must petition the department's Director of Graduate Education (DOGE) in writing prior to the first day class of the student's first semester in the program to have credits waived. No foreign language is required for the degree Master of Community and Regional Planning.

Double Degree Programs

Double degree programs are offered with architecture (MCRP/MArch), business administration (MCRP/MBA), landscape architecture (MCRP/MLA) and sustainable agriculture (MCRP/MS). Information about our programs and how to apply can be obtained from the department's web page at: <https://www.design.iastate.edu/academics/departments/crp/> or send an email to crp@iastate.edu.

Master of Community Development

The Master of Community Development (MCD) program is an online degree designed to educate students to become community developers and civic leaders who could bring about positive community change. Graduates of the Community Development program at Iowa State University will be skilled in understanding and articulating community problems, issues, and opportunities. Students will have the knowledge and skills to plan and facilitate community action. The MCD degree is designed for working professionals and nontraditional students through online learning. Degree requirements included completion of a 2-year, 30-credit program including a required core (15 credits) and electives (15 credits). The required core includes a capstone 3-credit practicum (COMDV 5300) and COMDV 5020, COMDV 5030, COMDV 5040, and COMDV 5050.

COMDV 5020	Theories and Constructs of Community Change	3
COMDV 5030	Community Development Methods	3
COMDV 5040	Creating Community Change	3
COMDV 5050	Analysis of the Community Economy	3
COMDV 5300	Community Development Practicum	3

Admission to the MCD program is through the Department of Community and Regional Planning and the Graduate College. A bachelor's degree from an accredited institution of higher education is required. Up to nine credits of course requirements may be waived with relevant coursework. Students may petition the program's Director of Graduate Education (DOGE) in writing prior to the first day of class in the student's first semester in the program to have credits waived. Further information on the MCD program can be found on the department's web site at: <https://www.design.iastate.edu/community-and-regional-planning/degrees/master-of-community-development/>. (<https://www.design.iastate.edu/community-and-regional-planning/degrees/master-of-community-development/>)

Master of Real Estate Development

In partnership with the Department of Finance in the College of Business, CRP offers a two-year, 33-credit Master of Real Estate Development (MRED) degree. The program is designed for working professionals, with coursework delivered in a blended online/on-campus format. During the academic year, students can complete coursework remotely and come to campus for three, one-week intensive workshops throughout the two-year degree. More information on the MRED program is available on the program website: <https://www.ivybusiness.iastate.edu/academics/graduate-programs/master-of-real-estate-development/>.

Graduate Certificates

The Certificate in Preservation and Cultural Heritage (P+CH) is a multidisciplinary graduate program that provides the practical skills and background needed to succeed in the fields of historic preservation and cultural resource management. The certificate program is open to Iowa State University graduate students in any College of Design major as well as those majoring in history, anthropology, and related disciplines. Interested students should visit <https://www.design.iastate.edu/academics/graduate-programs/preservation-and-cultural-heritage-certificate/> or contact historicplaces@iastate.edu for guidance.

The department also offers a 13-credit graduate certificate in Geographic Information Systems (GIS) in spatial analysis, GIS applications, and program management. The program is open to graduate students in all disciplines of the university. Information about the graduate certificate may be obtained from the department office and from the department's web page at: <https://www.design.iastate.edu/academics/graduate-programs/geographic-information-systems-certificate/>.

Design Studies

Interdepartmental Undergraduate Program

<http://www.design.iastate.edu>

The Design Studies programs bring together courses that deal with the integrated study of the conceptualization, production, visible form, uses, and history of artifacts, buildings, and environments as well as the common qualities and connections among the design, art and planning fields.

Design Core Program

Design Core Program: 12 cr.

DSNS 1020	Design Studio I	4
DSNS 1150	Design Collaborative Seminar	1
or DSNS 1100	Design Exchange Seminar I	
DSNS 1310	Drawing I	4
DSNS 1830	Design in Context	3
Total Credits		12

Undergraduate Minors

Minor - Critical Studies in Design

The undergraduate minor in Critical Studies in Design offers students opportunities to engage the history, theory and criticism of visual and material culture. In lectures and focused seminars, students explore historical and contemporary issues, including cultural production, the built environment, media and technology, design in everyday life, and models of professional practice. The minor is open to all undergraduates at Iowa State University.

Minor - Design Studies

The undergraduate minor in Design Studies is constructed to facilitate design awareness among interested students and to provide a vehicle for multi-disciplinary study within the College of Design. This minor is open to all undergraduate students at Iowa State University.

Minor - Digital Media

The undergraduate minor in Digital Media covers the knowledge and techniques for applying digital representations to generate designs and art. The body of knowledge specializes in the fields of design, art and planning. This minor is open to all undergraduate students at Iowa State University.

Minor - Geographic Information Science (GIS)

The undergraduate minor in Geographic Information Science (GIS) is an interdisciplinary program that provides students with opportunities to engage the theory, processes, techniques and tools that use spatial data and computational technology to create cutting-edge analysis and

mapping approaches for a wide range of fields, such as urban planning, architecture, landscape architecture, design, community development, agriculture, environmental sciences, natural resources, sociology, criminology, anthropology, political science, environmental studies and others. The minor is open to undergraduates in all university majors with a minimum overall GPA of 2.0 prior to enrolling.

Minor - Illustration

The undergraduate minor in Illustration is ideal for students interested in illustration for books, graphic novels, magazine articles, advertising and concept art for game design and film. This minor provides the ability to tailor a curriculum that serves these varied career interests, whether you want to work in the industry or freelance as an independent studio practitioner.

Minor - Preservation and Cultural Heritage

The undergraduate minor in Preservation and Cultural Heritage provides students with knowledge, skills, and credentials that complement undergraduate degrees in a wide variety of majors, but especially Architecture, Interior Design, Community & Regional Planning, Landscape Architecture, and History. To these ends, the Minor has two major curricular objectives:

- Provide students with a holistic understanding of historic preservation that draws from the various departments involved, yet allows for the development of expertise within a student's specific major.
- Provide a curriculum that conforms with the National Council for Preservation Education's pedagogical guidelines and the Federal government's Professional Qualification Standards for historic preservation under 36 Code of Federal Regulations (CFR) Part 61.

The Minor requires a minimum of 15 credit hours. At least six (6) credits need to be taken at the 3000 or above, and at least 9 of the 15 credits must not be used to meet any other department, college, or university requirement except the credit requirement for graduation.

Minor - Textile Design

The undergraduate minor in Textile Design allows students to focus specifically on the design and creation of textiles — a practice with applications in the fine arts, fashion and related fields. Open to undergraduates at the sophomore level and above enrolled in any College of Design major or in the Apparel, Merchandising and Design major in the College of Human Sciences.

Minor - Urban Studies

The undergraduate minor in Urban Studies is an interdisciplinary program that emphasizes urban life in a variety of settings and from different disciplinary and methodological approaches. The Urban Studies minor will allow students to explore varied and multiple dimensions of urban and community life through differing conceptual and analytical

frameworks. The minor is open to undergraduates in all university majors except Community & Regional Planning.

Additional information about minors is available in the Student Programs and Services Office, 297 College of Design.

Game Design

Overview

The Bachelor of Science in Game Design offers dynamic and multidisciplinary education in game design and development. The program is based on the principle that successful games are crafted through a blend of imaginative storytelling, cutting-edge technology, and artistic vision. The blend of skills in these areas culminates in engaging interactive digital and analog experiences that have the power to entertain, educate, and inspire.

Students in the Game Design major (GDM) study general game design principles, broad skills across the many disciplines of game design, and specialize in one focus area of interest that best suits their passions and career interests. These three areas are: Game Art, Game Computing, and Game Worlds. The focus areas reflect the major sub-disciplines within game design and allow students to develop mastery in one possible career path. Students across these focus areas share core courses that cover game design thinking, career development, game analysis, prototyping, and a capstone project studio in their final year, which they dedicate to producing a collaborative capstone project. Throughout their coursework, students gain individual and multidisciplinary team-based experience in iterative design individually and in multidisciplinary teams. Graduates leave with a portfolio of skills and games that prepare them for a range of careers in the game industry and adjacent allied fields.

The GDM brings together the artistry of game design elements, the mechanics of gameplay, and the technology of creation. A Bachelor of Science in Game Design is brought together, and Iowa State University provides the tools and knowledge you need to turn your creativity into reality.

Student Learning Outcomes

After successfully completing the Game Design major, students will be able to:

1. Understand principles of game design thinking, including genre, formal elements, dramatic elements, and system dynamics
2. Explain how human and social contexts shape game development and the impact of games
3. Employ appropriate technology, including hardware and software, for game development
4. Communicate and plan effectively within multidisciplinary teams
5. Evaluate user experience in games through play-testing and implement the lessons learned

6. Develop, critique, and analyze game prototypes using methods of game design thinking

7. Create, iterate, and publish finished games as part of a capstone portfolio

Grade Point Requirement

All students majoring in Game Design are required to earn a C- or better in all courses applied toward the degree, including transfer credits.

Game Design Focus Area

Game Design majors must choose at least one Game Design Focus Area. The options are Game Art, Game Computing, or Game Worlds.

Focus Area Description

Game Art will prepare students to solve visual problems in gaming. They will gain skills in drawing, visual design and storytelling, storyboarding, character animation, 3D modeling, and related fields. They will learn how to utilize this knowledge in the game development process.

Game Computing will provide comprehensive knowledge in programming, coding, and creating online digital games as well as skills used in the creation of analog games. Students will gain a profound education in object-oriented programming, data structures, and discrete computational structures which they will be able to apply in game design and development.

Game Worlds will provide students with the skills and knowledge to create meaningful and engaging worlds for games of every scale, understand and design dynamic stories, and comprehend the cultural relevance of the games they play, study, and develop. Within Game Worlds, courses are subdivided into Game Worlds, Narrative Design, and Society. This focus area will support students' acquisition of the skills to apply cultural lessons to the writing and narrative design of games.

Courses in each Focus Area belong to one of four subcategories:

- *Focus Required*
- *Focus Option*
- *Interdisciplinary Option*
- *Game Exploration*

Focus Required courses pertain to the focus area's core competencies.

Focus Option courses allow students to follow their specific career and personal interests within the Focus Area. *Interdisciplinary Option* courses require you to take courses in a Focus Area other than your own. *Game Exploration* courses allow discovery in the broader discipline.

Focus Required and Focus Option

Focus Required and Focus Option courses are discipline specific courses necessary to develop the skills and knowledge within that Focus Area. Student study in a Focus Area develops individual skills that students

will then bring to team-based, interdisciplinary Game Design projects and professional settings. The Game Design Curriculum sheet has clearly defined prerequisites not listed here for each Focus Area.

Degree Requirements

The Bachelor of Science in Game Design is a four-year program that consists of 121 credits: 40 credits of General Education, 65-66 credits in Game Design courses (required and elective courses related to a focus area), and 14-15 credits in General Electives.

Information on admission criteria, including allowable credits for transfer students, is announced yearly on the College of Design website.

Game Design Focus Areas

Game Design majors must choose a Focus Area: Game Art, Game Computing, or Game Worlds. All focus area study plans include a common core of required Game Design courses as well as required courses and electives that are specific to the focus area.

Game Art will prepare students to solve visual problems in gaming and will learn how to utilize this knowledge in the game development process. Students will gain skills in drawing, visual design and storytelling, storyboarding, character animation, 3D modeling, and related fields.

Game Computing will provide comprehensive knowledge in programming, coding, and creating online digital games. Students will focus on object-oriented programming, data structures, and discrete computational structures which they will be able to apply in game design and development.

Game Worlds will provide students with the skills and knowledge to create meaningful and engaging worlds for games of every scale, understand and design dynamic stories, and comprehend the cultural relevance of the games they play, study, and develop. Within Game Worlds, courses are subdivided into Game Worlds, Narrative Design, and Society. This focus area will support students’ acquisition of the skills to apply cultural lessons to the writing and narrative design of games.

General Education Requirements - All Focus Areas (40 credits)

University Requirements	6
International Perspectives	
U.S. Cultures and Communities	
Communications	10
ENGL 1500	Critical Thinking and Communication
ENGL 2500	Written, Oral, Visual, and Electronic Composition
LIB 1600	Introduction to College Level Research
Select one from the following:	
COMST 1010	Introduction to Communication Studies

COMST 2110	Interpersonal Communication
SPCM 1100	Listening
SPCM 2120	Fundamentals of Public Speaking
Humanities*	6
Social Sciences*	6
Math, Physical and Biological Sciences*	6
Additional General Education (3000-4000)*	6
Total Credits	40

*See approved list of courses on Curriculum Sheet

Game Art Focus Area

Game Art Required		
COMS 1270	Introduction to Computer Programming	3
DSNS 1310	Drawing I	4
ART 2300	Drawing II	3
GAME 2020	Game Design Fundamentals	3
GAME 2030	Introduction to Game Engines	3
ART 2120	Studio Fundamentals: Digital Media	3
GAME 2100	Game Career Development	2
GAME 2110	Game Play and Analysis	3
GAME 3010	Game Design Workshop	3
GAME 4010	Game Design Capstone	6
Select one from the following:		3
GAME 2720	Game Design and History	
GAME 2730	Game Design and Cultures	
Game Art Electives - Choose 18 credits from the following:		18
ART 3080	Computer Modeling, Rendering and Virtual Photography	
ART 4060	Introduction to 3D Organic Modeling in ZBrush	
ART 4070	Principles of Character Animation	
ART 3230	Scientific Illustration Principles and Techniques	
ART 3260	Digital Rendering	
ART 3270	Illustration as Communication	
ART 4080	Principles of 3D Animation	
ARTGR 4840	Selected Studies in Graphic Design	
ART 4310	Character and Scene Design	
ART 4320	Sequential Narrative Drawing	
ARTGR 4630	3D Motion Graphics	
ART 4700	Data, Code, and Form	
ART 4730	Video Art	
Game Design Exploratory Electives - 12 credits from other Focus Areas		12
Choose 3 credits from Game Computing Courses		

Choose 3 credits from Game Worlds Courses

Choose 6 credits from Game Art, Game Computing, and/or Game Worlds Courses

General University Electives 15

Total Credits 81

Game Computing Focus Area

Game Computing Required

COMS 1270 Introduction to Computer Programming 3

DSNS 1310 Drawing I 4

GAME 2020 Game Design Fundamentals 3

GAME 2030 Introduction to Game Engines 3

GAME 2040 Programming for Game Engines 3

ART 2120 Studio Fundamentals: Digital Media 3

GAME 2100 Game Career Development 2

GAME 2110 Game Play and Analysis 3

Select one from the following: 3

HIST 2720 Game Design and History

GAME 2730 Game Design and Cultures

GAME 3010 Game Design Workshop 3

GAME 4010 Game Design Capstone 6

COMS 2270 Object-oriented Programming 4

COMS 2280 Introduction to Data Structures 3

COMS 2300 Discrete Computational Structures 3

COMS 3110 Introduction to the Design and Analysis of Algorithms 3

COMS 3270 Advanced Programming Techniques 3

COMS 3360 Introduction to Computer Graphics 3

COMS 4370 Computer Game and Media Programming 3

Game Computing Electives - Choose 3 credits from the following 3

CYBE 2310 Cyber Security Concepts and Tools

CRP 3010 Urban Analytical Methods

CRP 4560 GIS Programming and Automation

EDUC 3020 Principles and Practices of Learning with Technology

SE 3090 Software Development Practices

SE 3170 Introduction to Software Testing

SE 3190 Construction of User Interfaces

SE 3390 Software Architecture and Design

SE 4210 Software Analysis and Verification for Safety and Security

Game Design Exploratory Electives - 6 credits from other Focus Areas 6

Choose 6 credits from Game Art or Game Worlds

General University Electives 14

Total Credits 81

Game Worlds Focus Area

Game Worlds Required

COMS 1270 Introduction to Computer Programming 3

DSNS 1310 Drawing I 4

GAME 2020 Game Design Fundamentals 3

GAME 2030 Introduction to Game Engines 3

ART 2120 Studio Fundamentals: Digital Media 3

GAME 2100 Game Career Development 2

GAME 2110 Game Play and Analysis 3

Select one from the following: 3

HIST 2720 Game Design and History

GAME 2730 Game Design and Cultures

GAME 3010 Game Design Workshop 3

GAME 4010 Game Design Capstone 6

Select one from the following: 3

ENGL 3040 Creative Writing: Fiction

ENGL 3150 Creative Writing: Screenplays

ENGL 3160 Creative Writing: Playwriting

Choose 3 credits from the following (World Building): 3

ANTHR 2300 Globalization and the Human Condition

HIST 2840 Wonders of the World, Global History of Innovation

POLS 1250 Democracy and Dictatorship: Introduction to Comparative Politics

RELIG 2050 World Religions

CRP 2010 The North American Metropolis

Choose 3 credits from the following (Narrative Design): 3

CLST 2730 Greek and Roman Mythology

ENGL 2750 Analysis of Popular Culture Texts

PHIL 3630 Metaphysics in Science Fiction and Popular Culture

Choose 3 credits from the following (Society): 3

ARTH 2800 History of Art I

ARTH 2810 History of Art II

HIST 2710 The History of Sports in the United States

RELIG 2150 Religion and Popular Culture

PHIL 2300 Moral Theory and Practice

CRP 2910 World Cities and Globalization

Choose 3 credits from the following (Open Topics): 3

AMIN 3220	Peoples and Cultures of Native North America	
ARTH 3950	Art and Theory Since 1945	
CRP 3200	Urban Geography	
ENGL 3150	Creative Writing: Screenplays	
ENGL 3300	Science Fiction	
HIST 3040	Cultural Heritage of the Ancient World	
HIST 3640	The Mythic Wild West	
PHIL 3640	Metaphysics: God, Minds, and Matter	
POLS 3080	Video Games and Politics	
POLS 3340	Politics and Society	
Choose 6 credits from the following (Open Topics):		6
AFAM 3300	Ethnic and Race Relations	
ENGL 3040	Creative Writing: Fiction	
ENGL 3020	Business Communication	
ENGL 3130	Rhetorical Website Design	
ENGL 3160	Creative Writing: Playwriting	
ARTH 4940	Women/Gender in Art	
HIST 4880	American Stuff, Colonial Times to the Present	
PHIL 3430	Philosophy of Technology	
PSYCH 3860	Media Psychology	
WGS 4300	Gender and Consumer Culture	
Game Design Exploratory Electives - 12 credits from other Focus Areas		12
Choose 3 credits from Game Computing		
Choose 3 credits from Game Art		
Choose 6 credits from Game Art, Game Computing, and/or Game Worlds Courses		
General University Electives		15
Total Credits		81

Four Year Plans

Game Art Focus Area

* Indicates prerequisite for future course not covered by core courses
May be skipped with satisfactory placement exam score

First Year		
Fall	Credits Spring	Credits
DSNS 1310	4 COMS 1270	3
GAME 2020	3 ART 2120	3
MATH 1400 (#* [or Gen Ed])	3 GAME 2030	3
ENGL 1500 (# [or Gen Ed])	3 MATH 1430 (#* [or Gen Ed])	4
GAME 2720	3 General Education/Elective	3
	16	16

Second Year		
Fall	Credits Spring	Credits
GAME 2100	2 GAME 2110	3
ART 2300	3 Game Art Elective	3
Game Design Exploratory Elective	3 Game Art Elective	3
General Education/Elective	3 Game Design Exploratory Elective	3
ENGL 2500	3 General Education/Elective	3
LIB 1600	1	
	15	15
Third Year		
Fall	Credits Spring	Credits
GAME 3010	3 Game Art Elective	3
Game Art Elective	3 Game Design Exploratory Elective	3
Game Art Elective	3 General Education/Elective	3
General Education/Elective	3 General Education/Elective	3
General Education/Elective	3 General Education/Elective	3
	15	15
Fourth Year		
Fall	Credits Spring	Credits
GAME 4010	6 Game Art Elective	3
Game Design Exploratory Elective	3 Game Art Elective/Gen Ed/Elective	3
Game Art Elective/Gen Ed/Elective	3 Game Art Elective/Gen Ed/Elective	3
General Education/Elective	3 General Education/Elective	3
	General Education	2
	15	14
Total Credits: 121		

Game Computing Focus Area

First Year		
Fall	Credits Spring	Credits
DSNS 1310	4 COMS 1270	3
GAME 2020	3 ART 2120	3
ENGL 1500 (# [or Gen Ed])	3 GAME 2030	3
MATH 1400 (#* [or Gen Ed])	3 MATH 1430 (#* [or Gen Ed])	4
GAME 2720	3 General Education/Elective	3
	16	16

Second Year

Fall	Credits Spring	Credits
GAME 2100	2 GAME 2110	3
GAME 2040	3 COMS 2280	3
COMS 2270	4 COMS 2300	3
ENGL 2500 (or Gen Ed)	3 MATH 1660 (** [or Gen Ed])	4
LIB 1600	1 Game Design Exploratory Elective	3
MATH 1650 (** [or Gen Ed])	4	
	17	16

Third Year

Fall	Credits Spring	Credits
GAME 3010	3 COMS 3360	3
COMS 3110	3 Game Design Exploratory Elective	3
COMS 3270	3 General Education/Elective	3
MATH 2070, MATH 2650, or MATH 3170	3-4 General Education/Elective	3
General Education	2-3 General Education/Elective	3
	14-16	15

Fourth Year

Fall	Credits Spring	Credits
GAME 4010	6 COMS 4370	3
Game Computing Elective	3 Game Computing Elective/Gen Ed/Elective	3
Game Computing/Gen Ed/Elective	3 Game Computing Elective/Gen Ed/Elective	3
General Education/Elective	3 Game Computing Elective/Gen Ed/Elective	3
	15	12

Total Credits: 121-123**Game Worlds Focus Area****First Year**

Fall	Credits Spring	Credits
DSNS 1310	4 COMS 1270	3
GAME 2020	3 ART 2120	3
ENGL 1500 (** [or Gen Ed])	3 GAME 2030	3
MATH 1400 (** [or Gen Ed])	3 MATH 1430 (** [or Gen Ed])	4
GAME 2720	3 ENGL 2500	3
	LIB 1600	1
	16	17

Second Year

Fall	Credits Spring	Credits
GAME 2100	2 GAME 2110	3
Game Worlds Required	3 Game Worlds Elective (Narrative)	3
Game Worlds Elective (Worlds)	3 Game Worlds Elective (Society)	3
General Education/Elective	3 Game Design Exploratory Elective	3
General Education/Elective	3 General Education/Elective	3
	14	15

Third Year

Fall	Credits Spring	Credits
GAME 3010	3 Game Worlds Elective (Open)	3
Game Design Exploratory Elective	3 Game Design Exploratory Elective	3
Game Worlds Elective (Open)	3 General Education/Elective	3
General Education/Elective	3 General Education/Elective	3
General Education/Elective	3 General Education/Elective	3
	15	15

Fourth Year

Fall	Credits Spring	Credits
GAME 4010	6 Game Worlds Elective	3
Game Design Exploratory Elective	3 Game Worlds Elective/Gen Ed/Elective	3
Game Worlds Elective/Gen Ed/Elective	3 Game Worlds Elective/Gen Ed/Elective	3
General Education/Elective	3 Game Worlds Elective/Gen Ed/Elective	3
	General Education/Elective	2
	15	14

Total Credits: 121

Graphic Design Overview

<http://www.design.iastate.edu/graphicdesign/index.php> (<http://www.design.iastate.edu/graphicdesign/>)

The Curriculum in Graphic Design leads to a 124-credit undergraduate Bachelor of Fine Arts in Graphic Design including the 31-credit Core Design Program.

Admission into the professional program depends upon available resources and is subject to the approval of a faculty committee at the completion of the Core Design Program. Information on admission criteria is posted each year on the College of Design website.

Transfer students with studio credits from other programs, colleges, and universities must present for departmental review a portfolio of work done in those courses in order to have the credits apply toward studio requirements. Students are required to present this portfolio upon admission and prior to registration for classes. Arrangements for this process must be made with department advisors.

A 30-graduate-credit program is offered leading to the Master of Arts with a specialization in Graphic Design for students planning to undertake a professional degree. (NOTE: Applicants without a degree background in graphic design may be required to complete up to 18 additional credits of coursework).

A 60-graduate-credit post-professional graduate program is also offered leading to the degree Master of Fine Arts.

Student Learning Outcomes

Students in this program will be able to:

- Use creative problem solving and design processes when faced with graphic design challenges.
- Employ visual organization skills in a variety of communication media.
- Understand applications of visual communication including animation, branding, image creation, information design, interaction design, symbology, typography, video, through contemporary and emerging technologies; and
- Integrate cultural, ethical, and historical considerations in preparation for professional practice.

Degree Requirements

Total Degree Requirement: 124 credits

Only 65 credits from a two-year institution may apply, which may include up to 16 technical credits; 9 P-NP credits of free electives; 2.00 minimum GPA.

International Perspective: 3 credits
U.S. Cultures and Communities: 3 credits
Communications: 10 credits

ENGL 1500	Critical Thinking and Communication *	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition *	3
LIB 1600	Introduction to College Level Research	1
One of the following:		3
COMST 1010	Introduction to Communication Studies	
COMST 2110	Interpersonal Communication	

SPCM 1100	Listening	
SPCM 2120	Fundamentals of Public Speaking	
Total Credits		10

* with a C or better

Humanities: 6 credits
6 credits from program curriculum sheet.

Social Sciences: 6 credits
6 credits from program curriculum sheet.

Math/Physics/Biol. Sciences: 6 credits		
COMS 1060	Introduction to Web Programming	3
3 credits from program curriculum sheet		3
Total Credits		6

General Education Courses: 12 credits
6 credits of course level 3000-4000 from program curriculum sheet;
Complete 6 credits from department curriculum sheet.

College of Design Core: 13 credits		
DSNS 1020	Design Studio I	4
DSNS 1150	Design Collaborative Seminar	1
	or DSNS 1100 Design Exchange Seminar I	
DSNS 1310	Drawing I	4
DSNS 1320	Digital Design Literacy	1
DSNS 1830	Design in Context	3
Total Credits		13

Art and Design History: 12 credits		
ARTH 2800	History of Art I	3
ARTH 2810	History of Art II	3
Six credits from program curriculum sheet		6
Total Credits		12

Studio Options: 6 credits
6 credits from ARTIS, ARTID, LA, ARCH, or another approved studio course.

Graphic Design: 52 credits		
ARTGR 2700	Graphic Design Studio I	3
ARTGR 2710	Graphic Design Studio II	3
ARTGR 2720	Digital Photography for Graphic Design	3
ARTGR 2730	Typography I	3
ARTGR 2740	Typography II	3
ARTGR 3770	Graphic Design Internship Seminar	1
ARTGR 3700	Graphic Design Studio III	3
ARTGR 3710	Graphic Design Studio IV	3

ARTGR 3870	Graphic Design History/Theory/ Criticism I	3
ARTGR 3720	Graphic Materials and Processes	3
ARTGR 4700	Graphic Design Studio V	3
ARTGR 4710	Graphic Design Capstone	3
ARTGR 4800	Graphic Design Internship	3
ARTGR 4890	Design Ethics	3
Twelve credit options from program curriculum sheet		12
Total Credits		52

Electives: 1 credits

Remaining electives sufficient to complete graduation requirements.

Graphic Design, B.F.A.

First Year

Fall	Credits	Spring	Credits
DSNS 1020 or 1310	4	DSNS 1020 or 1310	4
DSNS 1320	1	DSNS 1830 (or General Education)	3
DSNS 1830 (or General Education)	3	ENGL 1500 (or General Education)	3
DSNS 1100 or 1150	1	General Education	3
ENGL 1500 (or General Education)	3	General Education	3
General Education	3	LIB 1600	1
General Education	3		
18		17	

Second Year

Fall	Credits	Spring	Credits
ARTGR 2700	3	ARTGR 2710	3
ARTGR 2730	3	ARTGR 2740	3
ARTH 2800	3	ARTH 2810	3
ARTIS, ARTID, LA, or ARCH Studio or ARTGR 2720	3	ARTIS, ARTID, LA or ARCH studio or ARTGR 2720	3

ENGL 2500 (or Communication Study)	3	ENGL 2500 (or Communication Study)	3
15		15	

Third Year

Fall	Credits	Spring	Credits	Summer	Credits
ARTGR 3700	3	ARTGR 3710	3	ARTGR 4800 (or)	
ARTGR 3720	3	ARTGR Option	3	ARTGR 4950	3
ARTGR 3870	3	ART or DSN History, General Education, or Rome Prep	3	Students who elect to participate in the Rome Program need to take additional 3 elective credits to reach the 123.5 needed to graduate.	
ARTGR Option	3	DSNS 3010	1		
ARTIS, ARTID, LA, or ARCH Studio	3	Elective: ROME, Italian	1		
ARTGR 3770	1	General Education	3		
16		14		3	

Fourth Year

Fall	Credits	Spring	Credits
ARTGR 4700	3	ARTGR 4710	3
ARTGR Option	3	Elective	2-3
ART & DESIGN History or General Education	3	General Education	3

ARTIS, ARTID, LA or ARCH Studio or General Ed	3 General Education	3
ARTGR 4890	3 ARTGR Option	3
15		14-15

Admission into the BFA in Graphic Design Program depends upon available resources and is subject to the approval of a faculty committee at the completion of the Core Design Program. Information on the admission criteria is posted each year on the College of Design website.

Graduate Programs

The department offers the degrees of Master of Fine Arts (M.F.A.) in Graphic Design and Master of Arts (M.A.) in Experiential Graphic Design.

Credit earned at Iowa State University or other institution for the Master of Arts degree may be applied toward the Master of Fine Arts degree at the discretion of the program of study committee.

Applicants to the graduate program should have an undergraduate major in an art or design area and demonstrate the ability to do technically competent and original work through the presentation of a digital portfolio for faculty review. Past academic performance and the quality of studio work are critical in the admission process. A minimum 3.0 GPA in the student's undergraduate major is the standard for full admission to the graduate program. Admission is also determined by studio space available within the program area, which changes yearly due to graduate students' progress in their programs of study.

Graduate students who have not completed an undergraduate program of study substantially equivalent to that required of undergraduates in the department can expect that additional supporting coursework, determined by the graduate faculty, may be required.

Prospective students are advised to contact the graduate coordinator with specific questions about admission procedures and portfolio review. Application and additional program information may be obtained from the Department of Graphic Design, College of Design, Iowa State University, Ames, IA 50011-3092.

Master of Fine Arts in Graphic Design (M.F.A.)

The Master of Fine Arts in Graphic Design is recognized as the terminal degree in the field and requires a minimum of 60 credits. M.F.A. graduates in Graphic Design are skilled in communication design, problem solving, and are adept in the use of visual language, symbology, and interaction. Graduates are proficient in the design of communications and the use

of technologies that incorporate human interaction with environments, objects, and electronic and traditional publications. Students and faculty work collaboratively on a required thesis, integrating theory, creation, research, and design problem solving.

Master of Arts in Experiential Graphic Design (M.A.)

This 30-credit degree focuses on preparing students for visual communication. This degree provides a comprehensive exposure to all aspects of user experience, including but not exclusive to wayfinding, exhibition design, interaction, information design, and placemaking.

The MAXGD is for those seeking a graphic design specialization with little to no previous experience in the area. Students may use the degree as a complement to a bachelor's degree in graphic design or another design field to enhance their skills and qualifications for employment. It can also be used to complement those students with an undergraduate degree in a graphic design area that would like to add an additional graduate level study to their coursework prior to enter the field.

MFA in Graphic Design Degree Requirements Graphic Design Requirements, 27 cr.

ARTGR 5110	Graphic Design Graduate Studio I	3
ARTGR 5120	Audience and Perception	3
ARTGR 5210	Graphic Design Graduate Studio II	3
ARTGR 5220	Critical Media	3
ARTGR 5300	User Engagement	3
ARTGR 5400	Design for Behavioral Change	3
ARTGR 6100	Thesis Preparation Studio	3
ARTGR 6200	Graduate Thesis Studio I	3
ARTGR 6300	Graduate Thesis Studio II	3
Total Credits		27

Graphic Design Seminar Requirements, 10 cr.

ARTGR 5100	Graphic Design Theory	3
ARTGR 5200	Design & Cultural Semiotics	3
ARTGR 5310	Graphic Design Graduate Project Preparation	1
DSNS 5010	Introduction to Research Design	3
Total Credits		10

Elective Focus Area, 9 cr.

Outside of graphic design but supports area of research, may be studio (ex. DSNS 5460) or other class outside the College of Design: See Graphic Design M.F.A Suggested Minor Course List

May also include ISU Preparing Future Faculty (PFF): 3-11 cr.

Art History, Theory, Criticism, 12 cr.

Grad-level art/design history, theory, criticism courses in the College of Design 12

Total Credits 12

Thesis, 3-6 cr.

ARTGR 6990 Research-Thesis 3-6

Total 60 cr. minimum (not including any potential prerequisites)

Industrial Design

Overview

<http://www.design.iastate.edu/industrialdesign/index.php> (<http://www.design.iastate.edu/industrialdesign/>)

The vision of the Department of Industrial Design is to empower the next generation of designers to identify and solve small to large scale problems to devise systemic, forward-thinking solutions, mindful of societal needs and ecological repercussions, fostering health and well-being for people and the environment.

We do this by providing students with the necessary tools and experiences, spanning across the product development timeline from the front-end of problem finding through design research and synthesis, to discovery of meaningful design solutions that can range from products to services and systems. The industrial design program offers opportunities to collaborate with diverse disciplines on campus and beyond to tackle a wide variety of local and global design challenges.

Degree offerings include the Bachelor of Industrial Design (B.I.D.) and the Master of Industrial Design (M.I.D.).

Undergraduate Program Structure

Students in this program take a carefully defined sequence of courses developed to give them exposure and practice in the areas of theory and skill required by industrial design. These include design sketching and visualization, form development, history, creative thinking, engineering principles, research, design methodology, human factors, computer-aided design, manufacturing techniques, commercial factors, management, strategic design development, service design, and user experience design. In their third year, students select electives within and outside of the department, defining current issues in the profession. The upper-level studio classes are reserved for study abroad programs connecting students to the global design community, internships, and industry-sponsored projects with students from other departments and colleges. The curriculum aims to develop the ability to cope with diverse problem areas in industrial design, without restricting them to specific fields in design.

An industrial design degree from Iowa State prepares students for creative careers in private and corporate practice, with design consulting companies, in-house design departments, and product manufacturers.

Career choices with an industrial design degree include (but are not limited to):

Product designer, design researcher, automotive designer, softgoods designer, footwear & accessory designer, construction & agricultural equipment designer, furniture & lighting designer, interaction designer, service designer, exhibit designer, packaging designer, advertising & experience designer, UX designer and researcher.

Student Learning Outcomes

Upon completion of the industrial design program students will be able to:

1. Analyze and address critically the needs of ALL stakeholders involved in the design process and avoid biases, through emphasizing critical thinking, empathy, compassion, and reflective practices. (*DIVERSITY, EQUITY & INCLUSION*)
2. Navigate and apply varying design methods and techniques commonly used to identify and solve small to large scale problems creatively and methodically. (*CREATIVE DESIGN PROCESS*)
3. Develop comprehensive products, services and systems solutions through situation and circumstance appropriate touchpoints and platforms. (*PRODUCTS, SERVICES & SYSTEMS*)
4. Understand and evaluate ethical, societal, environmental, and cultural short and long-term consequences of design solutions for all people and the planet. (*SUSTAINABILITY & ETHICAL DESIGN - aka the designers' dilemma of unintended consequences*)
5. Communicate professionally and effectively with all stakeholders of the design process from peers and co-workers to clients and end users in both forms verbally and visually. (*COLLABORATION, COMMUNICATION & PROFESSIONALISM*)

Degree Requirements

The curriculum in Industrial Design leads to a 134-credit undergraduate Bachelor of Industrial Design including the first year Core Design Program.

Admission into the professional program depends upon available departmental resources. Updated information on admission criteria is announced yearly on the College of Design website.

Transfer students with studio credits from other programs, colleges, and universities must present a portfolio of work done in those courses, for departmental review, to have the credits apply toward studio. Students are required to present this portfolio upon admission and prior to

registration for classes. Arrangements for this process must be made with department advisors.

A 60-credit post-professional graduate program is also offered leading to the terminal degree Master of Industrial Design.

Total Degree Requirements: 134 credits

Only 65 credits from a two-year institution may apply, which may include up to 16 technical credits; 9 P-NP credits of free electives; 2.00 minimum GPA.

International Perspective: 3 credits

U.S. Cultures and Communities: 3 credits

Communications: 10 credits

ENGL 1500	Critical Thinking and Communication (*)	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition (*)	3
LIB 1600	Introduction to College Level Research	1
One of the following:		3
COMST 1010	Introduction to Communication Studies	
COMST 2110	Interpersonal Communication	
SPCM 1100	Listening	
SPCM 2120	Fundamentals of Public Speaking	
THRE 2510	Acting Foundations	
Total Credits		10

* With a C or better

Humanities: 6 credits

6 credits from program curriculum sheet

Social Sciences: 6 credits

6 credits from program curriculum sheet

Math/Physics/Biol.Sciences: 6 credits

6 credits from program curriculum sheet

General Education Courses: 9 credits

6 credits of course level 3000-4000 from program curriculum sheet:
complete 3 credits from department curriculum sheet.

College of Design Core: 13 credits

DSNS 1020	Design Studio I	4
DSNS 1150	Design Collaborative Seminar	1
or DSNS 1100	Design Exchange Seminar I	
DSNS 1310	Drawing I	4
DSNS 1320	Digital Design Literacy	1
DSNS 1830	Design in Context	3
Total Credits		13

History, Theory and Criticism: 12 credits

INDD 2100	Fundamentals of Industrial Design	3
INDD 2800	History of Industrial Design	3
INDD 3800	History and Culture of Objects	3
One course from the approved course list; must be 3000 level or higher.		3
Total Credits		12

Industrial Design: 63 credits

INDD 2010	Industrial Design Studio I	6
INDD 2020	Industrial Design Studio II	6
INDD 2200	Concepts of Sketching and Making I	3
INDD 2500	Activity-Centered Industrial Design	3
INDD 2600	Design Engineering: From Thought to Thing	3
INDD 3010	Industrial Design Studio III	6
INDD 3200	Design Research Methods	3
INDD 3300	Creative Thinking in Design	3
INDD 3400	Digital Design Technologies	3
INDD 3600	Materials and Processes for Industrial Design	3
INDD 3700	STEM literacy: How Things Work	3
INDD 4400	Portfolio and Professional Practice	3
INDD 4990	Senior Project	6
Total Credits		51

Experiential Learning: 12 credits		12
INDD 3020	Industrial Design Studio IV	
INDD 3970	Industrial Design Internship	
INDD 4010	Industrial Design Studio V: Commercial Practices	
INDD 4020	Industrial Design Studio: Design for Social Impact	
INDD 4950	Study Abroad Option	
INDD 5070	Industrial Design Practicum	
INDD 5900	Special Topics	
INDD 5920	Special Projects	
INDD 5930	Experiential Learning Special Projects	
INDD 5950	Study Abroad Option	
INDD 5970	Internship	
Total Credits		63

Electives: 9 credits

Electives should be assembled to support a focused area of study.

Suggested Departmental Electives:

INDD 2400	Digital Tools For Industrial Design	3
INDD 3500	Applied Human Factors Lab	1
INDD 4350	Strategic Design: Project Management	3

INDD 4600	Product Realization	3
INDD 5200	Design Theory Methodology	3
INDD 5300	Design Thinking	3
INDD 5400	Design Communication	3
INDD 5500	Human Factors: User Experience Design	3
INDD 5600	Change by Design: Disruptive Innovation	3
INDD 5700	Systems Thinking in Design	3
INDD 5800	Material Culture and Values	3

Industrial Design, B.I.D.

First Year

Fall	Credits Spring	Credits
DSNS 1020 or 1310	4 DSNS 1020 or 1310	4
DSNS 1830 (or General Education)	3 DSNS 1830 (or General Education)	3
ENGL 1500 (or General Education)	3 DSNS 1320	1
DSNS 1100 or 1150	1 ENGL 1500 (or General Education)	3
General Education	3 General Education	3
	General Education	3
	LIB 1600	1
	14	18

Second Year

Fall	Credits Spring	Credits
INDD 2010	6 INDD 2020	6
INDD 2100	3 INDD 2500	3
INDD 2200	3 INDD 2600	3
INDD 2800	3 INDD 3400	3
Dept. Elective or General Education	3 Dept. Elective or General Education	3
	18	18

Third Year

Fall	Credits Spring	Credits
INDD 3010	6 INDD 3020 (or Approved Experiential Learning)	6
INDD 3200	3 INDD 3300	3
INDD 3600	3 INDD 3700	3
Dept. Elective or General Education	3 INDD 3800	3
Dept. Elective or General Education	3 Dept. Elective or General Education	3
	18	18

Fourth Year

Fall	Credits Spring	Credits
INDD 4010 (or Approved Experiential Learning)	6 INDD 4990	6
Dept. Elective or General Education	3 INDD 4400	3
Dept. Elective or General Education	3 Dept. Elective or General Education	3
3000+ History, Theory and Criticism	3 Dept. Elective or General Education	3
	15	15

Graduate Program

Master of Industrial Design | MID 60 credit study | distributed across two consecutive years

What will (Industrial) Design look like in the future? Where is the field going? What new methods and methodologies will be needed to tackle current and emergent global issues? What will it mean to be human in the age of Artificial Intelligence? How will design disciplines answer to these new futures, new typologies of users, and constantly evolving technologies, and increasing environmental challenges?

These are just some of the questions we are concerned with in the MID program. Designing successfully during these times of uncertainty will require open minded designers, who, as connectors, are flexible, critical, empathetic and creative risk takers. Designers who are capable of working and collaborating in different contexts, under ever changing circumstances, across domains and most importantly in different roles.

Description of the degree

The Master of Industrial Design (MID) program at the College of Design, Iowa State University, emphasizes a creative problem-solving based curriculum rooted in design thinking methodologies, that allows students to explore their interests in the broad and expanding field.

Industrial Design is a human-centered discipline that questions existing boundaries and makes connections among diverse domains. Therefore, the program challenges students to develop the ability to recognize and define problems in new ways, and then find opportunities others might have missed or undervalued. Through a strategic and creative problem-solving process, Industrial Design tries to reimagine how we should go about developing innovative, sustainable and durable solutions for people and society at large that genuinely lead to better quality of life and better futures. The MID program actively connects with other knowledge domains and disciplines, to research how things are with the drive to propose how they ought to be. This is achieved through the challenging balance between critical and creative ways of thinking [and working] when devising novel, useful and meaningful artifacts, services,

experiences, and environments. Ultimately, the program integrates the design triad of people, business, and technology, in innovative ways, and is based on insightful research to create new value and competitive advantage in a variety of societal, economic, and environmental contexts.

Details about the degree

The MID program is centralized on the creation and application of new knowledge through in-depth investigations of existing 'gaps' culminating in a graduation project, which includes a creative component (project based) or a written thesis (research focused). At the same time, students expand their design practice skills using different methodologies, collaboratively, throughout the entire design process. They explore, generate, transfer, and implement interdisciplinary insights into foundational knowledge for the discipline of Industrial Design.

The MID is accredited and recognized as a terminal degree in Industrial Design. This graduate program is designed to offer significant mix of skills and experiences, including students from different disciplinary backgrounds, faculty-directed research programs, internships, international study abroad, industry-sponsored coursework, and also teaching experience.

The MID program is positioned in one of the most comprehensive design colleges in the country, facilitating the integration of methodologies and skill sets from multiple disciplines. Additionally, the program has established curricular connections to the nationally ranked College of Engineering and its Human Computer Interaction Graduate Program, the Ivy College of Business, as well as to numerous industry collaborators and practitioners.

Degree requirements include the completion of a 2-year, 60-credit program, including a required core (45 credits), focused electives (9-12 credits) and experiential learning credits (3-6 electives). The final MID Graduate Project includes one of the following: a) creative component with a design process report (6 credits) or b) research-focused written thesis (6 credits). Students and their supervisory team work collaboratively on the in-depth graduate project, adding to the body of knowledge of [industrial] design through investigating, exploring and solution finding of a complex [industrial] design problem.

Curriculum Outline

Required Core Courses: 45 cr.

INDD 5010	Industrial Design Graduate Studio I	6
INDD 5020	Industrial Design Graduate Studio II	6
INDD 5200	Design Theory Methodology	3
INDD 5300	Design Thinking	3
INDD 5400	Design Communication	3
INDD 5500	Human Factors: User Experience Design	3
INDD 5700	Systems Thinking in Design	3

INDD 5800	Material Culture and Values	3
INDD 5990X	Creative Component	1-6
INDD 6010	Industrial Design Graduate Studio III	6
INDD 6990	MInD Graduate Thesis	6
INDD 6400	Advanced Digital Technologies	3

Suggested Focused Electives 9-12 cr.

INDD 4350	Strategic Design: Project Management	3
INDD 4400	Portfolio and Professional Practice	3
INDD 4600	Product Realization	3
INDD 5050	MInD Lab I	3
INDD 5100	MInD Lab II	3
INDD 5150	Graduate Colloquium	1
INDD 5600	Change by Design: Disruptive Innovation	3
INDD 6300	Critical Reflections for Thesis Preparation	3

Or Experiential Learning:

INDD 5920	Special Projects (3-6 credits)	1-30
INDD 5930	Experiential Learning Special Projects (3-6 credits)	1-30
INDD 5950	Study Abroad Option	6
INDD 5970	Internship	6

First Year

Fall	Credits Spring	Credits
INDD 5010	6 INDD 5020 or DSNS 5460	6
INDD 5200	3 INDD 5400	3
INDD 5300	3 INDD 5500	3
INDD 5700	3 INDD 5800	3
Departmental Elective	3 Departmental Elective	3
	18	18

Second Year

Fall	Credits Spring	Credits
INDD 6010	6 INDD 6400	3
Focused Elective	3 INDD 5990X or INDD 6990	6
ISU or College Elective	3 ISU or College elective	3
ISU or College Elective	3 ISU or College Elective	3
	15	15

Admission to the MID program is by application to the department and to the Graduate College. Information about our programs and how to apply can be obtained from the department's web page at: <https://www.design.iastate.edu/industrial-design/degrees/master-of-industrial-design/> or send an email directly to the Director of Graduate Studies.

Interdisciplinary Design

OVERVIEW

Design plays a crucial role in innovation, imagination and human creativity. The secondary major in Interdisciplinary Design is an asset on any resume. It offers courses for students interested in pursuing careers and futures related to creative leadership, design for social change, disruptive innovation and user experience (UX), and provides the knowledge and skill sets necessary to address complex challenges and contemporary societal problems using key innovation and entrepreneurial concepts.

Interdisciplinary Design explores the central principle of human-centered experiences, and how people — users, customers, markets, audiences — are at the core of all creative activities and endeavors. Interdisciplinary Design dives deeply into the fundamental concepts that explain creative processes, from collaboration to iteration to implementation.

This program provides a strong foundation in creative problem solving, design thinking, strategic design, leadership and project management and new product development. Interdisciplinary Design builds an understanding of the innovation journey through design tools and techniques for ideation, insights forecasting and prototyping with users. This is the place to initiate a project, explore how to take an idea to execution and discover how to turn an insight into a reality.

The Interdisciplinary Design curriculum is built around a set of required innovation and design entrepreneurship-focused interdisciplinary studios and other required and elective courses, with many options for students across all university majors.

Student Learning Outcomes

Upon completion of the Interdisciplinary Design degree program, students will be able to:

- Generate ideas and be creative and innovative makers who use design methods, theory, and applications from multiple disciplines;
- Think strategically and creatively about society's increasing economic, social, and environmental challenges across scales and levels of complexity;
- Integrate and apply principles, values, and mindsets of innovation and entrepreneurship;
- Synthesize knowledge from many sources and work collaboratively within interdisciplinary teams; and
- Work with confidence in contexts where design thinking, skills in making, and critical analysis are valued.

Secondary Major

The secondary major in Interdisciplinary Design requires a minimum of 30 semester credits. Students seeking a secondary major in Interdisciplinary Design must complete:

Anchor Courses: 18 cr.

DES 1500	Introduction to Innovation and Design	3
DES 2300	Design Thinking	3
DES 2400	Design Innovation Studio	3
DES 3400	Design Entrepreneurship Studio	3
DES 4950	Design Innovation Launchpad	6
Total Credits		18

Other Required Courses: 9-10 cr.

For majors outside the College of Design

3 credits in a design history course

3 credits in Communications; choose from SPCM 2120, ENGL 3020, ENGL 3140

For College of Design majors

DSNS 1020 Design Studio I

DSNS 1830 Design in Context

3 credits in Communications; choose from SPCM 2120, ENGL 3020, ENGL 3140

Electives: 3 cr.

DES 2500	Design Intersections	3

Or approved elective(s) from a College of Design department (please consult with academic advisor to choose an approved elective that enhances depth of knowledge in first major)

Interior Design

Overview

<http://www.design.iastate.edu/interiordesign/index.php> (<http://www.design.iastate.edu/interiordesign/>)

The department offers the degrees Bachelor of Fine Arts (BFA) in Interior Design, Master of Arts (M.A.) in Interior Design, and Master of Fine Arts (MFA) in Interior Design.

BFA Interior Design

Emphasis is on the student's application of design processes to creatively solve problems of the interior environment based on knowledge of human safety, functional utility, and physical, psychological, and contextual fit. Graduates in interior design are competent in visual communication (sketching, drafting, and computer-aided design), design problem solving, space planning, lighting and color specification for interiors, finish and furniture selection, detailing interior construction, and

application of human factors. The curriculum is accredited by the Council for Interior Design Accreditation (CIDA) as providing professional-level education.

Transfer students with studio credits from other colleges and universities must present a portfolio of work done in those courses to determine if these credits can be applied toward specific studio requirements. Students are required to present their portfolio upon admission and prior to registration for classes. Arrangements for this process must be made with department advisors.

Graduate Study

A 34-graduate-credit program is offered leading to the Master of Arts, for students planning to undertake professional or design research-oriented pursuits. (NOTE: Applicants without a previous undergraduate degree in interior design may be required to complete up to 40 additional credits of deficiency work).

A 60-graduate-credit post-professional graduate program is also offered leading to the degree Master of Fine Arts.

Student Learning Outcomes

All graduating students with a BFA in Interior Design will:

- Develop an understanding of the design process to creatively solve a design problem and apply the design elements and principles to design solutions.
- Communicate ideas and design solutions effectively in written, oral, and visual form, including presentations of studio-based work.
- Collaborate in team-based projects with other students in interior design and work effectively in interdisciplinary teams, including an understanding of the role of interior designers in practice.
- Apply research and theories to projects, including the evidence of human-centered design in the built environment; develop an appreciation of global cultures and the history of interiors, architecture, and art.
- Demonstrate knowledge in the technical aspects of interior design, specifically in light and color, products and materials, environmental systems and human wellbeing, construction, and regulations and guidelines.

Degree Requirements

The curriculum in Interior Design leads to a 129-credit undergraduate Bachelor of Fine Arts in Interior Design including completion of the Core Design Program.

Admission into the professional program follows completion of the Core Design Program and depends upon available resources. Information on admission criteria to each professional degree is posted each year on the College admissions website.

Total Degree Requirement: 129 cr.

Only 65 credits from a two-year institution may apply, which may include up to 16 technical credits; 9 P-NP credits of free electives; 2.00 minimum GPA; Completion of all requirements listed below.

International Perspective: 3 cr.
U.S. Cultures and Communities: 3 cr.
Communication: 10 cr.

(C or better grade ENGL 1500 and ENGL 2500)

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
LIB 1600	Introduction to College Level Research	1
One course from the following:		3
COMST 1010	Introduction to Communication Studies	
COMST 2110	Interpersonal Communication	
SPCM 2120	Fundamentals of Public Speaking	
Total Credits		10

Humanities: 6 cr.

6 credits from program curriculum sheet.

Social Sciences: 6 cr.

6 credits from program curriculum sheet.

Math/Physics/Biol. Sciences: 6 cr.

One of the following:		3
MATH 1040	Introduction to Probability	
MATH 1050	Introduction to Mathematical Ideas	
MATH 1400	College Algebra	
	or MATH 15(Discrete Mathematics for Business and Social Sciences	
Three credit hours from program curriculum sheet.		3
Total Credits		6

General Education Courses: 9 cr.

9 credits from program curriculum sheet; 6 credits of course level 3000-4000.

College of Design Core: 13 cr.

DSNS 1020	Design Studio I	4
DSNS 1150	Design Collaborative Seminar	1
	or DSNS 1100 Design Exchange Seminar I	
DSNS 1310	Drawing I	4
DSNS 1320	Digital Design Literacy	1
DSNS 1830	Design in Context	3
Total Credits		13

General Design History: 6 cr.

Select 6 credits from any College of Design history courses.

Interior Design: 61-63 cr.

ARTID 2500	Fundamentals of Interior Design	2
ARTID 2510	Human Factors in Interior Design	3
ARTID 2610	Graphic Communication for Interior Design I	3
ARTID 2630	Graphic Communication for Interior Design II	3
ARTID 2650	Interior Design Studio I	4
ARTID 2670	Interior Design Studio II	4
ARTID 3500	Interior Finish Materials	3
ARTID 3510	Interior Regulations and Guidelines	3
ARTID 3520	Interior Lighting & Building Systems	3
ARTID 3530	Interior Construction and Details	3
ARTID 3550	Interior Design History/Theory/Criticism I	3
ARTID 3560	Interior Design History/Theory/Criticism II	3
ARTID 3600	Interior Design Internship Seminar I	1
ARTID 3610	Interior Design Internship Seminar II	1
ARTID 3650	Interior Design Studio III	4
ARTID 3670	Interior Design Studio IV	4
ARTID 4600	Interior Design Internship Documentation	1
ARTID 4610	Interior Design Professional Practices	2
ARTID 4650	Interior Design Studio V	4
DSNS 5460	Interdisciplinary Design Studio	4-6
Select course from ARTID 5690-5790 Advanced Studies in Interior Design		3
Total Credits		61-63

Studio/Business Option: 6 cr.

6 credits from program curriculum sheet.

Electives: 4-6 cr.

Complete electives sufficient to complete graduation requirements.

Interior Design, B.F.A.

Four Year Plan

Freshman

Fall	Credits Spring	Credits
DSNS 1020 or 1310	4 DSNS 1020 or 1310	4
DSNS 1150	1 DSNS 1830 (or Gen Edu)	3
DSNS 1320	1 ENGL 2500 (or Gen Edu)	3
DSNS 1830 (or Gen Edu)	3 Gen Edu	3
ENGL 1500	3 Gen Edu	3
ARTID 2500	2 LIB 1600	1
Gen Edu	3-4	
17-18		17

Sophomore

Fall	Credits Spring	Credits
ARTID 2500	2 ARTID 2510	3
ARTID 2610	3 ARTID 2630	3
ARTID 2650	4 ARTID 2670	4
ARTID 3530	3 ARTID 3500	3
ARTID 3550	3 ARTID 3560	3
Gen Edu	1 (DSNS 3010-Rome Prep)	0-1
16		16-17

Junior

Fall	Credits Spring	Credits
ARTID 3600	1 ARTID 3520	3
ARTID 3650	4 ARTID 3610	1
Studio/Bus Option	3 ARTID 3670	4
Gen Design Edu or Gen Edu	3 Gen Design Edu	3
ARTID 3510	3 Gen Edu	3
Gen Edu	3 Gen Edu	3
17		17

Senior

Fall	Credits Spring	Credits
ARTID 4650 (Gen Edu)	4 ARTID 4610	2
ARTID 4600	1 DSNS 5460	4-6
Advanced Studies in Interior Design (or Gen Edu)	3 Advanced Studies in Interior Design (or Gen Edu)	3
Studio/Bus Option	3 Gen Edu or Elective	3
Gen Edu	3	
Gen Edu or Elective	3	
17		12-14

Students enrolled in the Bachelor of Interior Design Program at ISU may apply for concurrent undergraduate/graduate status prior to their final semester of their undergraduate program. If accepted, students will be allowed to register for six graduate credits and apply the credits to an M.A. degree.

Graduate Study

The Department of Interior Design offers two graduate degrees in interior design: a five-semester Master of Fine Arts (MFA) and a three-semester Master of Arts (M.A.), each of which requires a thesis. The degree programs encourage interdisciplinary work within the College of Design and across related fields within the university. We currently offer double-degree programs and an interdisciplinary Ph.D. program in Human Computer Interaction (HCI) with a home department in Interior Design.

Financial support in the form of teaching and research assistantships is available on a competitive basis.

Master of Fine Arts in Interior Design (MFA)

The MFA is a terminal degree in Interior Design with a required thesis and a creative component. It is designed for students with undergraduate degrees in Interior Design or closely related disciplines and for students from other disciplines who complete required prerequisites in the Department of Interior Design. The MFA in Interior Design Program prepares students to become professionals in practice, teaching, and research.

The MFA program encourages students to research and engage diverse contemporary issues within design specializations across the field of Interior Design. Faculty in the program provide students with opportunities to engage and address social, cultural, environmental, historical, practical, and other concerns within regional, national, and international contexts. They amalgamate traditional methods and contemporary technologies and encourage students to develop new processes and methods as needed. Faculty members promote inclusive designs that accommodate current and future needs across diverse cultures and populations. The Interior Design Graduate Programs expect graduates to approach research and interdisciplinary coursework with dedication and commitment.

The MFA curriculum has an intensive five-semester course sequence that emphasizes foundations of interior design including methods, theory, process, the human condition, and studio. Design seminars offer training in varied interior design specializations including preservation and cultural heritage, inclusive design, lighting, color theory, research methods, and environmental design. The program offers study abroad opportunities, studios with specialized faculty, and independent study projects. Interdisciplinary option studios apply and integrate core-course content with technical proficiency in areas of preservation and cultural heritage, healthcare, design for elderly populations, and hospitality, among others. During the last two semesters students explore interior design through focused research and a written thesis. The MFA program concludes with a public defense of the thesis that includes a thesis exhibition with graphic representations of the research.

Students admitted to the program hold undergraduate degrees in a broad range of fields. A student without an undergraduate degree in interior design or interior architecture must complete the curriculum's prerequisites listed in curriculum sheets posted on the Graduate Programs in Interior Design's website (<https://www.design.iastate.edu/interior-design/graduate-degrees/graduate-program-overview/>). Students with undergraduate degrees in closely related to design fields may be eligible to waive part of the prerequisites in the program.

Master of Fine Arts (MFA), 60 Credits

Design Innovation and Social Entrepreneurship: Select 9 credits

ARTID 5690	Advanced Studies in Interior Design: Variable Topics	3
ARTID 5700X	Social Entrepreneurship in Aging	3
ARTID 5710	Advanced Visualization in Interior Design	3
ARTID 5720	Preservation & Cultural Heritage	3

Equitable and Inclusive Environments: Select 9 credits

ARTID 5510A	Design Humanics: Sensory Perception & Ergonomic Factors	3
ARTID 5510B	Design Humanics: Environment & Behavior	3
ARTID 5730	Advanced Color Theory	3
ARTID 5740	Inclusive Environments	3

Methods and Practicum: 9 credits

ARTID 5520A	Evidence-Based Design: Investigation Analysis	3
	or ARTID 5520BEvidence-Based Design: Synthesis	
	or ARTID 5520CEvidence-Based Design: Communication	
	or ARTID 5520DEvidence-Based Design: Procedural Alternatives	
ARTID 5540	Interior Design Teaching Practicum	3
ARTID 6600	Research Methods (or DSNS 5010 Introduction to Research Design)	3

Studio Courses: 20 credits

ARTID 6680	Advanced Experimental Interior Design	4
ARTID 6680	Advanced Experimental Interior Design	4
DSNS 5460	Interdisciplinary Design Studio *	6
DSNS 5460	Interdisciplinary Design Studio *	6

* This course is offered for variable credits. Students should select a section offered for 6 credits.

Thesis and Creative Component: 12 credits

ARTID 6990A	Thesis	6
ARTID 6990B	Thesis-Exhibition	6

Electives: 8 cr.

Total: 60 credits

Master of Arts in Interior Design (M.A.)

The post-professional Master of Arts (M.A.) in Interior Design is a 34-credit research degree with required a graduate thesis. The M.A. degree is open to applicants who hold a professional degree in Interior Design or Interior Architecture from an accredited program. The M.A. in Interior Design degree prepares students to become competent professionals in Interior Design practice, while the written research thesis contributes to the body of knowledge in the field.

M.A. candidates are required to develop a thesis proposal with a statement of purpose, research questions, literature review, methods summary, and outline of proposed chapters. A first professional degree is also open for applicants with non-professional degrees in various fields with the completion of required prerequisites in the Department of Interior Design. A first professional M.A. for graduates in closely related design fields may allow some prerequisite courses to be waived.

Master of Arts in Interior Design (M.A.), 34 Credits Design Innovation and Social Entrepreneurship: Select 6 credits

ARTID 5690	Advanced Studies in Interior Design: Variable Topics	3

ARTID 5700X	Social Entrepreneurship in Aging	3

ARTID 5710	Advanced Visualization in Interior Design	3

ARTID 5720	Preservation & Cultural Heritage	3

Equitable and Inclusive Environments: Select 6 credits

ARTID 5510A	Design Humanics: Sensory Perception & Ergonomic Factors	3

ARTID 5510B	Design Humanics: Environment & Behavior	3

ARTID 5730	Advanced Color Theory	3

ARTID 5740	Inclusive Environments	3

Methods: 6 credits

ARTID 5520A	Evidence-Based Design: Investigation Analysis	3
	or ARTID 5520BEvidence-Based Design: Synthesis	
	or ARTID 5520CEvidence-Based Design: Communication	
	or ARTID 5520DEvidence-Based Design: Procedural Alternatives	

ARTID 6600	Research Methods (or DSNS 5010 Introduction to Research Design)	3

Studio Courses: 10 credits

DSNS 5460	Interdisciplinary Design Studio	6

ARTID 6680	Advanced Experimental Interior Design	4

Thesis: 6 credits

ARTID 6990A	Thesis	6

Total: 34 credits Dual Degrees

Double-degree programs are offered with the Department of Architecture with a Master of Arts (M.A.) in Interior Design and a Master of Architecture (MArch). The graduate program also offers a Ph.D. in Human Computer Interaction (HCI) with home department in Interior Design. Information about our programs and how to apply can be obtained from the department of Interior Design Graduate Program website and from the graduate school's departmental web page.

Landscape Architecture Overview

Landscape architecture is an environmental design discipline. Landscape architects actively shape the human environment: they map, interpret, imagine, draw, build, conceptualize, synthesize, and project ideas that transform landscapes. The design process involves creative expression that derives from an understanding of the context of site (or landscape) ecosystems, cultural frameworks, functional systems, and social dynamics. Students in our program learn to change the world around them by re-imagining and re-shaping the landscape to enhance its aesthetic and functional dimensions, ecological health, cultural significance, and social relevance. The profession addresses a broad range of landscapes in urban, suburban, rural, and wilderness settings. The scale of landscape architecture projects varies from broad, regional landscape analysis and planning to detailed, individual site-scale designs. The curriculum at Iowa State prepares students for this challenge as they develop their abilities to design and communicate ideas through a sequence of foundational courses and studios. The program seeks to produce graduates who understand the ethical, social, and environmental/ecological dimensions of issues involving changes in the landscape.

Graduates are active in a broad range of careers, such as sustainable site design, land development, park management, environmental advocacy, community planning, urban design, and others. In their professional lives, graduates apply their creative and technical skills in the planned arrangement of natural and constructed elements on the land with a concern for the stewardship and conservation of natural, constructed, and human resources. The resulting environments serve useful, aesthetic, safe, and enjoyable purposes. Graduates are able to communicate effectively with colleagues in the sciences and humanities as well as in the allied professions and are prepared to work individually and in multidisciplinary teams to address complex problems dealing with the cultural/ecological environment.

The department offers graduate and undergraduate degree programs and cooperates in the undergraduate minors in Design Studies, Critical Studies in Design, and Digital Media.

The undergraduate curriculum includes one year of the college's Core Design Program followed by four years in the professional program. Applicants are reviewed on the basis of academic performance and a portfolio of original work; admission to the professional program is subject to the approval of a faculty committee at the completion of the Core Design Program. Information on admission criteria is posted each year on the College of Design website.

Following admission to the professional program, students embark on the traveling studio during the fall semester of their second year. This

studio is a full semester’s credit of integrated departmental courses and involves extensive travel within and beyond the great Midwest region of North America, to study regional natural systems and the cultural responses to those systems.

To enhance the study of landscape architecture in off-campus settings, the department requires students to choose from among the following options during the spring and summer of their fourth year: 1. a professional internship 2. the College of Design Rome Program 3. an independent study abroad experience or 4. National Student Exchange. The department assists students with placement, and additional information is provided through the department and the College of Design’s Career Services Office.

The undergraduate program consists of a five-year curriculum, requiring 150 credits, leading to the degree Bachelor of Landscape Architecture. These credits are distributed between a one-year Core Design Program of 30 credits and a four-year professional program of 120 credits.

Student Learning Outcomes

- Understand and practice design as an iterative process.
- Design landscapes as part of the built material world from concept to detail.
- Select and use a wide range of manual and digital techniques to communicate ideas; utilize appropriate communication and representation techniques based on the design problem.
- Present a project clearly and concisely to a client, community, or user group and produce professional communications.
- Produce basic construction documents and other project documentation including plans and specifications.
- Incorporate knowledge of ecology and plants into design proposals.
- Understand and practice landscape architecture as a continuously changing historical and cultural activity.
- Interpret how social, cultural, and political dynamics affect the use and design of public and private space.
- Function effectively in collaborative and multidisciplinary settings.
- Practice professional ethics, judgment, and skills and understand the professional’s role as a fiduciary.

Degree Requirements

The department offers graduate and undergraduate degree programs.

The undergraduate program consists of a five-year curriculum, requiring 150 credits, leading to the degree Bachelor of Landscape Architecture. These credits are distributed between a one-year Core Design Program of 31 credits and a four-year professional program of 120 credits.

Admission into the professional program depends upon available resources and is subject to the approval of a faculty committee at the

completion of the Core Design Program. Applicants are reviewed on the basis of academic performance and a portfolio of original work. Information on admission criteria is posted each year on the College of Design website.

The BLA from Iowa State University is an LAAB (Landscape Architectural Accreditation Board)-accredited professional degree program. In the United States, most state registration boards require a degree from an accredited professional degree program as a prerequisite for professional licensure. The LAAB is the sole entity recognized by the Council for Higher Education Accreditation to accredit U.S. first-professional degree programs in landscape architecture at the bachelor’s and master’s levels.

Total Degree Requirement: 150 credits

Only 65 credits from a two-year institution may apply, which may include up to 16 technical credits; 9 P-NP credits of free electives; 2.00 minimum GPA.

International Perspective: 3 credits
U.S. Cultures and Communities: 3 credits
Communications: 10 credits

(C or better grade in ENGL 1500 and ENGL 2500)

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
LIB 1600	Introduction to College Level Research	1
One of the following:		3
ENGL 3090	Proposal and Report Writing	
ENGL 3140	Technical Communication	
Total Credits		10

Humanities: 9 credits
9 credits from PHIL, HIST, MUSIC or other humanities course offerings.

Social Sciences: 6 credits
6 credits from ANTHR, ECON, POLS, PSYCH, or SOC.

Mathematics and Science: 12 credits		
One of the following:		3-4
MATH 1400	College Algebra	
MATH 1450	Applied Trigonometry	
MATH 1650	Calculus I (4 crs)	
ENVS 1200	Introduction to Renewable Resources	3
Science Elective		6

Additional General Education Course 3 credits
3 credits from 3000-4000-level courses

Design Core: 13 credits		
DSNS 1020	Design Studio I	4
DSNS 1150	Design Collaborative Seminar	1

or DSNS 1100	Design Exchange Seminar I	
DSNS 1310	Drawing I	4
DSNS 1320	Digital Design Literacy	1
DSNS 1830	Design in Context	3
Total Credits		13

Landscape Architecture: 91 credits

LA 2010	Studio: Landscape Interpretation and Representation	6
LA 2020	Studio: Site Design I	6
LA 2110	Digital Design Methods for Landscape Architecture	3
LA 2210	Native Plants of the Savanna Ecotone	3
LA 2410	Developing Identity as a Landscape Architect	1
LA 2720	Landscape Studies	3
LA 2810	Investigating Landscape Form, Process, and Detail	3
LA 3010	Site Design II	6
LA 3020	Ecological Design	6
LA 3220	Fundamentals of Planting Design	3
LA 3410	Contemporary Landscape Architecture	1
LA 3710	History of Modern Landscapes, 1750 to Present	3
LA 3730	Gardens and Landscapes from Antiquity to 1750	3
LA 3810	Shaping the Land	3
LA 4020	Urban Design	6
LA 4040	Advanced Landscape Architectural Design	6
LA 4110	Advanced Digital Design for Landscape Architecture	3
LA 4420	Professional Practice	2
LA 4440A	Landscape Architecture Independent Educational Enrichment: Professional Internship	R
or LA 4440B	Landscape Architecture Independent Educational Enrichment: Study Abroad	
or LA 4440C	Landscape Architecture Independent Educational Enrichment: National Student Exchange	
LA 4810	Landscape Materials	3
LA 4820	Landscape Construction Documentation	3
DSNS 5460	Interdisciplinary Design Studio	6
Plus nine credits professional electives		9
Total Credits		88

Electives: 12 credits

Complete electives sufficient to complete graduation requirements.

Landscape Architecture, B.L.A.

First Year

Fall	Credits Spring	Credits
DSNS 1020 or 1310	4 DSNS 1310 or 1020	4
DSNS 1320	1 DSNS 1830	3
DSNS 1150 or 1100	1 ENGL 1500 (or General Education)	3
LIB 1600	1 Science or Math	3
Science or Math	3 General Education	3
General Education	6	
16		16

Second Year

Fall	Credits Spring	Credits
LA 2010	6 LA 2020	6
LA 2210	3 LA 3730	3
LA 2410	1 LA 2110	3
LA 2720	3 ENVS 1200	3
LA 2810	3 ENGL 2500	3
16		18

Third Year

Fall	Credits Spring	Credits
LA 3010	6 LA 3020	6
LA 3810	3 LA 3410	1
LA 3710	3 LA 4810	3
LA 3220	3 General Education	3
General Education	3 General Education	3
18		16

Fourth Year

Fall	Credits Spring	Credits
LA 4020	6 One of the following:	R
LA 4110	3 LA 4440A	
LA 4740	3 LA 4440B	
Elective	3 LA 4440C	
ENGL 3090 or 3140	3 (or Rome Program)	12-15
DSNS 3010 (Rome option only)	1	
19		12-15

Fifth Year

Fall	Credits Spring	Credits
LA 4040	6 DSNS 5460	6
LA 4820	3 LA 4420	2
LA Electives	3 General Education	3
LA Electives	3 General Education	3

General Education	3
	18
	14

Additionally: Each student needs to take 3 credits of a U.S. Cultures and Communities and 3 credits of an International Perspectives course (usually covered by LA 3730). Students also need to take at least 6 credits of 3000 level or above in the combined areas of communication, science, math, humanities, and social science (6 total from all the areas).

Graduate Programs

The department offers the Master of Landscape Architecture (MLA), an accredited professional degree designed for students with or without an undergraduate degree in landscape architecture. The degree provides skills and knowledge as measured by the Landscape Architectural Accreditation Board (LAAB) and the licensing exam for students seeking to practice as a licensed professional in the public or private sectors. The MLA degree also offers competency for students interested in post-professional study as it provides the skills and knowledge for the application of research and/or scholarly methods to professional practice.

The MLA program offers an opportunity to focus on a concentration area of the student’s choosing through 9-12 credits of elective coursework and an optional thesis or creative component. The concentration area will be determined by the student in consultation with their advisor. Concentration electives may be selected from within the department, college, or university. The Creative Component or Thesis option is conducted under the supervision of a faculty advisor chosen by the student.

Students are also able to pursue double degrees with Master of Community and Regional Planning (MLA/MCRP) and Master of Urban Design (MLA/MUD). Students interested in the double-degree programs should contact the departments to receive a detailed description of requirements.

The department also offers courses in the Graduate Certificate Program in Geographic Information Systems (GIS), administered by the Department of Community and Regional Planning.

Design and Planning: 36 credits

LA 6010	Introduction to Landscape Architecture	6
LA 6020	Designing the Living Environment	6
LA 6030	Intermediate Landscape Architecture Studio	6
LA 6040	Urban Landscapes	6
LA 6050	Advanced Landscape Architecture	6
DSNS 5460	Interdisciplinary Design Studio	6

or 2 cr. LA 5800 Thesis, Creative Comp. Tutorial + 4 cr. LA 5990 Creative Comp. or LA 6990 Thesis

Theory/History/Research: 10 credits

LA 5710	Landscape Architectural Theory	3
LA 5900D	Special Topics: History/Theory/Criticism	3
or LA 5780D: LA History elective*		
LA 5410	Design Inquiry	3
LA 5430	Colloquium: Landscape Architecture Research	1

Technology/Ecology/Materiality: 14 credits

LA 5220	Advanced Plant Technology	3
LA 5420	Professional Practice	2
LA 5590	Digital Design Methods for Landscape Architecture	3
LA 5830	Landscape TopoGraphics	3
LA 5810	Landscape Materials	3

Advocacy/Planning/Policy: 6 credits

LA 5740	Environmental Justice in Built Environments	3
Planning Elective - choose one from:		3
CRP 5660	Policy Analysis and Planning	
CRP 5680	Planning and Development	
CRP 5910	Environmental Law and Planning	
CRP 5920	Land Use and Development Regulation Law	

Concentration Electives: 15 credits

Students may, in consultation with their advisor, also choose courses from CRP, ARCH, MUD, SUSE, INDD, or other relevant departments in the college or university.

Total 80 credits
Sustainable Environments
Master of Design in Sustainable Environments

The Master of Design in Sustainable Environments (MDesSE) is an initial interdisciplinary degree that focuses on holistic design strategies for the production of sustainable, resilient environments and artifacts. MDesSE students and faculty constitute a multidisciplinary, highly interactive community that is deeply engaged in understanding, promoting, and conceiving sustainable practices in design, planning, and artistic production. Students from a variety of backgrounds such as design, art, planning, education, engineering, science, etc., engage in research projects and are challenged to develop individual sustainable design strategies for issues of current relevance that conserve resources, ameliorate ecological problems, and promote social, political, and economic justice.

Coursework focuses on developing skills in modes of representation and information dissemination; foundational and emerging theoretical discourse; as well as research methods and design interventions. The degree concludes with an integrated capstone experience through a student-defined thematic project. Capstone projects are situated in different parts of the world and include themes that draw upon each student's specific area of interest while being informed by the theories, skills, methods, and tactics learned throughout the MDesSE program.

The Master of Design in Sustainable Environments degree consists of 35 credits, typically distributed over three semesters (fall, spring, and summer); however, students may choose to distribute these credits over four or five semesters. The degree is geared toward students with professional degrees in art (BFA, MFA), architecture (BArch, MArch), graphic design (BFA, MFA), interior design (BFA, MFA), industrial design (BID, MID), landscape architecture (BLA, MLA), community and regional planning (BSCR, MCRP, MUP), or engineering. Graduate students can also pursue the following double degrees in the College of Design: MArch/MDesSE, MCRP/MDesSE, MFA in IVA/MDesSE and MLA/MDesSE.

Courses primarily for graduate students, open to qualified undergraduates:

SUSE 5010: Sustainable Design in Communities

Credits: 5. Contact Hours: Lecture 2, Studio 6.

Prereq: Graduate Standing or Permission of Instructor

Exploring the challenges faced in implementing social, environmental, and economic sustainable solutions, this studio engages students in an interdisciplinary, team-oriented, and project-based learning environment through engagement with a Central Iowa community.

SUSE 5020: Sustainable Design Capstone Studio

Credits: 6. Contact Hours: Studio 12.

Prereq: Graduate Standing or Permission of Instructor

This advanced studio provides a community-based context for an interdisciplinary design team to work on a variety of self-directed, applied design research and intervention projects at multiple scales. Students utilize a common theoretical framework to organize their research and inform their interventions. Field trips.

SUSE 5110: Sustainable Design Colloquium I

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Study and discuss practices of sustainable design and design research. Investigate responsibilities, roles, technologies and methods for studying and advancing the art and science of designing sustainable environments.

SUSE 5120: Sustainable Design Seminar

Credits: 1. Contact Hours: Lecture 1.

Prereq: Graduate Standing or Permission of Instructor

Students begin design research in sustainability issues by learning how to build a network of professional and academic contacts related to their individual research topics. Assignments include developing and engaging in an immersion experience related to their research.

SUSE 5130: Sustainable Design Research Writing

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Students develop a comprehensive and conclusive research manuscript for submission to a conference or journal in their discipline. SUSE student manuscripts detail their capstone projects. Non-majors compose papers detailing completed research projects in their own discipline.

SUSE 5210: Foundation of Sustainable Design

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to the broad frameworks and tools for implementing sustainability among a variety of environments, industries, and enterprises. Investigates the role and opportunity for sustainable design strategies.

SUSE 5310: Human Dimensions of Sustainability

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

This interdisciplinary seminar uses applied research with communities to ground students in the issues and conditions impacting social and economic sustainability. Students develop a broad understanding of community sustainability through weekly readings, discussions, and small made objects. Topics of focus include university-community partnerships, participatory design, and social constructions of sustainability.

SUSE 5400: Methods for Sustainable Design

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Overview of qualitative, quantitative and design research methods. In-depth application of methods relevant to capstone project proposal development (SUSE 5020). Proposal must address research questions, articulation of research methods and preliminary findings grounded within contemporary theoretical discourse on Sustainable Environments. (Typically Offered: Spring)

SUSE 5500: Making Resilient Environments

(Cross-listed with CRP 5500).

Credits: 3. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Major theories and ideas revolving around the concept of resilience. Assessing the social and political processes associated with policy making for resilience. Application of the concept of resilience in order to understand and evaluate environments. Evaluate the different approaches toward resilience and develop an understanding of the relationship between sustainability and resilience. Case studies of communities that proactively prepare for, absorb, recover from, and adapt to actual or potential future adverse events. (Typically Offered: Spring)

Urban Design

The Master of Urban Design (M.U.D.) is an initial, interdisciplinary program of study that focuses on contemporary challenges of urbanism at local, regional and global scales. Courses are taught by faculty from Architecture, Community and Regional Planning, and Landscape Architecture; with an understanding that urban environments should be engaged through an integrated design process that includes ecological, social, material, economic, and urban policy factors.

The urban design degree reflects a deep commitment to resilient urban environments within the context of an increasingly concentrated, connected and, diverse urban world. Accordingly, the coursework engages emerging urbanization topics including:

- The formation of more adaptable, flexible and resilient cities;
- the exponential growth of megacities and steady decline of investments in traditional urban economies in the twenty-first century;
- The transformation of Industrial landscapes, particularly within the Midwestern context, and the global impact of transnational economic operations.
- the spatialization of informal economies, practices, and services across the south-north global divide;
- and, a reexamination of the potentials of hard and soft infrastructures, principles of the circular economy and a reframing of the urban-rural divide.

The program consists of 30 credits, typically distributed over three semesters (fall, spring and summer), however, students may choose to distribute these credits over four or five semesters. The degree is geared toward students with professional degrees in architecture (BArch, MArch), landscape architecture (BLA, MLA) or planning (BSCR, MCRP, MUP). Graduate students can also pursue the following double degrees in the College of Design: M Arch/MUD, MCRP/MUD and MLA/MUD.

Requirements:

URBD 5010	Urban Design Local Studio	6
URBD 5020	Urban Design Global Studio	6
History/Theory/Criticism		6
Technology/Methods		12
Total Credits		30

List of Courses:

History/Theory/Criticism - 6 credits from the following list

ARCH 5270	History, Theory, and Criticism of Chinese Architecture	3
ARCH 5280A	Studies in Architecture: Culture	3
ARCH 5750	Contemporary Urban Design Theory	3
ARCH 5970	Seminar on the Built Environment III: Theory	3
ARCH 5980	Seminar on the Built Environment IV: Topical Study	3
ARTH 5010	Issues in Visual and Material Culture Seminar	3
ARTH 5870	Nineteenth Century Art	3
ARTH 5880	Modern Art and Theory	3
ARTH 5920	Art History In Europe	3
ARTH 5940	Women/Gender in Art	3
ARTH 5950	Art and Theory Since 1945	3
ARTH 5960	History of Photography	3
ARTH 5970	Green Art: Earthworks and Beyond	3
CRP 5290	Planning in Developing Countries	3
CRP 5610	Planning Theory	3
CRP 5630	Planning the American Metropolis	3
LA 5780D	Topical Studies in Landscape Architecture: History/Theory/Criticism	2-3
URBD 5110	North American Urbanization	3
URBD 5210	Foundations of Urban Design	3
URBD 5220	Contemporary Urban Design Practices	3
URBD 5310	Methods of Urban Design Workshop	3
URBD 5330	Urbanism Theory and Methods	3

Technology/Methods - 12 credits from the following list

ARCH 4320	Advanced Computer Lighting and Rendering	3
ARCH 4340	Advanced Computer-aided Architectural Design	3
ARCH 5330	Digital Fabrication	3
ARCH 5340	Topics in Computer-aided Architectural Design	3
ARCH 5360	Advanced Design Media	3
ARCH 5580	Sustainability and Green Architecture	3
ARTGR 5730	Multimedia Design	3
ARTGR 5780	Graphic Design Advanced Web Design	3
ARTGR 5790	Wayfinding Design	3

COLLEGE OF ENGINEERING

W. Samuel Easterling, James L. and Katherine S. Melsa Dean of Engineering

Arun Somani, Senior Associate Dean

Sriram Sundararajan, Associate Dean for Academic Affairs

Connie Hargrave, Associate Dean for Engagement and Excellence

Sri Sritharan, Assistant Dean for Research

Cris Schwartz, Assistant Dean for Engineering Student Success

www.engineering.iastate.edu (<http://www.engineering.iastate.edu/>)

Aligning Education in Engineering with the University Mission

The mission of Iowa State University is to create, share, and apply knowledge to make Iowa and the world a better place. Students will become broadly educated, global citizens who are culturally informed, technologically adept, and ready to lead. The College of Engineering echoes this philosophy and emphasizes preparing its graduates to meet the challenges of the 21st century.

Engineering education seeks to develop a capacity for objective analysis, synthesis, and design to obtain a practical solution. The engineering programs at Iowa State University are designed to develop the professional competence of a diverse student body and, by breadth of study, to prepare students to solve the technical problems of society while considering the ethical, social, and economic implications of their work at state, national and global levels.

The focus of each curriculum is to strengthen students' critical thinking, creative abilities, and communication skills. Students in engineering will have the opportunity for interdisciplinary and experiential learning through learning communities, service learning, internships and cooperative education, as well as research, capstone, and study abroad experiences.

The problem-solving skills learned from an engineering education at Iowa State University also provide an excellent launching pad for careers not only in engineering, but also medicine, law, business, and many other fields.

Registration as a professional engineer, which is granted by each individual state, is required for many types of positions. The professional curricula in engineering at Iowa State University are designed to prepare a graduate for subsequent registration in all states.

Seniors in accredited curricula of the College of Engineering are encouraged to take the Fundamentals of Engineering Examination toward professional registration during their final academic year. Seniors in engineering curricula who have obtained at least 6 semester credits

in surveying may take the Fundamentals Examination for professional registration as land surveyors.

Concurrent Graduate/ Undergraduate Programs

Several engineering programs offer the opportunity for well-qualified undergraduate juniors and seniors to pursue a graduate degree in their program while finishing the undergraduate requirements. The programs offering concurrent undergraduate/graduate degrees are aerospace engineering, agricultural engineering, biological systems engineering, chemical engineering, civil engineering, computer engineering, electrical engineering, industrial engineering, materials engineering, mechanical engineering and software engineering.

Programs offering concurrent Bachelor of Science/Master of Business Administration degrees are aerospace engineering, agricultural engineering, biological systems engineering, chemical engineering, civil engineering, computer engineering, construction engineering, electrical engineering, industrial engineering, materials engineering, mechanical engineering and software engineering. For more information, refer to the graduate study sections for each engineering program. Advanced work in engineering is offered in the post-graduate programs. See the Graduate College section of this catalog.

Joint Undergraduate Programs

A Bachelor of Science degree in software engineering is offered in the College of Engineering and the College of Liberal Arts and Sciences.

Accreditation

Thirteen undergraduate engineering programs are accredited by the Engineering Accreditation Commission of ABET, <http://www.abet.org> (<http://www.abet.org/>). These thirteen programs are: aerospace, agricultural, biological systems, chemical, civil, computer, construction, cyber security, electrical, industrial, materials, mechanical and software engineering. Accreditation status is indicated in the Courses and Programs section for each engineering program.

Organization of Curricula

All curricula in engineering are designed as four-year programs. They are structured in two phases: a basic program and a professional program. The basic program consists primarily of subjects fundamental and common to all branches of engineering and includes chemistry, physics, mathematics, engineering computations, and English. The professional phase of a curriculum includes intensive study in a particular branch of engineering, as well as a continuation of supporting work in mathematics, basic sciences, humanities, and social sciences.

Students should complete the requirements of the basic program before proceeding to a professional program.

Preparation for the Engineering Curricula

In addition to the freshman admission requirements for direct from high school students, the college also requires 2 years of a single foreign language. Students coming in without the 2 years of a single foreign language must meet this requirement by no later than the time of graduation. Other high school credits particularly important to students wishing to study engineering include:

- 2 years of algebra,
- 1 year of geometry
- 1/2 year of trigonometry
- 1/2 year of pre-calculus
- 1 year each of chemistry, biology, and physics
- 3 years of social science
- 4 years of English

See Index (<http://catalog.iastate.edu/azindex/>) for specific admission requirements.

Placement in mathematics, English, and chemistry will generally be based on high school preparation and test scores. Advanced placement is possible for exceptionally well-prepared students. Students who are not adequately prepared may be encouraged or required to take additional preparatory coursework and should expect to spend more than the customary time to complete the engineering program. Any coursework which is preparatory or remedial in nature cannot be used to satisfy credit requirements for graduation in any of the engineering curricula.

Engineering Basic Program

Please see "Basic Program for Engineering Curricula" section.

Requirement for Graduation

In order to graduate in a professional engineering curriculum, students must have a minimum GPA of 2.00 in a department-designated group of 2000-level and above courses known as the Core. These courses will total no fewer than 24 semester credits.

Engineering Minors

The College of Engineering offers four undergraduate minors which are open only to students in the College of Engineering. These are minors in cyber-physical systems, energy systems, engineering sales and nondestructive evaluation. These minors must include at least nine credits which are beyond the total used to meet curriculum requirements.

The energy systems engineering minor is a 15-credit program that provides engineering students with focused educational opportunities in the broad area of energy systems. Students will understand broad energy perspectives, the language of energy systems and the economic,

environmental, and policy issues related to energy. The minor is administered by a supervisory faculty committee. For minor course requirements, refer to Energy Systems Engineering in Courses and Programs or see <http://www.me.iastate.edu/energy-systems-minor/>.

The engineering sales minor is a 15-credit minor that complements the technical training in the student's major discipline by providing the tools and knowledge required for technical (i.e. business-to-business) sales careers. The minor is administered by a supervisory faculty committee. For minor course requirements, refer to Engineering Sales in Courses and Programs.

The nondestructive evaluation minor (16 credit minimum) opens to engineering students who have met the basic program requirements and are not on academic warning or probation. The minor is supervised by an inter-disciplinary Engineering faculty committee. For minor course requirements, refer to Nondestructive Evaluation Engineering in Courses and Programs.

Engineering Minor (Interdisciplinary)

The College of Engineering offers an undergraduate minor in cyber security which is open to all students at ISU who meet the prerequisites. The cyber security minor is a 15-credit minor that is intended for students studying computer engineering, computer science, software engineering or management information systems with the goal of enabling them to work in cyber security. For minor course requirements, refer to the Cyber Security in Courses and Programs.

The biomedical engineering minor is a 17-credit interdisciplinary program that complements a student's major discipline by providing additional insight into the interactions between various engineering disciplines and biomedically relevant systems. The minor is open to all undergraduate students at ISU who meet the prerequisites. The minor is administered by a supervisory faculty committee. For minor course requirements, refer to Biomedical Engineering in Courses and Programs.

Undergraduate Majors and Minors Outside the College of Engineering

In addition to the engineering degree program, students may earn majors or minors in other colleges of the university. A major or minor program must meet all requirements of the offering department or program and its college and contain credits beyond the requirements for a B.S. degree in engineering. A minimum of 15 additional credits is required for each major area of study and an additional 9 credits for each minor.

Advising System

The purpose of the advising system in the College of Engineering is to work constructively with students in developing their individual academic

programs and to provide a resource contact person for students during their college careers.

The college offers an orientation program during the spring and summer for students planning to enter in the fall, and during the fall for students planning to enter in the spring. Students may also complete orientation online. All entering students are encouraged to attend orientation which includes meeting with an academic advisor to register for classes. Placement assessments given during the orientation program help determine the student's current level of proficiency which enables the academic advisor to prepare an appropriate course schedule for the student.

Special Programs

All engineering students are strongly encouraged to participate in either the cooperative education or internship programs. Students who are qualified to participate in the engineering honors program are also urged to do so. These programs are integrated into the professional engineering curricula and may require additional work. However, both these professional and academic programs offer opportunities that will enrich the standard academic experience. Engineering students are also encouraged to take advantage of study abroad opportunities available through the College of Engineering's International Programs Office.

a. Cooperative Education Program. The College of Engineering offers, through its curricula, an experiential education program. Enrollment in the program allows students to gain practical work experience in their career field while attending college. In general, students enrolled in the co-op program will require an additional semester to complete curriculum requirements.

Cooperative programs are a mechanism by which a student may work full-time for one semester per academic or calendar year. The student has the opportunity to assess career paths within her/his chosen curriculum and the employer evaluates the student's potential as a future full-time employee. Both domestic and international co-op programs are allowed. Cooperative education students pay no tuition to the university during their work periods and do not receive credit hours for their work experience. Students register for a non-credit cooperative education course (3980) for fall or spring and are considered full-time students while enrolled in these courses. For additional information contact your academic advisor and the Office of Engineering Career Services.

b. Internship Program. The College of Engineering offers, through its curricula, an experiential education program. Internships are a mechanism by which a student may work full-time for the summer.

Enrollment in the program allows students to gain practical work experience in their career field while attending college.

Internship students pay no tuition to the university during their work periods and do not receive credit hours for their work experience. Students who register for the internship course (3960) for the summer

are considered to be full-time students. For additional information contact your academic advisor and the Office of Engineering Career Services.

c. Honors Program. The College of Engineering participates in the University Honors Program (see Index (<http://catalog.iastate.edu/azindex/>)). The honors program is designed for students with above average ability who wish to individualize their programs of study. For further details consult the chair of the Engineering College Honors Program Committee or your departmental honors program advisor.

d. Engineering International Engagement. In a world where the sun never sets, engineers must be prepared to understand other cultures and other ways of doing business. Engineers must expand their exportable skills, language and cross-cultural skills.

The College of Engineering has formed worldwide partnerships to create opportunities for students to work and study with leading universities in other countries and multinational corporations. With careful planning, students may earn credit in courses that fulfill their degree requirements. To learn more about work and study abroad, visit the Engineering International Engagement website: <http://www.engineering.iastate.edu/studyabroad/>. (<http://www.engineering.iastate.edu/studyabroad/>)

Departments of the College

For information on undergraduate options refer to the following curriculum sections, and for graduate specializations or certificate programs, refer to the Courses and Programs section of the catalog.

- Aerospace Engineering
- Agricultural and Biosystems Engineering
- Chemical and Biological Engineering
- Civil, Construction and Environmental Engineering
- Electrical and Computer Engineering
- Industrial and Manufacturing Systems Engineering
- Materials Science and Engineering
- Mechanical Engineering

Degree Programs

Aerospace Engineering
 Agricultural Engineering
 Biological Systems Engineering
 Biomedical Engineering
 Chemical Engineering
 Civil Engineering
 Computer Engineering
 Construction Engineering
 Cyber Security Engineering
 Electrical Engineering

Engineering Mechanics
 Environmental Engineering
 Industrial Engineering
 Materials Engineering
 Materials Science and Engineering
 Mechanical Engineering
 Software Engineering
 Systems Engineering

Minors

Biomedical Engineering
 Cyber-Physical Systems (<https://www.engineering.iastate.edu/cps-minor/>)
 Cyber Security
 Energy Systems Engineering
 Engineering Sales
 Non-Destructive Evaluation Engineering

Certificates

Cyber Security

Engineering

Engineering

Two Bachelor's Degrees versus a Degree and Second Major

A student with multiple curricula within the College of Engineering is permitted to earn only multiple degrees. All requirements for each curricula must be met plus an additional 30 credits for each curricula being pursued beyond the curriculum which requires the most credits.

The Engineering program of study is not offered as an additional major, it is only offered as a full degree program. Students pursuing an Engineering degree program are allowed to pursue additional majors in other eligible programs of study if desired.

Students in the College of Engineering are able to earn a degree with a second major/curriculum as long as the second major/curriculum is within another college, meets all requirements of the additional programs and contains a minimum of 15 additional credits beyond the requirements for a B.S. degree in engineering for each additional area of study.

Basic Program for Engineering Curricula

The Basic Program is a set of courses that provides a foundation common to all engineering curricula. Students normally enroll in most of the Basic Program courses during their first year. Before enrolling in engineering courses at the 2000-level and above, students enrolled in the College of Engineering must do the following:

1. Complete the Basic Program with a Basic Program grade point average (GPA) of at least 2.00.
2. Earn an ISU cumulative GPA of at least 2.00.

A grade of C or better is required for any transfer credit course applied to the Basic Program. Grades from transfer courses will not be used in computing the Basic Program GPA.

Students enrolled in the College of Engineering who have not met the above requirements may enroll for no more than two semesters in 2000-level engineering courses. Students not enrolled in the College of Engineering may take engineering courses as long as they meet the prerequisites and space is available; only the first two semesters of engineering courses at the 2000-level and above taken at ISU while a student is not enrolled in the College of Engineering can be applied toward an engineering degree.

Entering undergraduates must demonstrate proficiency in trigonometry based on test scores, or by having transfer credits from a college trigonometry course, or by-passing MATH 1430 Preparation for Calculus before enrolling in MATH 1650 Calculus I.

The Department of English may recommend placement in one or more sections of ENGL 0990 or ENGL 1010 if the placement test administered to students whose first language is not English indicates deficiencies. Satisfactory completion of the recommended English course(s) will be required of students to complete their Basic Program.

Basic Program

(A minimum GPA of 2.00 required for this set of courses. Transfer courses are not used in the Basic Program GPA computation).

MATH 1650	Calculus I	4
MATH 1660	Calculus II	4
ENGL 1500	Critical Thinking and Communication (Must have a C or better)	3
CHEM 1670 or CHEM 1770 or CHEM 2010	General Chemistry for Engineering Students General Chemistry I Advanced General Chemistry	4-5
ENGR 1010	Engineering Orientation *	R
PHYS 2310	Introduction to Classical Physics I	4
PHYS 2310L	Introduction to Classical Physics I Laboratory	1
LIB 1600	Introduction to College Level Research	1
ENGR 1600	Engineering Problems with Computer Applications Laboratory	3

Or one of the following in place of ENGR 1600

AERE 1600	Aerospace Engineering Problems With Computer Applications Laboratory
ABE 1600	Systematic Problem Solving and Computer Programming

BME 1600	Biomedical Engineering Problems with Computer Applications Laboratory	
CE 1600	Engineering Problems with Computational Laboratory	
CHE 1600	Chemical Engineering Problems with Computer Applications Laboratory	
CPRE 1850	Introduction to Computer Engineering and Problem Solving I	
EE 1850	Introduction to Electrical Engineering and Problem-Solving I	
IE 1600	Information Engineering	
ME 1600	Mechanical Engineering Problem Solving with Computer Applications	
SE 1850	Problem Solving in Software Engineering	
Total Credits		24-25

ENGL 2500 Written, Oral, Visual, and Electronic Composition is normally taken in the second year. With advanced placement to ENGL 2500, credit for ENGL 1500 Critical Thinking and Communication is earned upon successful completion of ENGL 2500 Written, Oral, Visual, and Electronic Composition, but only when ENGL 2500 Written, Oral, Visual, and Electronic Composition is completed at Iowa State.

* Students enrolled in the joint software engineering degree program should take SE 1010 Software Engineering Orientation, note that ENGR 1010 can be substituted for SE 1010.

Aerospace Engineering Undergraduate Study

The undergraduate curriculum in aerospace engineering leads to the degree Bachelor of Science. The Aerospace Engineering Program is accredited by the Engineering Accreditation Commission of ABET, <https://www.abet.org> (<https://www.abet.org/>), under the commission's General Criteria and Program Criteria for Aerospace and Similarly Named Engineering Programs.

The design, function and testing of vehicles and devices that operate in an atmosphere, space, or even underwater are included in the field of aerospace engineering and can be found in this curriculum. You'll be part of learning that involves such things as aerodynamics and propulsion (subsonic, transonic, supersonic and hypersonic aerodynamics, jet and rocket engine design); aircraft and spacecraft structures (materials properties, design of aircraft and spacecraft structure, materials testing and nondestructive evaluation); flight dynamics and control (aircraft and spacecraft flight dynamics, control systems, autonomy); software programming and much more. A wide variety of opportunities awaits the aerospace engineering graduate in research, development, design, production, sales, and management in the aerospace industry, and in

many related industries. Some of our graduates have become highly regarded professionals in the aerospace industry.

Our department is proud of a strong connection to NASA, which is directly involved in various programs available to our students, including the NASA-supported Iowa Space Grant Consortium (ISGC), part of the agency's National Space Grant College and Fellowship Program. It provides numerous opportunities for students through NASA internships, fellowships and scholarships, including the opportunity to spend time working and learning in NASA facilities. The ISGC is also highly involved in NASA-supported STEM (Science, Technology, Engineering, Math) programs that help encourage young people entering engineering and other fields of study.

The Make To Innovate (M:2:I) program is an exciting student program in our department that engages students in hands-on projects that further develop their understanding of engineering fundamentals. Design. Build. Test. Each year a large number of student teams work together to develop and advance projects that include such things as lunar vehicles, satellites, rockets, high altitude balloons, future design of commercial aircraft, and much more. Some of M:2:I's teams compete in national student competitions and have achieved impressive results.

There are many cooperative education and internship opportunities available to the department's undergraduate students that can place them in real-world work opportunities, while a student, with some of the leading aerospace industry employers or government agencies. The usual four-year curriculum is extended for students who participate in alternating industrial experience periods and academic periods. This arrangement offers valuable practical experience and financial assistance during the college years.

Undergraduate Mission and Educational Objectives

The Department of Aerospace Engineering maintains an internationally recognized academic program in aerospace engineering via ongoing consultation with students, faculty, industry, and aerospace professionals. Results of these consultations are used in a process of continuous academic improvement to provide the best possible education for our students.

Mission statement:

The mission of the aerospace engineering program is to prepare the aerospace engineering student for a career with wide-ranging opportunities in research, development, design, production, sales, and management in the aerospace industry and in the many related industries which are involved with the solution of multi-disciplinary, advanced technology problems.

Program Educational Objectives:

The objectives of the Aerospace Engineering program at ISU are to produce graduates:

- Who actively contribute to the field of aerospace, related fields or other disciplines;
- Are critical thinkers and lifelong learners; and
- Are aware of the societal, economic and environmental impact of their work.

Student Learning Outcomes

Upon graduation, students should have:

- An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
- An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
- An ability to communicate effectively with a range of audiences.
- An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
- An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
- An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
- An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

CURRICULUM IN AEROSPACE ENGINEERING

Leading to the degree Bachelor of Science.

TOTAL CREDITS REQUIRED: 129.0.

Any transfer credit courses applied to the degree program require a grade of C or better (but will not be calculated into the ISU cumulative GPA, Basic Program GPA or Core GPA). See also Basic Program and Special Programs. Note: Department does not allow Pass/Not Pass credits to be used to meet graduation requirements for either required or elective courses.

INTERNATIONAL PERSPECTIVES¹: 3 CR.

U.S. Cultures and Communities¹: 3 CR.

COMMUNICATION PROFICIENCY/LIBRARY REQUIREMENT:

ENGL 1500	Critical Thinking and Communication (Must have a C or better in this course)	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition (Must have a C or better in this course)	3
LIB 1600	Introduction to College Level Research	1
One of the following:		3
ENGL 3140	Technical Communication (C or better in this course)	3
ENGL 3090	Proposal and Report Writing (C or better in this course)	3

GENERAL EDUCATION ELECTIVES: 12.0 CR.²

Complete 12 cr. General Education Electives are requirements for graduation so may not be taken on a P-NP basis.

BASIC PROGRAM: 24 CR.

A minimum GPA of 2.00 required for this set of courses (please note that transfer course grades will not be calculated into the Basic Program GPA). See Requirement for Entry into Professional Program in College of Engineering Overview section.

CHEM 1670	General Chemistry for Engineering Students	4
or CHEM 1770 General Chemistry I		
ENGL 1500	Critical Thinking and Communication (Must have a C or better in this course)	3
ENGR 1010	Engineering Orientation	R
AERE 1600	Aerospace Engineering Problems With Computer Applications Laboratory ³	3
LIB 1600	Introduction to College Level Research	1
MATH 1650	Calculus I	4
MATH 1660	Calculus II	4
PHYS 2310	Introduction to Classical Physics I	4
PHYS 2310L	Introduction to Classical Physics I Laboratory	1
Total Credits		24

MATH AND PHYSICAL SCIENCE: 12 CR.

MATH 2650	Calculus III	4
MATH 2670	Elementary Differential Equations and Laplace Transforms	4
PHYS 2320	Introduction to Classical Physics II	4
Total Credits		12

AEROSPACE ENGINEERING CORE: 47 CR.

A minimum GPA of 2.00 required for this set of courses, including any transfer courses (please note that transfer course grades will not be calculated into the Core GPA):

AERE 2610	Introduction to Performance and Design	3
AERE 3100	Aerodynamics I: Incompressible Flow	3
AERE 3110	Aerodynamics II: Compressible Flow	3
AERE 3210	Flight Structures Analysis	3
AERE 3310	Flight Control Systems I	3
AERE 3220	Aerospace Structures Laboratory	2
AERE 3440	Aerodynamics and Propulsion Laboratory	3
AERE 3510	Astrodynamics I	3
AERE 3550	Aircraft Flight Dynamics and Control	3
AERE 4110	Aerospace Vehicle Propulsion	3
AERE 4150	Rocket Propulsion	3
or AERE 4330	Spacecraft Dynamics and Control	
AERE 4210	Advanced Flight Structures	3
AERE 4610	Modern Design Methodology with Astronautics Applications	3
or AERE 4600X	Modern Design Methodology with Aeronautics Applications	
AERE 4620	Design of Space Systems	3
or AERE 4700X	Design of Aeronautical Systems	
EM 3240	Mechanics of Materials	3
ME 2310	Engineering Thermodynamics I	3
Total Credits		47

OTHER REMAINING COURSES: 34 CR.

ENGL 2500	Written, Oral, Visual, and Electronic Composition (Must have a C or better in this course)	3
CE 2740	Engineering Statics	3
ME 3450	Engineering Dynamics	3
MATE 2730	Principles of Materials Science and Engineering	3
AERE 1610	Numerical, Graphical and Laboratory Techniques for Aerospace Engineering	4
AERE 3610	Computational Techniques for Aerospace Design	3
AERE 3620	Aerospace Systems Integration	3
3 credits from the following		3
any AERE or EM graduate level (5000+ level) course		
AERE 4070	Applied Formal Methods	
AERE 4120	Spacecraft Electric Propulsion	
AERE 4130X	Hypersonic Aerothermodynamics	
AERE 4150	Rocket Propulsion	
AERE 4170	Experimental Mechanics	

AERE 4220	Vibrations and Aeroelasticity	
AERE 4230	Composite Flight Structures	
AERE 4260	Design of Aerospace Structures	
AERE 4320	Flight Control Systems II	
AERE 4330	Spacecraft Dynamics and Control	
AERE 4420	V/STOL Aerodynamics and Performance	
AERE 4450	Experimental Flow Mechanics and Heat Transfer	
AERE 4460	Computational Fluid Dynamics	
AERE 4480	Fluid Dynamics of Turbomachinery	
AERE 4510	Orbital Mechanics	
AERE 4520	Introduction To Systems Engineering And Analysis	
AERE 4630	Introduction to Multidisciplinary Design Optimization	
AERE 4640	Spacecraft Systems	
AERE 4680	Large-Scale Complex Engineered Systems (LSCES)	
AERE 4730X	Random Variables	
AERE 4800	Ultrasonic Nondestructive Evaluation	
AERE 4830	Aeroacoustics	
One of the following:		3
ENGL 3140	Technical Communication (Must have a C or better in this course)	3
ENGL 3090	Proposal and Report Writing (Must have a C or better in this course)	3
Technical Electives (see below) ²		3
Career Electives (see below) ²		3
Total Credits		40

Technical Electives, 3 cr. and Career Electives, 3 cr. selected from preceding AERE list or departmental-approved 3000-level or above courses relevant to technical and career areas.

Seminar/Co-op/Internships/Flight Experience:

AERE 1920	Aerospace Seminar	R
AERE 3010	Flight Experience	R

Co-op and internships are optional

1. These university requirements will add to the minimum credits of the program unless the university-approved courses are also allowed by the department to meet other course requirements within the degree program. U.S. Cultures and Communities and International Perspectives courses may not be taken Pass/Not Pass.
2. Choose from department approved list. (http://www.aere.iastate.edu/students/undergraduate_program/)

3. See Basic Program for Professional Engineering Curricula for accepted substitutions for curriculum designated courses in the Basic Program.

See also: A 4-year plan of study grid showing course template by semester.

Aerospace Engineering, B.S.

Freshman

Fall	Credits Spring	Credits
MATH 1650	4 MATH 1660	4
CHEM 1670	4 PHYS 2310	4
AERE 1600	3 PHYS 2310L	1
LIB 1600	1 AERE 1610	4
ENGL 1500	3 General Education Elective	3
ENGR 1010	R AERE 1920	R
	15	16

Sophomore

Fall	Credits Spring	Credits
MATH 2650	4 MATH 2670	4
PHYS 2320	4 ME 3450	3
MATE 2730	3 EM 3240	3
CE 2740	3 AERE 2610	3
ENGL 2500	3 ENGL 3140 or 3090	3
	17	16

Junior

Fall	Credits Spring	Credits
AERE 3210	3 AERE 4210	3
AERE 3220	2 AERE 3610	3
ME 2310	3 AERE 3620	3
AERE 3100	3 AERE 3440	3
AERE 3510	3 AERE 3110	3
AERE 3550	3 AERE 3310	3
AERE 3010	R	
	17	18

Senior

Fall	Credits Spring	Credits
Technical Elective	3 Technical Elective	3
AERE 4610 or 4600X	3 Technical Elective	3
AERE 4110	3 AERE 4620 or 4700X	3
AERE 4150 or 4330	3 General Education Elective	3
General Education Elective	3 General Education Elective	3
	15	15

Nondestructive Evaluation (NDE)

The NDE Minor (http://catalog.iastate.edu/collegeofengineering/non_destructiveevaluationengineering/) is multidisciplinary and open to undergraduates in the College of Engineering.

BS/MS & BS/ME Degree Programs

The concurrent BS/MS & BS/ME (<https://www.aere.iastate.edu/graduate-students/concurrent-degrees/>) classification offers an opportunity for well-qualified Iowa State juniors and seniors to begin working on a master's degree before completing a bachelor's degree.

Graduate Study

The department offers graduate programs that lead to the degrees Master of Engineering, Master of Science, and Doctor of Philosophy with major in aerospace engineering and minor work to students taking major work in other departments. For all graduate degrees, it is possible to establish a co-major program with another graduate degree-granting department. Within the aerospace program, students can specialize in one or more of the following areas: aerospace systems design, atmospheric and space flight dynamics, computational fluid dynamics, control systems, wind engineering, fluid mechanics, optimization, structural analysis, and non-destructive evaluation.

Master of Science and Master of Engineering

The Master of Science degree requires a thesis and has strong research emphasis. The Master of Science degree is recommended for students who anticipate entering a doctoral program later. The Master of Engineering degree does not require either research credits or a thesis and is intended for students who do not anticipate pursuing a doctoral degree. The Master of Engineering degree can be completed with coursework only or with a combination of coursework and creative component. Credits for creative component will be obtained by registering for **AERE 5990 Creative Component**. A written report and an oral presentation will be given to the student's graduate committee.

At least 30 credits of acceptable graduate work are required for both the Master of Science and the Master of Engineering degrees. For specific course, research, and creative component requirements, see the departmental Graduate Student Handbook (<http://www.aere.iastate.edu/files/2015/04/AerE-Graduate-Handbook-Revised-S15.pdf>).

Bachelor of Science/Master of Science Concurrent Degree Program

The department offers concurrent BS/MS and BS/ME degree programs (<http://www.aere.iastate.edu/students/concurrent-degrees/>) and a concurrent B.S./MBA degree program which offer an opportunity for well-qualified Iowa State juniors and seniors to begin working on a master's degree before completing a bachelor's degree. The concurrent degree

programs reduce by one year the normal time period for completing both degrees separately.

Preparation for Graduate Work

The normal prerequisite for major graduate work in aerospace engineering is the completion of an undergraduate curriculum substantially equivalent to that required of aerospace engineering students at this university. Due to the diversity of interests of aerospace faculty, students whose prior undergraduate or graduate education has been in allied engineering and/or scientific fields may also qualify. In such cases, it may be necessary for the student to take additional work to provide the requisite aerospace background. A prospective graduate student is urged to specify the degree program and the specific field(s) of interest on the application for admission.

Courses are offered at the times stated in the course description. Where no specific time of offering is stated, the course may be offered during any semester provided there is sufficient demand.

Graduate Minor Work

Minor work for aerospace engineering majors is usually selected from mathematics, physics, electrical engineering, engineering mechanics, mechanical engineering, materials science, meteorology, computer science, and computer engineering.

Agricultural Engineering

For the undergraduate curriculum in Agricultural Engineering leading to the degree Bachelor of Science. The Agricultural Engineering Program is accredited by the Engineering Accreditation Commission of ABET, <https://www.abet.org>, under the commission's General Criteria and Program Criteria for Agricultural and Similarly Named Engineering Programs.

As an agricultural engineer, you apply your knowledge of the biological, physical, engineering, and technical sciences to solve problems for the world's largest industry – the agriculture and food system all while sustaining our natural resources.

The Agricultural Engineering program offers three focused degree options to align your passions for a career of impact:

Animal Production Systems Engineering: Design the next generation of livestock, poultry, and indoor plant production facilities with a systems-based approach integrating structural analysis, environmental control, manure/nutrient and energy optimization, and animal welfare. Areas of study also focus on precision livestock farming (PLF) and controlled environment agriculture (CEA) systems and technologies.

Land and Water Resources Engineering: Design, analyze, and implement sustainable solutions to enhance crop production while mitigating environmental impacts. Areas of study involve remote sensing, advanced

modeling, and watershed-based approaches to manage water resources, improve water quality, and protect natural resources.

Vehicle Systems Engineering: Develop, analyze, and improve the next generation of off-road vehicle systems and agricultural equipment. Areas of study involve mechanical systems, power transmission, controls and automation, and soil-crop-machine interactions.

Goal: To educate students in the analysis and design of machinery, animal housing, and environmental systems for the production, processing, storage, handling, distribution, and use of food, feed, fiber and other biomaterials, and the management of related natural resources, by integrating basic physical and biological sciences with engineering design principles.

Student Learning Outcomes: Graduates of the Agricultural Engineering curriculum should have, at the time of graduation:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Program Educational Objectives: Three to five years after graduation, our graduates will be using the knowledge, skills, and abilities from their agricultural engineering degree to improve the human condition through successful careers in a wide variety of fields. They will be effective leaders, collaborators, and innovators who address environmental, social, technical, and business challenges. They will be engaged in life-long learning and professional development through self-study, continuing education, or graduate/professional school.

Graduates find employment in diverse ag- and bio-related industries and government agencies dealing with agricultural machines and buildings,

animal and environmental control, grain processing and handling, soil and water resources, food, biorenewables, and biotechnology. Their work involves engineering design, development, testing, research, manufacturing, consulting, sales, and service. Students are highly encouraged to participate in either cooperative education or internship programs.

The department also offers a Bachelor of Science curriculum in biological systems engineering. Additionally, the department offers Bachelor of Science curricula in agricultural systems technology and in industrial technology.

Well-qualified juniors and seniors in agricultural engineering who are interested in graduate study may apply for concurrent enrollment in the Graduate College to simultaneously pursue a Bachelor of Science degree in agricultural engineering and a Master of Science degree in agricultural engineering. A concurrent Bachelor of Science and Master of Business Administration program is also offered by the department. Refer to Graduate Study for more information.

Curriculum in Agricultural Engineering

Administered by the Department of Agricultural and Biosystems Engineering.

Leading to the degree bachelor of science.

Total credits required:

126.0 cr Land and Water Resources Engineering Option

128.0 cr VEHICLE SYSTEMS Engineering Option

128.0 cr Animal Production Systems Engineering Option.

Any transfer credit courses applied to the degree program require a grade of C or better (but will not be calculated into the ISU cumulative GPA, Basic Program GPA or Core GPA). See also Basic Program and Special Programs. International Perspectives: 3 cr.¹

U.S. Cultures and Communities: 3 cr.¹

Communication Proficiency/Library requirement :

ENGL 1500	Critical Thinking and Communication (Must have a C or better in this course)	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition (Must have a C or better in this course)	3
LIB 1600	Introduction to College Level Research	1
Communication Elective: One of the following (Must have a C or better in this course)		3
AGEDS 3110	Presentation and Sales Strategies for Agricultural Audiences	
ENGL 3090	Proposal and Report Writing	
ENGL 3140	Technical Communication	
MKT 4500	Advanced Professional Selling	
SPCM 2120	Fundamentals of Public Speaking	
SPCM 3120	Business and Professional Speaking	

Social Sciences and Humanities: 12 cr.^{1,2}

3 credits from international perspectives-university approved list	3
3 credits from U.S. diversity-university approved list	3
6 credits from Social Sciences and Humanities courses-department approved list	6
Total Credits	12

Basic Program: 24 cr.

A minimum GPA of 2.00 required for this set of courses (please note that transfer course grades will not be calculated into the Basic Program GPA). See Requirement for Entry into Professional Program in College of Engineering Overview section. Within the Agricultural Engineering Basic Program, students are required to complete CHEM 1670 and CHEM 1670L or the sequence of CHEM 1770, CHEM 1770L, and CHEM 1780. This is a departmental requirement within the College of Engineering Basic Program requirements. CHEM 1780 credits can then be applied to the Math/Science Elective within the options of Power and Machinery Engineering and Animal Production Systems Engineering of the Agricultural Engineering major requirements.

ABE 1600	Systematic Problem Solving and Computer Programming ³	3
CHEM 1670	General Chemistry for Engineering Students	4
or CHEM 1770		
and		
CHEM 1780	General Chemistry II	
ENGL 1500	Critical Thinking and Communication (Must have a C or better in this course)	3
ENGR 1010	Engineering Orientation	R
LIB 1600	Introduction to College Level Research	1
MATH 1650	Calculus I	4
MATH 1660	Calculus II	4
PHYS 2310	Introduction to Classical Physics I	4
PHYS 2310L	Introduction to Classical Physics I Laboratory	1
Total Credits		24

Math and Physical Science: 7 cr.

CHEM 1670L	Laboratory in General Chemistry for Engineering	1
or CHEM 1770LLaboratory in General Chemistry I		
MATH 2660	Elementary Differential Equations	3
STAT 3050	Engineering Statistics	3
Total Credits		7

Ag Engineering Core: 35 cr.

(A minimum GPA of 2.00 required for this set of courses, including any transfer courses please note that transfer course grades will not be calculated into the Core GPA).

ABE 2160	Fundamentals of Agricultural and Biosystems Engineering	3
ABE 2180	Project Management & Design in Agricultural and Biosystems Engineering	2
ABE 3160	Applied Numerical Methods for Agricultural and Biosystems Engineering	3
ABE 3630	Agri-Industrial Applications of Electric Power and Electronics	4
ABE 3780	Mechanics of Fluids	3
ABE 4040	Instrumentation for Agricultural and Biosystems Engineering	3
ABE 4150	Agricultural & Biosystems Engineering Design I	2
ABE 4160	Agricultural & Biosystems Engineering Design II	2
CE 2740	Engineering Statics	3
EM 3240	Mechanics of Materials	3
EM 3270	Mechanics of Materials Laboratory	1
or ABE 3780L	Mechanics of Fluids Laboratory	
IE 3050	Engineering Economic Analysis	3
ME 2310	Engineering Thermodynamics I	3
Total Credits		35

Other Remaining Courses: 11 cr.

ABE 1100	Experiencing Agricultural and Biosystems Engineering	1
ABE 1700	Engineering Graphics and Introductory Design	3
ABE 2010	Preparing for Workplace Seminar	1
ENGL 2500	Written, Oral, Visual, and Electronic Composition (Must have a C or better in this course)	3
Communication Elective: One of the following (Must have a C or better in this course)		3
AGEDS 3110	Presentation and Sales Strategies for Agricultural Audiences	
ENGL 3090	Proposal and Report Writing	
ENGL 3140	Technical Communication	
MKT 4500	Advanced Professional Selling	
SPCM 2120	Fundamentals of Public Speaking	
SPCM 3120	Business and Professional Speaking	
Total Credits		11

Complete remaining courses from one of the following options:

Land and Water Resources Engineering Option: 37 cr.

ABE 4310	Design and Evaluation of Soil and Water Conservation Systems	3
AGRON 1810	Introduction to Crop Science	3
AGRON 1820	Introduction to Soil Science	3

BIOL 2510	Biological Processes in the Environment	3
or BIOL 2110		
CE 3260	Principles of Environmental Engineering	3
CE 3720	Engineering Hydrology and Hydraulics	3
GEOL 2010	Geology for Engineers and Environmental Scientists	3
MICRO 2010	Introduction to Microbiology	2
MICRO 2010L	Introductory Microbiology Laboratory	1
ABE 2730	CAD for Process Facilities and Land Use Planning	1
GIS Elective (One of the following):		3
CRP 2510	Fundamentals of Geographic Information Systems	
CRP 4510	Introduction to Geographic Information Systems	
ENSCI 2700	Geospatial Technologies	
GEOL 4520	Intro GIS for Geoscientists	
NREM 3450	Natural Resource Photogrammetry and Geographic Information Systems	
NREM 4460	Integrating GPS and GIS for Natural Resource Management	
Subsurface Systems Elective (One of the following):		3
CE 3600	Geotechnical Engineering	
CE 4730	Groundwater Hydrology	
Water Quality Elective (One of the following):		3
ABE 4320	Nonpoint Source Pollution and Control	
ABE 4370	Watershed Modeling and Policy	
ABE Breadth (One of the following):		3
ABE 3400	Functional Analysis of Soil, Crop, and Machine Systems	
ABE 3800	Principles of Biological Systems Engineering	
ABE 4240 (3 different 1cr modules)		
ABE 4400	Modeling and Simulation of Soil-Crop-Machine Systems	
ABE 4690	Engineering for Grain Storage, Preservation, Handling, and Processing Systems	
ABE 4720	Controlled Environments for Animals and Plants (offered Spring even years)	
ABE 4780	Wood Frame and Agri-Industrial Structures (offered Spring odd years)	
ABE 4800	Engineering Analysis of Biological Systems	
Total Credits		37

Vehicle Systems Engineering Option: 39 cr.

ABE 3400	Functional Analysis of Soil, Crop, and Machine Systems	3
ABE 3420	Agricultural Tractor Power	3

ABE 4100	Electronic Systems Integration for Agricultural Machinery	3
ABE 4130	Fluid Power Engineering	3
BIOL 2510	Biological Processes in the Environment	3
	or BIOL 2110	
ME 3450	Engineering Dynamics	3
	Computer Graphics (One of the following):	1
ABE 2710	Engineering Applications of Parametric Solid Modeling	
ABE 2720	Parametric Solid Models, Drawings, and Assemblies Using Creo Parametric	
ABE 2730	CAD for Process Facilities and Land Use Planning	
	ABE Elective (One of the following):	3
ABE 4310	Design and Evaluation of Soil and Water Conservation Systems	
ABE 4690	Engineering for Grain Storage, Preservation, Handling, and Processing Systems	
ABE 4720	Controlled Environments for Animals and Plants (offered Spring even years)	
ABE 4780	Wood Frame and Agri-Industrial Structures (offered Spring odd years)	
ABE 4800	Engineering Analysis of Biological Systems	
	Math/Science Elective	3
AGRON 1810	Introduction to Crop Science	
AGRON 1820	Introduction to Soil Science	
CHEM 1780	General Chemistry II (In combination with CHEM 1770)	
MATH 2070	Matrices and Linear Algebra	
MATH 2650	Calculus III	
PHYS 2320	Introduction to Classical Physics II	
PHYS 2320L	Introduction to Classical Physics II Laboratory	
	Complete 14 cr. Technical Electives ²	14
Total Credits		39

Animal Production Systems Engineering Option: 39 cr.

ABE 3270L	Animal Production Systems Design Lab	1
ABE 4690	Engineering for Grain Storage, Preservation, Handling, and Processing Systems	3
ABE 4720	Controlled Environments for Animals and Plants (offered Spring even years)	3
ABE 4780	Wood Frame and Agri-Industrial Structures (offered Spring odd years)	3
BIOL 2510	Biological Processes in the Environment	3
	or BIOL 2110	

CE 3320	Structural Analysis I	3
CE 3330	Structural Steel Design I	3
CE 3340	Reinforced Concrete Design I	3
TSM 3270	Livestock and Poultry Production: Facilities, Technology, and Management	3
	Animal Science/Horticulture Elective (One of the following):	3
ANS 2230	Poultry Science	
ANS 2250	Swine Science	
ANS 2260	Beef Cattle Science	
ANS 2290	Sheep Science	
ANS 2350	Dairy Cattle Science	
HORT 2210	Principles of Horticulture Science	
	Computer Graphics (One of the following):	1
ABE 2710	Engineering Applications of Parametric Solid Modeling	
ABE 2720	Parametric Solid Models, Drawings, and Assemblies Using Creo Parametric	
ABE 2730	CAD for Process Facilities and Land Use Planning (Preferred)	
	ABE elective (One of the following): ²	3
ABE 3400	Functional Analysis of Soil, Crop, and Machine Systems	
ABE 4310	Design and Evaluation of Soil and Water Conservation Systems	
ABE 4400	Modeling and Simulation of Soil-Crop-Machine Systems	
ABE 4800	Engineering Analysis of Biological Systems	
	Animal Production Systems Engineering Elective	4
CE 3600	Geotechnical Engineering	
ME 4360	Heat Transfer	
	Math/Science Elective	3
AGRON 1810	Introduction to Crop Science	
AGRON 1820	Introduction to Soil Science	
CHEM 1780	General Chemistry II (In combination with CHEM 1770)	
GEOL 2010	Geology for Engineers and Environmental Scientists	
HORT 3320	Greenhouse and Nursery Operations and Management	
MATH 2070	Matrices and Linear Algebra	
MATH 2650	Calculus III	
PHYS 2320	Introduction to Classical Physics II	

PHYS 2320L	Introduction to Classical Physics II Laboratory	
Total Credits		39

Co-op/Internships (Optional)

1. These university requirements will add to the minimum credits of the program unless the university-approved courses are also approved by the department to meet other course requirements within the degree program.
U.S. Cultures and Communities, International Perspectives and Social Science/Humanities courses may not be taken Pass/Not Pass.
2. Choose from department approved list. (<http://www.abe.iastate.edu/undergraduate-students/agricultural-engineering/ae-curricula/>)
3. See Basic Program for Professional Engineering Curricula for accepted substitutions for curriculum designated courses in the Basic Program.

TRANSFER CREDIT REQUIREMENTS

Students graduating with a degree in AE or BSE are required to have a minimum of 18 credits of 3000-level and 4000-level ABE courses taken at Iowa State University (excluding 4900, 4150, and 4160), and must complete the two-semester ABE Capstone sequence (ABE 4150 & 4160) at Iowa State University. The Department of Agricultural & Biosystems Engineering requires a grade of C or better for any transfer credit course that is applied to the degree program.

See also: A 4-year plan of study grid showing course template by semester.

Agricultural Engineering, B.S. - Vehicle Systems option

First Year

Fall	Credits Spring	Credits
ENGR 1010	R ABE 1100	1
ABE 1700	3 ABE 1600	3
CHEM 1670	4 MATH 1660	4
CHEM 1670L	1 PHYS 2310	4
MATH 1650	4 PHYS 2310L	1
ENGL 1500	3 ENGL 2500	3
LIB 1600	1	
	16	16

Second Year

Fall	Credits Spring	Credits
ABE 2160	3 ABE 2010	1
CE 2740	3 ABE 2180	2
MATH 2660	3 EM 3240	3
Math/Science Elective	3 STAT 3050	3
Technical Elective	3 Technical Elective	3

Computer Graphics Elective	1
International Perspectives Elective	3
15	16

Third Year

Fall	Credits Spring	Credits
ABE 3160	3 ABE 3420	3
ABE 3400	3 ABE 3780	3
ABE 3630	4 EM 3270 or ABE 3780L	1
ME 2310	3 BIOL 2510 or 2110	3
ME 3450	3 Technical Elective	3
	Communications Elective	3
	16	16

Fourth Year

Fall	Credits Spring	Credits
ABE 4150	2 ABE 4160	2
ABE 4040	3 ABE 4100	3
ABE 4130	3 ABE Elective	3
Technical Elective	3 IE 3050	3
Social Sciences or Humanities Elective	3 Social Science or Humanities Elective	3
U.S. Cultures and Communities Elective	3 Technical Elective	2
	17	16

Agricultural Engineering, B.S. - Animal Production Systems Engineering option

First Year

Fall	Credits Spring	Credits
ENGR 1010	R ABE 1100	1
ABE 1700	3 ABE 1600	3
CHEM 1670	4 MATH 1660	4
CHEM 1670L	1 PHYS 2310	4
MATH 1650	4 PHYS 2310L	1
ENGL 1500	3 ENGL 2500	3
LIB 1600	1	
	16	16

Second Year

Fall	Credits Spring	Credits
ABE 2160	3 ABE 2010	1
CE 2740	3 ABE 2180	2
MATH 2660	3 EM 3240	3
TSM 3270	3 ME 2310	3

ABE 3270L	1 STAT 3050	3
U.S. Cultures and Communities Elective	3 BIOL 2110 or 2510	3
16		15

Third Year

Fall	Credits Spring	Credits
ABE 3160	3 ABE 4780	3
ABE 3630	4 CE 3330	3
ABE 3780	3 IE 3050	3
CE 3320	3 Computer Graphics Elective	1
EM 3270 or ABE 3780L	1 Communication Elective	3
Math/Science Elective	3 International Perspective Elective	3
17		16

Fourth Year

Fall	Credits Spring	Credits
ABE 4150	2 ABE 4160	2
ABE 4040	3 ABE 4690	3
ABE Elective	3 ABE 4720	3
ANS/HORT Elective	3 CE 3340	3
Animal Production Systems Engineering Elective	4 Social Science or Humanities Elective	3
Social Science or Humanities Elective	3	
18		14

Agricultural Engineering, B.S. - Land and Water Resources Engineering
option

First Year

Fall	Credits Spring	Credits
ENGR 1010	R ABE 1100	1
ABE 1700	3 ABE 1600	3
CHEM 1670	4 MATH 1660	4
CHEM 1670L	1 PHYS 2310	4
MATH 1650	4 PHYS 2310L	1
ENGL 1500	3 ENGL 2500	3
LIB 1600	1	
16		16

Second Year

Fall	Credits Spring	Credits
ABE 2160	3 ABE 2010	1
CE 2740	3 ABE 2180	2
MATH 2660	3 ME 2310	3

AGRON 1810	3 ABE 3780	3
AGRON 1820	3 ABE 3780L	1
	STAT 3050	3
	BIOL 2510 or 2110	3
15		16

Third Year

Fall	Credits Spring	Credits
ABE 3160	3 ABE 2730	1
ABE 3630	4 ABE 4310	3
CE 3720	3 EM 3240	3
GIS Elective	3 MICRO 2010	2
Communication Elective	3 MICRO 2010L	1
	ABE Breadth Elective	3
	U.S. Cultures and Communities Elective	3
16		16

Fourth Year

Fall	Credits Spring	Credits
ABE 4150	2 ABE 4160	2
ABE 4040	3 CE 3260	3
GEO 2010	3 IE 3050	3
Water Quality Elective	3 Subsurface Systems Elective	3
Social Science or Humanities Elective	3 Social Science or Humanities Elective	3
International Perspectives Elective	3	
17		14

Concurrent B.S./Master's Engineering Degree

The Department of Agricultural and Biosystems Engineering has concurrent Bachelor of Science /Master of Science (B.S./M.S.) program in agricultural and biosystems engineering designed especially for departmental seniors who wish to pursue advanced studies. Up to 6 credits of graduate course work can be used to satisfy your program requirements for both degrees.

The concurrent B.S./M.S. program allows seniors to:

- Become eligible for a research assistantship during their senior year.
- Complete an M.S. degree (with thesis) within 18 months of B.S. graduation.

For more information about our concurrent undergraduate and graduate programs in Agricultural & Biosystems Engineering, visit: <https://www.abe.iastate.edu/graduate-students/abe-concurrent-degrees/>.

Concurrent B.S. in Agricultural Engineering and MBA in the College of Business

Accelerate Your Career with an MBA

Today's successful engineers often need strong business management skills to complement their degree in engineering. These skills are especially important for engineers who are interested in working for technical companies, launching their own business ventures, or pursuing nontraditional jobs such as consulting. The MBA provides an opportunity for competitive advantage for advancement into management positions.

The Colleges of Business and Engineering offer an integrated, concurrent program leading to Bachelor of Science and Master of Business Administration degrees. The program is designed to be completed in a minimum of five academic years or ten semesters. The actual time for completion may be longer depending upon semester course loads, internships, and course sequencing.

For more information about our concurrent undergraduate and graduate programs in Agricultural & Biosystems Engineering, visit: <https://www.abe.iastate.edu/graduate-students/abe-concurrent-degrees/>.

Graduate Study

The department offers Master of Science, Master of Engineering, and Doctor of Philosophy degrees with a major in agricultural and biosystems engineering. Within the agricultural and biosystems engineering major the student may specialize in advanced machinery engineering, animal production systems engineering, biological and process engineering, occupational safety engineering, or water and environmental stewardship engineering. For more information about our concurrent undergraduate and graduate programs in Agricultural & Biosystems Engineering, visit: <https://www.abe.iastate.edu/graduate-students/agricultural-engineering/>

For the Master of Science program, at least 30 credits of acceptable graduate work must be completed with a minimum of 22 credits of course work; corresponding numbers for the Master of Engineering program are 32 and 27. For the Doctor of Philosophy degree, at least 72 credits of acceptable graduate work must be completed with a minimum of 42 credits of course work. All Ph.D. students must complete a teaching/extension experience prior to graduation.

The department also offers both master of science and Doctor of Philosophy degrees in industrial and agricultural technology.

The department also participates in interdepartmental majors in environmental science, sustainable agriculture, human-computer interaction, and toxicology (see Index).

Biological Systems Engineering

For the undergraduate curriculum in Biological Systems Engineering leading to the degree Bachelor of Science. The Biological Systems Engineering Program is accredited by the Engineering Accreditation Commission of ABET, <https://www.abet.org> (<https://www.abet.org/>), under the commission's General Criteria and Program Criteria for Biological and Similarly Named Engineering Programs.

Biological Systems Engineers use their understanding of science and engineering to inspire designs and solve novel problems using natural systems as inspiration. Biological Systems Engineering integrates life sciences, biology, and chemistry with engineering to develop solutions for biological and ecological systems. Biological systems scale from microbes to ecosystems. They approach analysis and design from a systems perspective, appreciating the complexity of biological systems and developing solutions that accommodate and anticipate the adaptability of biological systems.

The Biological Systems Engineering program offers three focused degree options allowing students to craft their degree to match their career aspirations.

Ecological Engineering: Use biology, ecology, and engineering principles to design ecosystems for the mutual benefit of humans and nature. Enjoy a career that emphasizes the design, management, and restoration of ecosystems with roles in consulting firms, governmental agencies, and industry.

Food and Bioprocessing Engineering: Design and operate modern food processing systems, such as food pasteurization, sterilization, freezing, and hydration while improving the economic and environmental sustainability of biorenewable resource production systems. Enjoy a career improving the safety and quality of food by applying engineering, biology, and chemistry principles and emphasize the design and operation of industrial-scale bioconversion systems.

Open Option: Craft the degree to prepare for a professional degree program outside of engineering. Enjoy a career in academia, law, or industry that has a foundation in problem solving, systems approaches, biology, and chemistry.

Goal: To educate students to solve problems related to biorenewables production and processing, water quality, environmental impacts of the bioeconomy, food processing, and biosensors, and in so doing to prepare students for professional practice and post-graduate educational opportunities.

Student Learning Outcomes: Graduates of the Biological Systems Engineering curriculum should have at the time of graduation:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Program Educational Objectives: Three to five years after graduation, our graduates will be using the knowledge, skills, and abilities from their biological systems engineering degree to improve the human condition through successful careers in a wide variety of fields. They will be effective leaders, collaborators, and innovators who address environmental, social, technical, and business challenges. They will be engaged in life-long learning and professional development through self-study, continuing education, or graduate/professional school.

Well-qualified juniors and seniors in biological systems engineering who are interested in graduate study may apply for concurrent enrollment in the Graduate College to simultaneously pursue a Bachelor of Science degree in biological systems engineering and a Master of Science degree in agricultural engineering. Under concurrent enrollment, students are eligible for assistantships and simultaneously take undergraduate and graduate courses.

A concurrent Bachelor of Science and Master of Business Administration program is also offered by the department.

The department also offers a Bachelor of Science curriculum in agricultural engineering. See College of Engineering. Additionally, the department offers Bachelor of Science curricula in agricultural systems technology and in industrial technology. See College of Agriculture and Life Sciences.

The department also participates in interdepartmental majors in environmental science, sustainable agriculture, human computer interaction, and toxicology (see Index (<http://catalog.iastate.edu/azindex/>)).

Curriculum in Biological Systems Engineering

Administered by the Department of Agricultural and Biosystems Engineering.

Leading to the degree Bachelor of Science.

Total credits required:

129.0 cr Ecological Engineering Option

128.0 cr Food & Bioprocess Engineering Option

128.0cr Open Option.

Any transfer credit courses applied to the degree program require a grade of C or better (but will not be calculated into the ISU cumulative GPA, Basic Program GPA or Core GPA). See also Basic Program and Special Programs.

International Perspectives: 3 cr.¹

U.S. Cultures and Communities: 3 cr.¹

Communication Proficiency/Library requirement:

ENGL 1500	Critical Thinking and Communication (Must have a C or better in this course)	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition (Must have a C or better in this course)	3
LIB 1600	Introduction to College Level Research	1
Communication Elective: One of the following (Must have a C or better in this course)		3
AGEDS 3110	Presentation and Sales Strategies for Agricultural Audiences	
ENGL 3090	Proposal and Report Writing	
ENGL 3140	Technical Communication	
MKT 4500	Advanced Professional Selling	
SPCM 2120	Fundamentals of Public Speaking	
SPCM 3120	Business and Professional Speaking	

Social Sciences and Humanities: 12 cr.^{1,2}

3 credits from international perspectives-university approved list	3
3 credits from U.S. diversity-university approved list	3
6 credits from Social Sciences and Humanities courses-department approved list	6

Total Credits 12

Basic Program: 24 cr.

A minimum GPA of 2.00 required for this set of courses (please note that transfer course grades will not be calculated into the Basic Program GPA). See Requirement for Entry into Professional Program in College of Engineering Overview section. Within the Biological Systems Engineering Basic Program, students are required to complete CHEM 1670 and

CHEM 1670L or the sequence of CHEM 1770, CHEM 1770L, and CHEM 1780. This is a departmental requirement within the College of Engineering Basic Program requirements. The CHEM 1780 course will show as completing the chemistry portion of the Basic Program and the credits will be applied towards a student's classification.

ABE 1600	Systematic Problem Solving and Computer Programming ³	3
CHEM 1670	General Chemistry for Engineering Students or CHEM 1770 and CHEM 1780	4
ENGL 1500	Critical Thinking and Communication (Must have a C or better in this course)	3
ENGR 1010	Engineering Orientation	R
LIB 1600	Introduction to College Level Research	1
MATH 1650	Calculus I	4
MATH 1660	Calculus II	4
PHYS 2310	Introduction to Classical Physics I	4
PHYS 2310L	Introduction to Classical Physics I Laboratory	1
Total Credits		24

Biological, Math and Physical Science: 14 cr.

BIOL 2120	Principles of Biology II	3
CHEM 1670L	Laboratory in General Chemistry for Engineering or CHEM 1770L Laboratory in General Chemistry I	1
MATH 2670	Elementary Differential Equations and Laplace Transforms	4
MICRO 3020	Biology of Microorganisms	3
STAT 3050	Engineering Statistics	3
Total Credits		14

Biological Systems Engineering Core: 42 cr.

(A minimum GPA of 2.00 required for this set of courses, including any transfer courses; please note that transfer course grades will not be calculated into the Core GPA).

ABE 2160	Fundamentals of Agricultural and Biosystems Engineering	3
ABE 2180	Project Management & Design in Agricultural and Biosystems Engineering	2
ABE 2730	CAD for Process Facilities and Land Use Planning	1
ABE 3160	Applied Numerical Methods for Agricultural and Biosystems Engineering	3
ABE 3630	Agri-Industrial Applications of Electric Power and Electronics	4
ABE 3780	Mechanics of Fluids	3
ABE 3800	Principles of Biological Systems Engineering	3

ABE 4040	Instrumentation for Agricultural and Biosystems Engineering	3
ABE 4150	Agricultural & Biosystems Engineering Design I	2
ABE 4160	Agricultural & Biosystems Engineering Design II	2
ABE 4800	Engineering Analysis of Biological Systems	3
CE 2740	Engineering Statics	3
EM 3240	Mechanics of Materials	3
EM 3270	Mechanics of Materials Laboratory or ABE 3780L Mechanics of Fluids Laboratory	1
IE 3050	Engineering Economic Analysis	3
ME 2310	Engineering Thermodynamics I	3
Total Credits		42

Other Remaining Courses: 11 cr.

ABE 1100	Experiencing Agricultural and Biosystems Engineering	1
ABE 1700	Engineering Graphics and Introductory Design	3
ABE 2010	Preparing for Workplace Seminar	1
ENGL 2500	Written, Oral, Visual, and Electronic Composition (Must have a C or better in this course)	3
Communication Elective: One of the following (Must have a C or better in this course)		3
AGEDS 3110	Presentation and Sales Strategies for Agricultural Audiences	
ENGL 3090	Proposal and Report Writing	
ENGL 3140	Technical Communication	
MKT 4500	Advanced Professional Selling	
SPCM 2120	Fundamentals of Public Speaking	
SPCM 3120	Business and Professional Speaking	
Total Credits		11

Complete remaining courses from one of the following options:

Ecological Engineering Option: 26 cr.

ABE 3340X	Principles of Ecological Engineering	3
ABE 4310	Design and Evaluation of Soil and Water Conservation Systems	3
ABE 4340	Ecosystem Restoration Engineering	3
BIOL 3120	Ecology	4
CE 3720	Engineering Hydrology and Hydraulics	3
CHEM 2110	Quantitative and Environmental Analysis	2
CHEM 2110L	Quantitative and Environmental Analysis Laboratory	2
Ecological Elective ²		6
Total Credits		26

Food & Bioprocess Engineering Option: 25 cr.

ABE 4500	Emerging Technologies in Biomanufacturing	3
ABE 4510	Food and Bioprocess Engineering	3
ABE 4690	Engineering for Grain Storage, Preservation, Handling, and Processing Systems	3
ME 4360	Heat Transfer	4
CHEM 2310	Elementary Organic Chemistry	3
CHEM 2310L	Laboratory in Elementary Organic Chemistry	1
FSHN 3110	Food Chemistry	3
FSHN 3110L	Food Chemistry Laboratory	1
MICRO 3020L	Microbiology Laboratory	1
Option Elective (select 3 cr from the following):		3
ABE 3250	Biorenewable Systems	
FSHN 4200	Food Microbiology	
FSHN 4710	Food Processing	
SCM 3010	Supply Chain Management	
Total Credits		25

Open Option: 25 cr.

ABE 4510	Food and Bioprocess Engineering	3
ME 4360	Heat Transfer	4
CHEM 3310	Organic Chemistry I	3
CHEM 3310L	Laboratory in Organic Chemistry I	1
CHEM 3320	Organic Chemistry II	3
CHEM 3320L	Laboratory in Organic Chemistry II	1
MICRO 3020L	Microbiology Laboratory	1
Sequence I, II & III Elective ²		9
Total Credits		25

Co-op/Internships (Optional)

- These university requirements will add to the minimum credits of the program unless the university-approved courses are also approved by the department to meet other course requirements within the degree program.
U.S. Cultures and Communities, International Perspectives and Social Science/Humanities courses may not be taken Pass/Not Pass.
- Choose from department approved list. (<http://www.abe.iastate.edu/undergraduate-students/biological-systems-engineering/bse-curricula/>)
- See Basic Program for Professional Engineering Curricula for accepted substitutions for curriculum designated courses in the Basic Program.

TRANSFER CREDIT REQUIREMENTS

Students graduating with a degree in AE or BSE are required to have a minimum of 18 credits of 3000-level and 4000-level ABE courses taken

at Iowa State University (excluding 4900, 4150, and 4160), and must complete the two-semester ABE Capstone sequence (ABE 4150 & 4160) at Iowa State University. The Department of Agricultural & Biosystems Engineering requires a grade of C or better for any transfer credit course that is applied to the degree program.

See also: A 4-year plan of study grid showing course template by semester for Biological Systems Engineering.

Biological Systems Engineering, B.S. - Ecological Engineering Option

First Year

Fall	Credits Spring	Credits
ENGR 1010	R ABE 1100	1
ABE 1700	3 ABE 1600	3
CHEM 1670	4 MATH 1660	4
CHEM 1670L	1 PHYS 2310	4
MATH 1650	4 PHYS 2310L	1
ENGL 1500	3 BIOL 2120	3
LIB 1600	1	
16		16

Second Year

Fall	Credits Spring	Credits
ABE 2160	3 ABE 2010	1
CE 2740	3 ABE 2180	2
CHEM 2110	2 MATH 2670	4
CHEM 2110L	2 STAT 3050	3
ENGL 2500	3 ABE 3780	3
BIOL 3120	4 ABE 3780L or EM 3270	1
	U.S. Communities & Cultures	3
	Elective	
17		17

Third Year

Fall	Credits Spring	Credits
ABE 2730	1 ABE 3630	4
ABE 3160	3 ABE 3800	3
ABE 3340X	3 ABE 4310	3
CE 3720	3 EM 3240	3
ME 2310	3 IE 3050	3
Communication Elective	3	
16		16

Fourth Year

Fall	Credits Spring	Credits
ABE 4150	2 ABE 4160	2
ABE 4040	3 Ecological Elective	3

ABE 4340	3 Ecological Elective	3	Fourth Year		
ABE 4800	3 Social Science or Humanities Elective	3	Fall	Credits Spring	Credits
			ABE 4150	2 ABE 4160	2
MICRO 3020	3 International Perspectives Elective	3	ABE 4040	3 ABE 4510	3
Social Science or Humanities Elective	3		ABE 4800	3 EM 3270 or ABE 3780L	1
			ABE 4500	3 ME 4360	4
			Option Elective	3 Social Science or Humanities Elective	3
17		14			
Biological Systems Engineering, B.S. Food & Bioprocess Engineering Option			International Perspectives Elective	3 Social Science or Humanities Elective	3
				17	16
First Year			Biological Systems Engineering, B.S. - Open Option		
Fall	Credits Spring	Credits	First Year		
ENGR 1010	R ABE 1100	1	Fall	Credits Spring	Credits
ABE 1700	3 ABE 1600	3	ENGR 1010	R ABE 1100	1
MATH 1650	4 MATH 1660	4	ABE 1700	3 ABE 1600	3
CHEM 1670	4 PHYS 2310	4	CHEM 1670	4 MATH 1660	4
CHEM 1670L	1 PHYS 2310L	1	CHEM 1670L	1 PHYS 2310	4
ENGL 1500	3 ENGL 2500	3	MATH 1650	4 PHYS 2310L	1
LIB 1600	1		ENGL 1500	3 ENGL 2500	3
	16	16	LIB 1600	1	
Second Year				16	16
Fall	Credits Spring	Credits	Second Year		
ABE 2160	3 ABE 2010	1	Fall	Credits Spring	Credits
CE 2740	3 ABE 2180	2	ABE 2160	3 ABE 2010	1
BIOL 2120	3 ABE 2730	1	CE 2740	3 ABE 2180	2
CHEM 2310	3 MATH 2670	4	BIOL 2120	3 ABE 2730	1
CHEM 2310L	1 MICRO 3020	3	CHEM 3310	3 CHEM 3320	3
U.S. Cultures and Communities Elective	3 MICRO 3020L	1	CHEM 3310L	1 CHEM 3320L	1
	ME 2310	3	U.S. Cultures and Communities Elective	3 MATH 2670	4
	16	15		ME 2310	3
Third Year				16	15
Fall	Credits Spring	Credits	Third Year		
ABE 3160	3 ABE 3630	4	Fall	Credits Spring	Credits
ABE 3780	3 ABE 3800	3	ABE 3160	3 ABE 3630	4
STAT 3050	3 ABE 4690	3	ABE 3780	3 ABE 3800	3
FSHN 3110	3 EM 3240	3	MICRO 3020	3 EM 3240	3
FSHN 3110L	1 IE 3050	3	MICRO 3020L	1 IE 3050	3
Communication Elective	3		STAT 3050	3 Sequence I Elective	3
	16	16	Communication Elective	3	
				16	16

Fourth Year

Fall	Credits Spring	Credits
ABE 4150	2 ABE 4160	2
ABE 4040	3 ABE 4510	3
ABE 4800	3 EM 3270 or ABE 3780L	1
Sequence II Elective	3 ME 4360	4
International Perspectives Elective	3 Sequence III Elective	3
Social Science or Humanities Elective	3 Social Science or Humanities Elective	3
	17	16

Concurrent B.S./Master's Engineering Degree

The Department of Agricultural and Biosystems Engineering has concurrent Bachelor of Science /Master of Science (B.S./M.S.) program in agricultural and biosystems engineering designed especially for departmental seniors who wish to pursue advanced studies. Up to 6 credits of graduate course work can be used to satisfy your program requirements for both degrees

The concurrent B.S./M.S. program allows seniors to:

- Become eligible for a research assistantship during their senior year.
- Complete an M.S. degree (with thesis) within 18 months of B.S. graduation.

For more information about our concurrent undergraduate and graduate programs in Agricultural & Biosystems Engineering, visit: <https://www.abe.iastate.edu/graduate-students/abe-concurrent-degrees/>.

Concurrent B.S. in Biological Systems Engineering and MBA in the College of Business**Accelerate Your Career with an MBA**

Today's successful engineers often need strong business management skills to complement their degree in engineering. These skills are especially important for engineers who are interested in working for technical companies, launching their own business ventures, or pursuing nontraditional jobs such as consulting. The MBA provides an opportunity for competitive advantage for advancement into management positions.

The Colleges of Business and Engineering offer an integrated, concurrent program leading to Bachelor of Science and Master of Business Administration degrees. The program is designed to be completed in a minimum of five academic years or ten semesters. The actual time for completion may be longer depending upon semester course loads, internships, and course sequencing.

For more information about our concurrent undergraduate and graduate programs in Agricultural & Biosystems Engineering, visit: <https://www.abe.iastate.edu/graduate-students/abe-concurrent-degrees/>.

Graduate Study

The department offers Master of Science, Master of Engineering, and Doctor of Philosophy degrees with a major in agricultural and biosystems engineering. Within the agricultural and biosystems engineering major the student may specialize in advanced machinery engineering, animal production systems engineering, biological and process engineering, occupational safety engineering, or water and environmental stewardship engineering. For more information about our concurrent undergraduate and graduate programs in Agricultural & Biosystems Engineering, visit: <https://www.abe.iastate.edu/graduate-students/agricultural-engineering/>

For the Master of Science program, at least 30 credits of acceptable graduate work must be completed with a minimum of 22 credits of course work; corresponding numbers for the Master of Engineering program are 32 and 27. For the Doctor of Philosophy degree, at least 72 credits of acceptable graduate work must be completed with a minimum of 42 credits of course work. All Ph.D. students must complete a teaching/extension experience prior to graduation.

The department also offers both master of science and Doctor of Philosophy degrees in industrial and agricultural technology.

The department also participates in interdepartmental majors in environmental science, sustainable agriculture, human-computer interaction, and toxicology (see Index).

Biomedical Engineering Undergraduate Study

For undergraduate curriculum in biomedical engineering leading to the degree Bachelor of Science.

engineering.iastate.edu/bme/ (<https://www.engineering.iastate.edu/bme/>)

Administered as an interdepartmental degree program.

Biomedical engineering seeks to better human health by designing engineered systems that can interface with biomedical systems or by controlling the biomedical systems themselves. Biomedical engineers leverage their deep understanding of fundamental scientific disciplines including physics, chemistry and biology as well as a broad understanding of different traditional engineering disciplines such as chemical, electrical and mechanical engineering. Broad areas of biomedical engineering include medical molecules and materials, biomedical mechanics and manufacturing and biomedical

instrumentation that allow for engineering of cells and tissues or delivery of drugs and vaccines or devices that can detect or alleviate disease, regenerate tissue or assist after injury.

Practicing biomedical engineers work in research, uncovering fundamental properties of either biomedical systems or the engineered systems with which they interface. They work as product engineers, bringing innovative technology to bear in a usable product that can pass approval processes by the relevant regulatory organizations or process engineers, developing manufacturing approaches that can produce products economically, safely and under the proper conditions to ensure their use in the human body. Finally, biomedical engineers work in technical sales, intellectual property or governmental regulation.

The curriculum of biomedical engineering includes broad training in math, chemistry, physics, biology as well as engineering sciences such as thermodynamics, materials, fluid and solid mechanics and circuits. The curriculum also provides training in areas such as disease therapeutics and drug delivery, implants and tissue engineering, advanced diagnostics and biosensors, prosthetics and organ mechanics, medical device manufacturing, and medical imaging and equipment electronics. This training will culminate in lab and design courses that will emphasize a synthesis of these topics to design, build and test biomedical systems.

The curriculum will prepare students for a career in serving society through designing and manufacturing biomedical systems that improve human health. The curriculum will also prepare students to navigate difficult ethical questions through training in bioethics and will include broader training in the social sciences and humanities. This prepares graduates to better gauge the impact of biomedical engineering design decisions on broader society. Finally, graduates will be well-trained to communicate both with other technical colleagues as well as the broader public that benefits from the biomedical engineering products.

Student Learning Outcomes

Graduates of the biomedical engineering curriculum should have, at the time of graduation:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Program Educational Objectives

The objectives of the biomedical engineering program at Iowa State University are to produce graduates who:

- Will excel in careers as professional biomedical engineers in the businesses and industries related to biomedical engineering.
- Will successfully pursue research and advanced studies in biomedical engineering or in related professional fields such as medicine, law and business.

A cooperative education program is available to students in biomedical engineering.

Curriculum in Biomedical Engineering

Total credits required: 129

See also basic program and special programs.

The BME Program requires a grade of C or better from any transfer credit course that is applied to the degree program but will not be calculated into the ISU cumulative GPA, Basic Program GPA, or Core GPA.

BASIC PROGRAM: 24 CR.

A minimum GPA of 2.00 required for this set of courses (please note that transfer course grades will not be calculated into the Basic Program GPA). See Basic Program for Engineering Curricula in College of Engineering section.

BME 1600	Biomedical Engineering Problems with Computer Applications Laboratory ³	3
CHEM 1670 or CHEM 1770	General Chemistry for Engineering Students General Chemistry I	4
ENGL 1500	Critical Thinking and Communication	3
ENGR 1010	Engineering Orientation	R
LIB 1600	Introduction to College Level Research	1
MATH 1650	Calculus I	4
MATH 1660	Calculus II	4
PHYS 2310	Introduction to Classical Physics I	4
PHYS 2310L	Introduction to Classical Physics I Laboratory	1
Total Credits		24

Social Sciences and Humanities: 12 cr.

Complete a total of 12 cr. with at least 6 cr., but not more than 9 cr., from the same department.

INTERNATIONAL PERSPECTIVES¹: 3 CR.**U.S. Cultures and Communities¹: 3 CR.****COMMUNICATION PROFICIENCY:**

ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
ENGL 3140	Technical Communication	3

Bioethics: 3 cr.

Choose from PHIL 3310 Moral Problems in Medicine, PHIL 3360 Bioethics and Biotechnology, or PHIL 3430 Philosophy of Technology

Foundational Courses: 34 cr.

BIOL 2120	Principles of Biology II	3
BIOL 2120L	Principles of Biology Laboratory II	1
BIOL 3350	Principles of Human and Other Animal Physiology	3
BIOL 3500	Comprehensive Human Anatomy	4
or BMS 4470	Introduction to Human Gross Anatomy	
or BMS 4480	Principles of Human Gross Anatomy	
CHEM 1670L	Laboratory in General Chemistry for Engineering	1
or CHEM 1770L	Laboratory in General Chemistry I	
MATH 2650	Calculus III	4
MATH 2670	Elementary Differential Equations and Laplace Transforms	4
MATE 2730	Principles of Materials Science and Engineering	3
ME 2310	Engineering Thermodynamics I	3
or MATE 3110	Thermodynamics in Materials Engineering	
PHYS 2320	Introduction to Classical Physics II	4
PHYS 2320L	Introduction to Classical Physics II Laboratory	1
STAT 3050	Engineering Statistics	3

Total Credits 34

FOUNDATIONAL ELECTIVES²: 14 CR.

BME 3600	Biotransport	3
BBMB 3030	General Biochemistry	3
CE 2740	Engineering Statics	3
CHEM 1780 & 1780L	General Chemistry II and Laboratory in College Chemistry II	4
CHEM 2310 & 2310L	Elementary Organic Chemistry and Laboratory in Elementary Organic Chemistry	4
or CHEM 3310 & 3310L	Organic Chemistry I and Laboratory in Organic Chemistry I	
EE 2850	Problem Solving Methods and Tools for Electrical Engineering	4
EE 3140	Electromagnetics for non Electrical Engineers	3

EE 4420	Introduction to Circuits and Instruments	2
EE 4480	Introduction to AC Circuits and Motors	2
ME 3240L & ME 3240	Manufacturing Engineering Laboratory and Manufacturing Engineering	4
ME 3450	Engineering Dynamics	3
ME 3700	Engineering Measurements	3

BME Core: 24 cr.

A minimum GPA of 2.00 is required for this set of courses (please note that transfer course grades will not be calculated into the Core Program GPA).

BME 1040	Biomedical Engineering First-Year Learning Community	R
BME 2010	Faculty-guided Professional Development in Biomedical Engineering	R
BME 2200	Introduction to Biomedical Engineering	3
BME 2700	Introduction to Biomedical Engineering Design	2
BME 3400	Numerical Analysis in Biomedical Engineering	3
BME 3500	Bioinstrumentation	4
BME 3520	Molecular, Cellular and Tissue Biomechanics	3
BME 3520L	Molecular, Cellular and Tissue Biomechanics Lab	1
BME 3540	Introduction to Biomaterials	3
BME 3540L	Survey of Biomaterials Lab	1
BME 4200	Biomedical Engineering Design I	2
BME 4300	Biomedical Engineering Design II	2

Total Credits 24

Note: Students with transfer credits in Biomedical Engineering core courses must earn at least 18 semester credits in ISU courses in this category at the 3000-level or above to qualify for the B.S. degree in Biomedical Engineering.

ELECTIVES²: 12 CR.

Complete 6 credits of BME Electives from approved list	6
Complete 3 credits of Engineering Electives from approved list	3
Complete 3 credits of Bioscience Electives from approved list	3
Total Credits	12

¹ These university requirements will add to the minimum credits of the program unless the university-approved courses are also approved by the department to meet other course requirements within the degree program. U.S. Cultures and Communities and International Perspectives courses may not be taken Pass-Not Pass.

² Electives used to meet graduation requirements may not be taken Pass-Not Pass.

³ See Basic Program for Engineering Curricula for accepted substitutions for curriculum designated courses in the Basic Program.

Four-Year Plans
Medical Molecules and Materials Emphasis

Freshman		
Fall	Credits Spring	Credits
MATH 1650	4 MATH 1660	4
ENGL 1500	3 CHEM 1780	3
CHEM 1770	4 CHEM 1780L	1
CHEM 1770L	1 PHYS 2310	4
BME 1600	3 PHYS 2310L	1
BME 1040	R BIOL 2120	3
LIB 1600	1 BIOL 2120L	1
ENGR 1010	R	
16		17
Sophomore		
Fall	Credits Spring	Credits
ENGL 2500	3 BIOL 3350	3
PHYS 2320	4 BME 2200	3
PHYS 2320L	1 BME 2700	2
CHEM 2310 or 3310	3 MATH 2650	4
CHEM 2310L or 3310L	1 MATE 2730	3
MATH 2670	4 PHIL 3310, 3360, or 3430	3
	BME 2010	R
16		18
Junior		
Fall	Credits Spring	Credits
BBMB 3030	3 BME 3500	4
MATE 3110	3 BME 3540	3
BME 3520	3 BME 3540L	1
BME 3520L	1 STAT 3050	3
BME 3400	3 BME 3600	3
EE 4420	2 ENGL 3140	3
15		17
Senior		
Fall	Credits Spring	Credits
BME 4200	2 BME 4300	2
BIOL 3500, BMS 4470, or BMS 4480	4 SSH Elective	3
BME Elective	3 Engineering Elective	3
SSH Elective	3 BME Elective	3

SSH Elective	3 Bioscience Elective	3
	SSH Elective	3
15		17

Total Credits: 131

BioMedical Mechanics and Manufacturing Emphasis		
Freshman		
Fall	Credits Spring	Credits
MATH 1650	4 MATH 1660	4
ENGL 1500	3 SSH Elective	3
CHEM 1670	4 PHYS 2310	4
CHEM 1670L	1 PHYS 2310L	1
BME 1600	3 BIOL 2120	3
BME 1040	R BIOL 2120L	1
LIB 1600	1	
ENGR 1010	R	
16		16
Sophomore		
Fall	Credits Spring	Credits
ENGL 2500	3 BIOL 3350	3
PHYS 2320	4 BME 2200	3
PHYS 2320L	1 BME 2700	2
CE 2740	3 MATH 2650	4
MATH 2670	4 MATE 2730	3
	PHIL 3310, 3360, or 3430	3
	BME 2010	R
15		18
Junior		
Fall	Credits Spring	Credits
BIOL 3500, BMS 4470, or BMS 4480	4 BME 3500	4
ME 2310	3 BME 3540	3
BME 3520	3 BME 3540L	1
BME 3520L	1 STAT 3050	3
BME 3400	3 BME 3600	3
EE 4420	2 ENGL 3140	3
ME 3240L	1	
17		17
Senior		
Fall	Credits Spring	Credits
BME 4200	2 BME 4300	2
ME 3240	3 SSH Elective	3
BME Elective	3 Engineering Elective	3

SSH Elective	3 BME Elective	3
ME 3450	3 Bioscience Elective	3
	SSH Elective	3
14		17

Total Credits: 130**BioMedical Instrumentation Emphasis****Freshman**

Fall	Credits Spring	Credits
MATH 1650	4 MATH 1660	4
ENGL 1500	3 EE 2850	4
CHEM 1670	4 PHYS 2310	4
CHEM 1670L	1 PHYS 2310L	1
BME 1600	3 BIOL 2120	3
BME 1040	R BIOL 2120L	1
LIB 1600	1	
ENGR 1010	R	
16		17

Sophomore

Fall	Credits Spring	Credits
ENGL 2500	3 BIOL 3350	3
PHYS 2320	4 BME 2200	3
PHYS 2320L	1 BME 2700	2
SSH Elective	3 MATH 2650	4
MATH 2670	4 MATE 2730	3
	BME 2700	2
	PHIL 3310, 3360, or 3430	3
	BME 2010	R
15		20

Junior

Fall	Credits Spring	Credits
BIOL 3500, BMS 4470, or BMS 4480	4 BME 3500	4
ME 2310	3 BME 3540	3
BME 3520	3 BME 3540L	1
BME 3520L	1 STAT 3050	3
BME 3400	3 ENGL 3140	3
EE 4420	2	
16		14

Senior

Fall	Credits Spring	Credits
BME 4200	2 BME 4300	2
EE 4480	2 SSH Elective	3

EE 3140	3 Engineering Elective	3
BME Elective	3 BME Elective	3
SSH Elective	3 Bioscience Elective	3
ME 3700	3 SSH Elective	3
16		17

Total Credits: 131**Biomedical Engineering Minor**

Minor supervised by an interdisciplinary faculty committee, administered by the Chemical and Biological Engineering Department. The Biomedical Engineering minor is a unique opportunity for students to acquire a multidisciplinary engineering and life sciences background for entering the field of biomedical engineering.

The program is open to all undergraduate students at Iowa State University who meet the course prerequisites. This minor will provide students with a foundation of core biology and engineering relevant to further study in biomedical engineering along with an introduction to the application of engineering principles to biomedical problems from a multidisciplinary perspective as well as the applications within the majors of the participating departments.

A minimum of 17 cr. meeting the six requirements below with a minimum of 3 of those credits not being used to meet any other department, college, or university requirement and a minimum of 6 cr. at the 3000 level or above. No more than 3 cr. of 4900 credit may be applied to this minor. At least 3 credits must be taken at Iowa State University.

BIOL 2120	Principles of Biology II	3
BME 2200	Introduction to Biomedical Engineering	3
BIOL 2560	Fundamentals of Human Physiology	3
	or BIOL 3350 Principles of Human and Other Animal Physiology	
	Introductory Engineering Elective *	3
	Advanced Engineering Elective **	3
	Professional Elective ***	2-3

Total Credits 17-18

*A second (Introductory) engineering course from a department other than that of your major. The topic of the course should have ready application to later BME-related electives in that discipline (ABE 3780; CE 2740; CHE 2100; CPRE 2810; EE 2010, EE 3140, or EE 4420 and EE 4480; EM 3240; IE 2710; MATE 2730; ME 2310; or other courses approved by the Biomedical Engineering curriculum committee).

** 3000-5000 level engineering course with clear biomedical engineering application (BME 4900, BME 3410, EE 4500; CHE 4400; MATE 4560; IE 4470; IE 5710; ME 5500 or other courses approved by the Biomedical Engineering curriculum committee).

other courses approved by Biomedical Engineering curriculum committee).

*** 3000-5000 level engineering or life sciences course with clear biomedical engineering application OR BME 4900 OR departmental 4900 with biomedical engineering topic OR 2000+-level life sciences laboratory course (If a 2000-level course is chosen here, the student will need to meet the required 6 cr. of 3000+ courses by substitution of a higher-level course for the other requirements or by taking an additional course.), OR 3000-5000 level BME course.

Chemical Engineering

<http://www.cbe.iastate.edu/>

Administered by the Department of Chemical and Biological Engineering

For undergraduate curriculum in Chemical Engineering leading to the degree Bachelor of Science. The Chemical Engineering Program is accredited by the Engineering Accreditation Commission of ABET, <https://www.abet.org> (<https://www.abet.org/>), under the commission's General Criteria and Program Criteria for Chemical, Biochemical, Biomolecular and Similarly Named Engineering Programs.

Chemical engineering is a profession, which provides a link between scientific knowledge and manufactured products. The chemical engineer relies on science, experience, creativity, and ingenuity to produce these materials economically. Almost everything of a material nature used by society today has at some point felt the influence of the chemical engineer. From raw materials such as minerals, coal, petroleum, and agricultural products; chemical engineers create versatile intermediate and commodity chemicals, high performance fuels, new materials for construction, pharmaceuticals, high performance foodstuffs, synthetic textiles, plastics, solid state electronic components, and dozens of other engineered materials. The chemical engineer's influence has been important in the development of catalysts, fuel cells, automatic controls, biochemical processes, artificial kidneys, tissue engineering, nuclear energy, medical instruments and devices, as well as in the development of air and water pollution control systems. Many new and equally exciting challenges await the practicing chemical engineer of the future.

The profession of chemical engineering embraces a wide variety of activities including research, process development, product development, design, manufacturing supervision, technical sales, consulting, and teaching. The engineer can be behind a desk, in a laboratory, in a manufacturing plant, or engaged in nationwide and worldwide travel. Successful chemical engineers find chemistry, mathematics, and physics to be interesting and exciting. Many chemical engineers also have interest in the biological sciences. The curriculum in chemical engineering includes continued study of chemistry, biochemistry, mathematics, and physics as well as intensive study in the engineering

sciences such as chemical reaction engineering, thermodynamics, mass transfer, fluid mechanics, heat transfer, system analysis and process synthesis, and design.

Student Learning Outcomes

Upon graduation, students should be able to:

1. Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. Apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. Communicate effectively with a range of audiences.
4. Recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. Acquire and apply new knowledge as needed, using appropriate learning strategies.

The curriculum assures that graduates have a thorough grounding in chemistry, along with a working knowledge of advanced chemistry such as organic, inorganic, physical, analytical, materials chemistry, or biochemistry. In addition, a working knowledge, including safety and environmental aspects, of material and energy balances applied to chemical processes; thermodynamics of physical and chemical equilibria; heat, mass, and momentum transfer; chemical reaction engineering; continuous and stage-wise separation operations; process dynamics and control; process design; and appropriate modern experimental and computing techniques is assured.

Program Educational Objectives

The objectives of the Chemical Engineering Program at Iowa State University are to produce graduates who:

- Will excel in careers as practicing chemical engineers in the businesses and industries related to chemical engineering; and
- Will successfully pursue research and advanced studies in chemical engineering, or in related fields such as chemistry or biology, or in related professional fields such as medicine, law, and business.

Cooperative Education

A cooperative education program is available to students in chemical engineering.

Curriculum in Chemical Engineering

Degree requirements leading to the degree Bachelor of Science.

Total credits required: 128.0.

INTERNATIONAL PERSPECTIVES¹: 3 CR.

U.S. Cultures and Communities¹: 3 CR.

COMMUNICATION PROFICIENCY/LIBRARY REQUIREMENT:

ENGL 1500	Critical Thinking and Communication (Must have a C or better in this course)	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition (Must have a C or better in this course)	3
LIB 1600	Introduction to College Level Research	1
One of the following (C or better in this course)		3
ENGL 3090	Proposal and Report Writing	
ENGL 3120	Communicating Science and Public Engagement	
ENGL 3140	Technical Communication	
JLMC 3470	Science Communication	

The CBE Department requires a grade of a C or better for any transfer credit course that is applied to the degree program. Transfer credits will not be calculated into the ISU cumulative GPA, Basic Program GPA, or Chemical Engineering Core GPA.

Social Sciences and Humanities: 15 cr.²

Complete a total of 15 cr. with at least 6 cr. but not more than 9 cr. from the same department.

Basic Program: 24 cr.³

A minimum GPA of 2.00 required for this set of courses (please note that transfer course grades will not be calculated into the Basic Program GPA). See Basic Program for Engineering Curricula in College of Engineering section.

CHEM 1770	General Chemistry I	4
or CHEM 1670	General Chemistry for Engineering Students	
or CHEM 2010	Advanced General Chemistry	
ENGL 1500	Critical Thinking and Communication (Must have a C or better in this course)	3
ENGR 1010	Engineering Orientation	R
CHE 1600	Chemical Engineering Problems with Computer Applications Laboratory ³	3
LIB 1600	Introduction to College Level Research	1
MATH 1650	Calculus I	4
MATH 1660	Calculus II	4
PHYS 2310	Introduction to Classical Physics I	4
PHYS 2310L	Introduction to Classical Physics I Laboratory	1
Total Credits		24

Math and Physical Science: 30 cr.

MATH 2650	Calculus III	4
MATH 2670	Elementary Differential Equations and Laplace Transforms	4
CHEM 1770L	Laboratory in General Chemistry I ⁴	1
or CHEM 1670L	Laboratory in General Chemistry for Engineering	
or CHEM 2010L	Laboratory in Advanced General Chemistry	
CHEM 1780	General Chemistry II ⁴	3
CHEM 1780L	Laboratory in College Chemistry II ⁴	1
CHEM 3250	Chemical Thermodynamics	3
CHEM 3310	Organic Chemistry I	3
CHEM 3320	Organic Chemistry II	3
PHYS 2320	Introduction to Classical Physics II	4
PHYS 2320L	Introduction to Classical Physics II Laboratory	1
BBMB 3010	Survey of Biochemistry	3
Total Credits		30

Chemical Engineering Core: 38 cr.

A minimum GPA of 2.00 is required for this set of courses (please note that transfer course grades will not be calculated into the Chemical Engineering Core GPA). Students must earn at least 23 Chemical Engineering Core credits at the 3000-level or above, including CHE 4290 and CHE 4300, at ISU to qualify for the B.S. degree in chemical engineering.

CHE 2020	Chemical Engineering Seminar	R
CHE 2050	Chemical Engineering Progress Assessment	R
CHE 2100	Material and Energy Balances	3
CHE 3100	Computational Methods in Chemical Engineering	3
CHE 3250	Chemical Engineering Laboratory I	2
CHE 3560	Transport Phenomena I	3
CHE 3570	Transport Phenomena II	3
CHE 3580	Separations	3
CHE 3810	Chemical Engineering Thermodynamics	3
CHE 3820	Chemical Reaction Engineering	3
CHE 4200	Chemical Process Safety	3
CHE 4210	Process Control	3
CHE 4260	Chemical Engineering Laboratory II	2
CHE 4290	Chemical Engineering Product Design	3
CHE 4300	Process and Plant Design	4
Total Credits		38

Other Remaining Courses: 21 cr.²

ENGL 2500	Written, Oral, Visual, and Electronic Composition (Must have a C or better in this course)	3
One of the following Communication Electives:		3

ENGL 3090	Proposal and Report Writing (Must have a C or better in this course)	
ENGL 3120	Communicating Science and Public Engagement (Must have a C or better in this course)	
ENGL 3140	Technical Communication (Must have a C or better in this course)	
JLMC 3470	Science Communication (Must have a C or better in this course)	
Statistics Electives ²		3
Chemical Engineering Electives ²		6
Engineering Electives ²		3
Professional Electives ²		3
Total Credits		21

SEMINARS/CO-OPS/INTERNSHIPS:

Co-op/Internship is optional

1. These university requirements will add to the minimum credits of the program unless the university-approved courses are also approved by the department to meet other course requirements within the degree program. U.S. Cultures and Communities and International Perspectives courses may not be taken Pass/Not Pass.
2. Choose from department approved list (<http://www.cbe.iastate.edu/current-students/guides-and-handbooks/>).
3. See Basic Program for Engineering Curricula for accepted substitutions for curriculum designated courses in the Basic Program.
4. Students who substitute CHEM 2010/2010L credit for CHEM 1770/CHEM 1770L/CHEM 1780L credit cannot also receive credit for CHEM 1780. Credit for CHEM 1780 must be earned through an Advanced Chemistry Elective².

Pass-Not Pass Policy

A maximum of nine Pass-Not Pass semester credits may be used to meet graduation requirements. Courses offered on a Satisfactory-Fail basis may not be taken on a Pass-Not Pass basis. Pass-Not Pass credits can be applied toward requirements for a B.S. degree in chemical engineering only if the course is specified in the curriculum as a social science and humanities elective or is a course not used in the degree program. Pass-Not Pass credits are not acceptable for technical elective courses or for courses used to satisfy the US Cultures and Communities or International Perspectives requirements.

See also: A 4-year plan of study grid showing course template by semester.

Chemical Engineering, B.S.

Freshman

Fall	Credits Spring	Credits
CHE 1600	3 CHEM 1780	3
ENGR 1010	R CHEM 1780L	1
CHEM 1770	4 MATH 1660	4
CHEM 1770L	1 PHYS 2310	4
MATH 1650	4 PHYS 2310L	1
ENGL 1500	3 SSH Elective*	3
LIB 1600	1	
	16	16

Sophomore

Fall	Credits Spring	Credits
CHE 2020	R CHE 3560	3
CHE 2050	R CHEM 3250	3
CHE 2100	3 CHEM 3320	3
CHEM 3310	3 MATH 2670	4
MATH 2650	4 ENGL 2500	3
PHYS 2320	4	
PHYS 2320L	1	
	15	16

Junior

Fall	Credits Spring	Credits
CHE 3100	3 CHE 3250	2
CHE 3570	3 CHE 3580	3
CHE 3810	3 CHE 3820	3
BBMB 3010	3 Engineering Elective*	3
Statistics Elective*	3 Communication Elective*	3
	SSH Elective*	3
	15	17

Senior

Fall	Credits Spring	Credits
CHE 4200	3 CHE 4260	2
CHE 4210	3 CHE 4300	4
CHE 4290	3 CHE Elective*	3
CHE Elective*	3 Professional Elective*	3
SSH Elective*	3 SSH Elective*	3
	SSH Elective*	3
	15	18

* Choose from department approved list (<http://www.cbe.iastate.edu/current-students/guides-and-handbooks/>).

The Chemical and Biological Engineering Department offers well-qualified juniors and seniors in chemical engineering who are interested in graduate study the opportunity to apply for concurrent enrollment in the Graduate College to simultaneously pursue both the Bachelor of Science in Chemical Engineering and the Master of Engineering in Chemical Engineering.

For more information about concurrent undergraduate and graduate programs in Chemical Engineering visit: <https://www.cbe.iastate.edu/prospective-students/bachelorsmasters-concurrent-degree-programs> (<https://www.cbe.iastate.edu/prospective-students/bachelorsmasters-concurrent-degree-programs/>).

Graduate Study

The department offers work for the degrees Master of Science, Master of Engineering, and Doctor of Philosophy with major in chemical engineering, and minor work to students taking major work in other departments. Prerequisite to major graduate work is a bachelor's degree in chemical engineering, chemistry, or another related field. Students with undergraduate background other than chemical engineering should contact the department for further details. A thesis is required for the Master of Science degree. The Master of Science degree also requires a minimum of 30 graduate credits (minimum of 15 for coursework, 12 within CHE and 3 outside). The Master of Engineering requirements are the same for total credits but include a special project or coursework rather than research thesis. The Doctor of Philosophy degree requires a minimum of 72 graduate credits (minimum of 26 for coursework, at least 16 inside CHE). Candidates for the Doctor of Philosophy degree can refer to the department's home page and/or the department's Graduate Student Handbook for degree options and credit requirements.

Civil Engineering

<http://www.ccee.iastate.edu/>

Administered by the Department of Civil, Construction and Environmental Engineering

For undergraduate curriculum in Civil Engineering leading to the degree Bachelor of Science. The Civil Engineering Program is accredited by the Engineering Accreditation Commission of ABET, <https://www.abet.org> (<https://www.abet.org/>), under the commission's General Criteria and Program Criteria for Civil and Similarly Named Engineering Programs.

Civil engineers apply principles of motion and materials to plan, design, construct, maintain, and operate public and private facilities, while working under economic, social, and environmental constraints.

Commonly included are transportation systems; bridges and buildings; water supply, pollution control, waste management, irrigation, and drainage systems; river and harbor improvements; dams and reservoirs. Civil engineering also includes planning, designing, and executing surveying operations and locating, delimiting, and delineating physical and cultural features on the earth's surface. Research, testing, sales, management, and related functions are also a part of civil engineering. Work on campus is supplemented by inspection trips, which furnish an opportunity for firsthand study of engineering systems in operation, as well as projects under construction.

Environmental engineering, as an emphasis in civil engineering, is concerned with protecting the public and natural health; providing an ample safe water supply; managing solid and hazardous waste; treating and disposing of domestic and industrial wastewaters and waste; resource recovery; providing adequate drainage of urban and rural areas for sanitation; and controlling water quality, soil contamination, and air pollution. The environmental emphasis for the civil engineering degree replaces some of the courses and electives in the general curriculum with further courses in chemistry, biology, and microbiology as well as specific topics in environmental engineering and design.

Student Learning Outcomes

Graduates of the Civil Engineering curriculum should have at the time of graduation:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Program Educational Objectives

By three to five years after graduation, graduates of the civil engineering program will have:

1. Pursued successful careers and expertise in civil engineering or a related profession that includes professionalism and increasing responsibility.
2. Collaborated effectively on multi-disciplinary teams to address the needs of society and the environment.
3. Pursued lifelong learning, professional development, advanced studies, and licensure as appropriate for their career goals and for developments in the field.

The civil engineering curriculum equips students with a broad education that includes technical skills in analysis and design and professional practices such as communication, teamwork, leadership, and ethics.

The faculty encourages the students to develop their professional skills by participating in cooperative education, internships, or progressive summer engineering employment and study abroad programs. Qualified juniors and seniors interested in graduate studies may apply to the Graduate College to concurrently pursue the bachelor's degree and either a Master of Science in Civil Engineering or a Master of Business Administration in the College of Business Administration. These students would have the opportunity to graduate in five years with both degrees.

Curriculum in Civil Engineering (General)

Administered by the Department of Civil, Construction and Environmental Engineering.

Leading to the degree bachelor of science.

Total credits required: 128-129.

Any transfer credit courses applied to the degree program require a grade of C or better (but will not be calculated into the ISU cumulative GPA, Basic Program GPA or Core GPA). See also Basic Program and Special Programs. Note: Department does not allow Pass/Not Pass credits to be used to meet graduation requirements.

International Perspectives: 3 cr. ¹

U.S. Cultures and Communities: 3 cr. ¹

Communication Proficiency/Library requirement

ENGL 1500	Critical Thinking and Communication (Must have a C or better in this course)	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition (Must have a C or better in this course)	3
LIB 1600	Introduction to College Level Research	1

Social Sciences and Humanities: 12 cr. ²

Complete 12 cr. with 6 cr. at 2000-level or above.

Basic Program: 24 cr. ³

A minimum GPA of 2.00 required for this set of courses (please note that transfer course grades will not be calculated into the Basic Program GPA). See Requirement for Entry into Professional Program in College of Engineering Overview section.

CHEM 1670	General Chemistry for Engineering Students	4
or CHEM 1770	General Chemistry I	
& CHEM 1780	and General Chemistry II	
ENGL 1500	Critical Thinking and Communication (Must have a C or better in this course)	3
ENGR 1010	Engineering Orientation	R
CE 1600	Engineering Problems with Computational Laboratory ³	3
LIB 1600	Introduction to College Level Research	1
MATH 1650	Calculus I	4
MATH 1660	Calculus II	4
PHYS 2310	Introduction to Classical Physics I	4
PHYS 2310L	Introduction to Classical Physics I Laboratory	1
Total Credits		24

Math and Physical Science: 18-19 cr.

CHEM 1670L	Laboratory in General Chemistry for Engineering	1
or CHEM 1770L	Laboratory in General Chemistry I	
CHEM 1780 & 1780L	General Chemistry II and Laboratory in College Chemistry II ⁴	4-5
or PHYS 2320 & 2320L	Introduction to Classical Physics II and Introduction to Classical Physics II Laboratory	
GEOL 2010	Geology for Engineers and Environmental Scientists	3
MATH 2650	Calculus III	4
MATH 2660	Elementary Differential Equations	3
	Statistics Elective ²	3
Total Credits		18-19

Civil Engineering Core: 34 cr. Minimum GPA of 2.00 required for this set of courses to graduate (including transfer courses; please note that transfer course grades will not be calculated into the Core GPA).

A minimum of 25 credits within the CE-general core must be taken at Iowa State University.

CE 2740	Engineering Statics	3
EM 3240	Mechanics of Materials	3
ME 3450	Engineering Dynamics	3
CE 2060	Engineering Economic Analysis and Professional Issues in Civil Engineering	3

CE 3260	Principles of Environmental Engineering	3
ABE 3780	Mechanics of Fluids	3
CE 3320	Structural Analysis I	3
CE 3550	Principles of Transportation Engineering	3
CE 3600	Geotechnical Engineering	4
CE 3720	Engineering Hydrology and Hydraulics	3
CE 3820	Design of Concretes	3
Total Credits		34

Other Remaining Courses: 40 cr.

CE 1200	Civil Engineering Learning Community	1
CE 1110	Geomatics	3
CE 1700	Graphics for Civil Engineering	2
CE 3060	Project Management for Civil Engineers	3
Any two of the following three courses:		6
CE 3330	Structural Steel Design I	
CE 3340	Reinforced Concrete Design I	
CE 4600	Foundation Engineering	
CE 4850	Civil Engineering Design	3
EM 3270	Mechanics of Materials Laboratory	1
ENGL 2500	Written, Oral, Visual, and Electronic Composition (Must have a C or better in this course)	3
SPCM 2120	Fundamentals of Public Speaking	3
Civil Engineering Design Elective ²		3
Technical Communication Elective ²		3
Engineering Topics Electives ²		9
Total Credits		40

Seminar/Co-op/Internships: R cr.

CE 4030	Program and Outcome Assessment	R

Notes.

1. These university requirements will add to the minimum credits of the program unless the university-approved courses are also approved by the department to meet other course requirements within the degree program. U.S. Cultures and Communities and International Perspectives courses may not be taken Pass/Not Pass.
2. Choose from department approved list (<http://www.ccee.iastate.edu/academics/advising/civil-engineering-student-forms/>). At least six of nine credits must be CE or CONE courses for the Engineering Topics Electives.
3. See Basic Program for Professional Engineering Curricula for accepted substitutions for curriculum designated courses in the Basic Program.

4. Students who transfer in with CHEM 1670/CHEM 1670L will be able to take CHEM 1780/CHEM 1780L to complete the program's Chemistry requirement.

See also: A 4-year plan of study grid showing course template by semester for Civil Engineering

Curriculum in Civil Engineering with Environmental Option

Administered by the Department of Civil, Construction and Environmental Engineering.

Leading to the degree Bachelor of Science.

Total credits required: 132.

Any transfer credit courses applied to the degree program require a grade of C or better (but will not be calculated into the ISU cumulative GPA, Basic Program GPA or Core GPA). See also Basic Program and Special Programs.

International Perspectives: 3 cr. ¹

U.S. Cultures and Communities: 3 cr. ¹

Communication Proficiency/Library requirement:

ENGL 1500	Critical Thinking and Communication (Must have a C or better in this course)	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition (Must have a C or better in this course)	3
LIB 1600	Introduction to College Level Research	1

Social Sciences and Humanities: 12 cr. ²

Complete 12 cr. with 6 cr. at 2000-level or above.

Basic Program: 24 cr. ³. Minimum GPA of 2.00 required for this set of courses to graduate, including any transfer courses (please note that transfer course grades will not be calculated into the Basic Program GPA).

CHEM 1770	General Chemistry I	4
ENGL 1500	Critical Thinking and Communication (Must have a C or better in this course)	3
ENGR 1010	Engineering Orientation	R
CE 1600	Engineering Problems with Computational Laboratory ³	3
LIB 1600	Introduction to College Level Research	1
MATH 1650	Calculus I	4
MATH 1660	Calculus II	4
PHYS 2310	Introduction to Classical Physics I	4
PHYS 2310L	Introduction to Classical Physics I Laboratory	1
Total Credits		24

Math and Physical Science: 27 cr.

CHEM 1770L	Laboratory in General Chemistry I	1
CHEM 1780	General Chemistry II ⁴	3
CHEM 1780L	Laboratory in College Chemistry II ⁴	1
CHEM 2310	Elementary Organic Chemistry	3
CHEM 2310L	Laboratory in Elementary Organic Chemistry	1
BIOL 2510	Biological Processes in the Environment	3
GEOL 2010	Geology for Engineers and Environmental Scientists	3
MATH 2650	Calculus III	4
MATH 2660	Elementary Differential Equations	3
MICRO 2010	Introduction to Microbiology	2
Statistics Elective ²		3
Total Credits		27

Civil/Env Engineering Core: 31 cr. Minimum GPA of 2.00 required for this set of courses to graduate (including transfer courses; please note that transfer course grades will not be calculated into the Core GPA).

A minimum of 22 credits within the CE-Environmental core must be taken at Iowa State University.

CE 2740	Engineering Statics	3
EM 3240	Mechanics of Materials	3
CE 2060	Engineering Economic Analysis and Professional Issues in Civil Engineering	3
CE 3260	Principles of Environmental Engineering	3
CE 3320	Structural Analysis I	3
ABE 3780	Mechanics of Fluids	3
CE 3550	Principles of Transportation Engineering	3
CE 3600	Geotechnical Engineering	4
CE 3720	Engineering Hydrology and Hydraulics	3
CE 3820	Design of Concretes	3
Total Credits		31

Other Remaining Courses: 38 cr.

CE 1200	Civil Engineering Learning Community	1
CE 1110	Geomatics	3
CE 1700	Graphics for Civil Engineering	2
CE 3060	Project Management for Civil Engineers	3
CE 3340	Reinforced Concrete Design I	3
CE 4280	Water and Wastewater Treatment Plant Design	3
Any two of the following four courses		6
ENVE 4260	Environmental Engineering Science	
ENVE 4270	Environmental Engineering Systems	
ENVE 4290	Air Pollution and Control	

ENVE 4300	Solid and Hazardous Waste Management	
CE 4850	Civil Engineering Design	3
EM 3270	Mechanics of Materials Laboratory	1
ABE 3780L	Mechanics of Fluids Laboratory	1
ENGL 2500	Written, Oral, Visual, and Electronic Composition (Must have a C or better in this course)	3
SPCM 2120	Fundamentals of Public Speaking	3
Civil Engineering Design Elective ²		3
Technical Communication Elective ²		3
Total Credits		38

Seminar/Co-op/Internships: R cr.

CE 4030	Program and Outcome Assessment	R

Co-op/Internship optional.**Notes.**

1. These university requirements will add to the minimum credits of the program unless the university-approved courses are also approved by the department to meet other course requirements within the degree program. U.S. Cultures and Communities and International Perspectives courses may not be taken Pass/Not Pass.
2. Choose from department approved list. (<http://www.ccee.iastate.edu/academics/advising/civil-engineering-student-forms/>)
3. See Basic Program for Professional Engineering Curricula for accepted substitutions for curriculum designated courses in the Basic Program.
4. Students who transfer in with CHEM 1670 General Chemistry for Engineering Students/CHEM 1670L Laboratory in General Chemistry for Engineering will be able to take CHEM 1780 General Chemistry II/CHEM 1780L Laboratory in College Chemistry II to complete the program's Chemistry requirement.

See also: A 4-year plan of study grid showing course template by semester for Civil Engineering

Civil Engineering, B.S. - environmental OPTION**First Year**

Fall	Credits Spring	Credits
CE 1600	3 CE 1700	2
CHEM 1770	4 MATH 1660	4
CHEM 1770L	1 PHYS 2310	4
ENGL 1500	3 PHYS 2310L	1
MATH 1650	4 BIOL 2510 (Spring only)	3
ENGR 1010	R International Perspective	3
CE 1200	1	
	16	17

Second Year

Fall	Credits Spring	Credits
ENGL 2500	3 CE 1110	3
CE 2740	3 CE 2060	3
CHEM 1780	3 CE 3060	3
CHEM 1780L	1 EM 3240	3
MATH 2650	4 MATH 2660	3
GEOL 2010	3 Statistics Elective	3
LIB 1600	1	
	18	18

Third Year

Fall	Credits Spring	Credits
CE 3320	3 CE 3260	3
CE 3550	3 CE 3340	3
CE 3820	3 SPCM 2120	3
ABE 3780	3 CE 3720	3
ABE 3780L	1 MICRO 2010	2
EM 3270	1 Technical Communication Elective	3
CHEM 2310	3	
CHEM 2310L	1	
	18	17

Fourth Year

Fall	Credits Spring	Credits
CE 3600	4 CE 4030	R
Take two of four: ENVE 4260, 4270, 4290 or 4300	3 Take two of four: ENVE 4260, 4270, 4290 or 4300	3
ENVE 4260 (Fall only)	ENVE 4270 (Spring only)	
ENVE 4300 (Fall only)	ENVE 4290 (Spring only)	
CE Design Elective	3 CE 4280	3
SSH Elective	6 CE 4850	3
	US Cultures and Communities	3
	16	12

Civil Engineering, B.S. - GENERAL Program

First Year

Fall	Credits Spring	Credits
CE 1600	3 CE 1700	2
CHEM 1670	4 MATH 1660	4
CHEM 1670L	1 SPCM 2120	3
ENGL 1500	3 PHYS 2310	4
MATH 1650	4 PHYS 2310L	1

ENGR 1010	R	
CE 1200	1	
	16	14

Second Year

Fall	Credits Spring	Credits
ENGL 2500	3 EM 3240	3
CHEM 1780	3 MATH 2660	3
CHEM 1780L	1 CE 3060	3
CE 2740	3 ABE 3780	3
MATH 2650	4 CE 1110	3
GEOL 2010	3 Statistics Elective	3
LIB 1600	1	
	18	18

Third Year

Fall	Credits Spring	Credits
CE 3320	3 CE 3340 (CE 4600 may be substituted for CE 3330 or CE 3340)	3
ME 3450	3 CE 3720	3
CE 3600	4 CE 3820	3
EM 3270	1 CE 3550	3
CE 2060	3 Engr Topic Elective	3
Technical Communication	3 International Perspective	3
	17	18

Fourth Year

Fall	Credits Spring	Credits
CE 3330 (CE 4600 may be substituted for CE 3330 or CE 3340)	3 CE 4030	R
CE 3260	3 CE 4850	3
Engr Topic Elective	3 CE Design Elective	3
SSH Elective	6 Engr Topic Elective	3
	US Cultures and Communities	3
	15	12

A concurrent bachelor of science/master of science (B.S./M.S.) degree program is available to qualified seniors at Iowa State University.

Go to: <https://www.ccee.iastate.edu/prospective-graduate-students/concurrent-programs/> for more information.

Graduate Study

The Department of Civil, Construction and Environmental Engineering offers graduate programs for the degrees of Master of Engineering,

Master of Science, and Doctor of Philosophy with a major in civil engineering with areas of specialization in structural engineering, environmental engineering, construction engineering and management, geotechnical engineering, civil engineering materials, transportation engineering, and intelligent infrastructure engineering. The department also offers graduate minors of 12 to 15 credits of coursework to students from other engineering departments.

Candidates for the degrees of Master of Engineering and Master of Science are required to complete a total of 30 acceptable graduate credits. The Master of Engineering degree involves all course work. The Master of Science degree requires the preparation of a thesis or creative component. Candidates for the Doctor of Philosophy degree is required to complete a minimum of 72 acceptable graduate credits.

Normal prerequisite for graduate study in civil engineering is the completion of an undergraduate curriculum substantially equivalent to that required of engineering students at this university. Because of the diversity of interests within the graduate programs in civil engineering, a student may qualify for graduate study even though undergraduate or prior graduate training has been in a discipline other than engineering. Additional courses will be required depending upon the student's background and area of interest.

The department participates in the interdepartmental graduate programs in environmental science and wind energy science, engineering and policy. The department also offers graduate certificates in construction management, environmental engineering, and environmental systems.

The construction management certificate requires 12 graduate credits (nine credits of core courses and three credits of approved elective courses). The environmental engineering and environmental systems certificates require 12 graduate credits (six credits of "core courses", six credits of approved "elective courses") and a seminar course or an approved equivalent.

Additional information about graduate programs, specialization areas, and admission criteria are available on the department's website <http://www.ccee.iastate.edu/ccee-advanced-degree-programs> (<https://www.ccee.iastate.edu/ccee-advanced-degree-programs/>).

Computer Engineering

www.ece.iastate.edu (<http://www.ece.iastate.edu>)

Administered by the Department of Electrical and Computer Engineering

For the undergraduate curriculum in Computer Engineering leading to the degree Bachelor of Science. The Computer Engineering Program is accredited by the Engineering Accreditation Commission of ABET, <https://www.abet.org> (<https://www.abet.org/>), under the commission's General

Criteria and Program Criteria for Electrical, Computer, Communications, Telecommunication(s) and Similarly Named Engineering Programs.

The Department of Electrical and Computer Engineering (ECPE) at Iowa State University provides undergraduate students with the opportunity to learn electrical and computer engineering fundamentals, study applications of the most recent advances in state-of-the-art technologies, and to prepare for the practice of computer engineering. The student-faculty interaction necessary to realize this opportunity occurs within an environment that is motivated by the principle that excellence in undergraduate education is enhanced by an integrated commitment to successful, long-term research and outreach programs.

The computer engineering curriculum offers focus areas in software systems, embedded systems, networking, information security, computer architecture, and VLSI.

Students also may take elective courses in control systems, electromagnetics, microelectronics, VLSI, power systems, and communications and signal processing.

Student Learning Outcomes: Graduates of the Computer Engineering curriculum should have at the time of graduation:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Program Educational Objectives: The program objectives for the computer engineering programs describe accomplishments that graduates are expected to attain within five years after graduation. Graduates will have applied their expertise to contemporary problem solving, be engaged professionally, have continued to learn and adapt,

and have contributed to their organizations through leadership and teamwork. More specifically, the objectives for expertise, engagement, learning, leadership and teamwork are defined below for each program.

The objectives of the computer engineering program at Iowa State University are:

- Graduates, within five years of graduation, should demonstrate peer-recognized **expertise** together with the ability to articulate that expertise and use it for contemporary problem solving in the analysis, design, and evaluation of computer and software systems, including system integration and implementation.
- Graduates, within five years of graduation, should demonstrate **engagement** in the engineering profession, locally and globally, by contributing to the ethical, competent, and creative practice of engineering or other professional careers.
- Graduates, within five years of graduation, should demonstrate sustained **learning** and adapting to a constantly changing field through graduate work, professional development, and self-study.
- Graduates, within five years of graduation, should demonstrate **leadership** and initiative to ethically advance professional and organizational goals, facilitate the achievements of others, and obtain substantive results.
- Graduates, within five years of graduation, should demonstrate a commitment to **teamwork** while working with others of diverse cultural and interdisciplinary backgrounds.

As a complement to the instructional activity, the ECPE department provides opportunities for each student to have experience with broadening activities. Through the cooperative education and internship program, students have the opportunity to gain practical industry experience. Students have the opportunity to participate in advanced research activities, and through international exchange programs, students learn about engineering practices in other parts of the world. Well-qualified juniors and seniors in computer engineering who are interested in graduate study may apply for concurrent enrollment in the Graduate College to simultaneously pursue both the Bachelor of Science and Master of Science, the Bachelor of Science and Master of Business Administration, or the Bachelor of Science and Master of Engineering degrees.

Curriculum in Computer Engineering

Administered by the Department of Electrical and Computer Engineering.

Leading to the degree Bachelor of Science.

Total credits required: 127

Any transfer credit courses applied to the degree program require a grade of C or better (but will not be calculated into the ISU cumulative GPA, Basic Program GPA or Core GPA). See also Basic Program and Special Programs.

Note: Department does not allow Pass/Not Pass credits to be used to meet graduation requirements.

International Perspectives: 3 cr.¹

U.S. Cultures and Communities: 3 cr.¹

Communication Proficiency/Library requirement:

ENGL 1500	Critical Thinking and Communication (Must have a C or better in this course)	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition (Must have a C or better in this course)	3
LIB 1600	Introduction to College Level Research	1
One of the following:		3
ENGL 3140	Technical Communication (C or better in this course)	
ENGL 3090	Proposal and Report Writing (C or better in this course)	

General Education Electives: 21 cr.

²

ENGL 2500	Written, Oral, Visual, and Electronic Composition (Must have a C or better in this course.)	3
ENGL 3140	Technical Communication (Must have a C or better in this course.)	3
or ENGL 3090	Proposal and Report Writing	
Complete minimum of 3 cr. from Approved General Education Component 3000 level or higher.		3
Complete additional 12 cr. from Approved General Education Component.		12
Total Credits		21

Basic Program: 24 cr.

A minimum GPA of 2.00 required for this set of courses (please note that transfer course grades will not be calculated into the Basic Program GPA). See Requirement for Entry into Professional Program in College of Engineering Overview section.

CHEM 1670	General Chemistry for Engineering Students	4
or CHEM 1770	General Chemistry I	
ENGL 1500	Critical Thinking and Communication (Must have a C or better in this course)	3
ENGR 1010	Engineering Orientation	R
CPRE 1850	Introduction to Computer Engineering and Problem Solving I	3
LIB 1600	Introduction to College Level Research	1
MATH 1650	Calculus I	4
MATH 1660	Calculus II	4
PHYS 2310	Introduction to Classical Physics I	4

PHYS 2310L	Introduction to Classical Physics I Laboratory	1
Total Credits		24

Math and Physical Science: 17 cr.

COMS 2270	Object-oriented Programming	4
COMS 2280	Introduction to Data Structures	3
MATH 2070	Matrices and Linear Algebra	3
MATH 2670	Elementary Differential Equations and Laplace Transforms	4
STAT 3300	Probability and Statistics for Computer Science	3
Total Credits		17

Computer Engineering Core: 36 cr.

(A minimum GPA of 2.00 required for this set of courses, including any transfer courses; please note that transfer course grades will not be calculated into the Core GPA).

CPRE 2320	Professional and Ethical Issues in Electrical and Computer Engineering	3
CPRE 2810	Digital Logic	4
CPRE 2880	Embedded Systems I: Introduction	4
CPRE 3080	Operating Systems: Principles and Practice	4
CPRE 3100	Theoretical Foundations of Computer Engineering	3
CPRE 3810	Computer Organization and Assembly Level Programming	4
COMS 3090	Software Development Practices	3
COMS 3110	Introduction to the Design and Analysis of Algorithms	3
EE 2010	Electric Circuits	4
EE 2300	Electronic Circuits and Systems	4
Total Credits		36

Other Remaining Courses: 29 cr.

CPRE 4910	Senior Design Project I and Professionalism	3
CPRE 4920	Senior Design Project II	2
Computational Thinking Technical Electives ²		6
Computer Engineering Technical Electives ²		12
Technical Electives ²		6
Total Credits		29

Seminar/Co-op/Internships:

CPRE 1660	Professional Programs Orientation	R
CPRE 4940	Portfolio Assessment	R

Co-op or internship is optional.

Outcomes Assessment - Students are required to prepare and to maintain a portfolio of their technical and non-technical skills. This portfolio is evaluated for student preparation during the student's curriculum

planning process. Results of the evaluation are used to advise students of core strengths and weaknesses.

Transfer Credit Requirements

The degree program must include a minimum of 30 credits at the 3000-level or above in professional and technical courses earned at ISU in order to receive a B.S. in computer engineering. These 30 credits must include: CPRE 4910 Senior Design Project I and Professionalism, CPRE 4920 Senior Design Project II, and credits in the core professional curriculum and/or in technical electives. The Electrical and Computer Engineering Department requires a grade of C or better for any transfer credit course that is applied to the degree program.

1. These university requirements will add to the minimum credits of the program unless the university-approved courses are also approved by the department to meet other course requirements within the degree program. U.S. Cultures and Communities and International Perspectives courses may not be taken Pass/Not Pass but are used to meet the general education electives.
2. From department approved lists. (<http://www.ece.iastate.edu/academics/bachelors-degree-requirements/>)
3. See Basic Program for Professional Engineering Curricula for accepted substitutions for curriculum designated courses in the Basic Program.

See also: A 4-year plan of study grid showing course template by semester.

Note: International perspectives and U.S. diversity courses are used to meet the general education electives.

Computer Engineering, B.S.

First Year

Fall	Credits	Spring	Credits
CHEM 1670	4	COMS 2270	4
CPRE 1850	3	CPRE 1660	R
ENGL 1500	3	MATH 1660	4
ENGR 1010	R	ENGL 2500	3
LIB 1600	1	PHYS 2310	4
MATH 1650	4	PHYS 2310L	1
15		16	

Second Year

Fall	Credits	Spring	Credits
CPRE 2810	4	CPRE 2880	4
COMS 2280	3	EE 2300	4
EE 2010	4	CPRE 3100	3
MATH 2670	4	MATH 2070	3

Gen Ed Elective	3
15	17

Third Year

Fall	Credits Spring	Credits
CPRE 2320	3 CPRE 3080	4
CPRE 3810	4 ENGL 3140	3
COMS 3110	3 COMS 3090	3
General Education Elective	3 General Education Elective	3
Technical Electives	3 Computational Thinking	3
	Tech Elective	
	16	16

Fourth Year

Fall	Credits Spring	Credits
CPRE 4910	3 CPRE 4920	2
CPRE 4940	Required Computational Thinking	3
	Tech Elective	
STAT 3300	3 General Education Elective	3
CPRE Elective	6 CPRE Electives	6
General Education Elective	3 Technical Electives	3
	15	17

Computer Engineering students have the opportunity to become a concurrent undergraduate/graduate student in a few programs.

Concurrent B.S./M.ENG or M.S. in Computer Engineering

Concurrent B.S./M.ENG or M.S. in Cyber Security

Computer engineering students have the opportunity to begin their coursework towards their master's degree in computer engineering or cyber security during their final semester(s) of undergraduate coursework. In order to be eligible, student must have a 3.0 cumulative GPA or higher to begin a Master of Engineering ("M.ENG") degree or a 3.3 cumulative GPA to begin a Master of Science ("M.S.") degree. Students should meet with their academic advisor to discuss this option.

Concurrent B.S./MBA

Juniors and Seniors have the opportunity to continue their undergraduate coursework while also pursuing a Master of Business Administration (MBA) degree. For additional information please visit the concurrent MBA website www.ivybusiness.iastate.edu/full-time-concurrent-mba (<https://www.ivybusiness.iastate.edu/full-time-concurrent-mba/>).

Graduate Study

The department offers work for the degrees Master of Engineering, Master of Science, and Doctor of Philosophy with a major in computer

engineering and minor work to students with other majors. Minor work for computer engineering majors is usually selected from a wide range of courses outside computer engineering.

The Master of Engineering degree is coursework only. It is recommended for off-campus students.

The Master of Science degree with thesis is recommended for students who intend to continue toward the Doctor of Philosophy degree or to undertake a career in research and development. The non-thesis Master of Science degree requires a creative component.

The department also offers three graduate certificate programs in embedded systems, computer networking, and software systems.

The normal prerequisite to graduate major work in computer engineering is the completion of undergraduate work substantially equivalent to that required of computer engineering students at this university. It is possible for a student to qualify for graduate study in computer engineering even though the student's undergraduate or prior graduate training has been in a discipline other than computer engineering. Supporting work, if required, will depend on the student's background and area of research interest. Prospective students from a discipline other than computer engineering are required to submit, with the application for admission, a statement of the proposed area of graduate study.

The department requires submission of GRE General test scores by applicants. All students whose first language is not English and who have no U.S. degree must submit TOEFL examination scores. Students pursuing the Doctor of Philosophy must complete the department qualifying process.

The Department of Electrical and Computer Engineering is a participating department in the interdepartmental Master of Science and Doctor of Philosophy degree programs in bioinformatics and computational biology. Students interested in these programs may earn their degrees while working under an advisor in electrical and computer engineering.

The Department of Electrical and Computer Engineering also is a participating department in the interdepartmental certificate, Master of Engineering, and Master of Science in Cyber Security programs. Students interested in studying information assurance topics may earn a degree in computer engineering or in information assurance. (See catalog section on Cyber Security.)

Well-qualified juniors and seniors in computer engineering who are interested in graduate study may apply for concurrent enrollment in the Graduate College to simultaneously pursue both Bachelor of Science and Master of Science, or Bachelor of Science and Master of Business Administration, or Bachelor of Science and Master of Engineering degrees. Under concurrent enrollment, students are eligible for assistantships and simultaneously take undergraduate and graduate

courses. Details are available in the Student Services Office and on the department's web site.

Construction Engineering

The curriculum in Construction Engineering, leading to a Bachelor of Science degree can be referenced here: www.catalog.iastate.edu/collegeofengineering/constructionengineering/#curriculumtext.

The Construction Engineering Program is accredited by the Engineering Accreditation Commission of ABET, <https://www.abet.org> (<https://www.abet.org/>), under the commission's General Criteria and Program Criteria for Construction and Similarly Named Engineering Programs.

Student Learning Outcomes

Graduates of the construction engineering curriculum should have at the time of graduation:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Program Educational Objectives: Three to five years after graduation, our graduates will have pursued successful careers and expertise in construction engineering or a related profession that includes professionalism and increasing responsibility. They will collaborate effectively on multi-disciplinary teams to address the needs of society and the environment. They will pursue lifelong learning, professional development, advanced studies, and licensure as appropriate for their career goals and for developments in the field.

Students who successfully complete the curriculum will be prepared for entry into the field or for further study at the graduate level in

construction engineering or related fields of study, such as law, business, and/or other engineering disciplines.

Construction engineers need to possess teamwork skills and strong fundamental knowledge of engineering design and management principles, including knowledge of business procedures, economics, and human behavior. Graduates of this curriculum may expect to engage in design of temporary structures, coordination of project design, systems design, cost estimating, planning and scheduling, company and project management, materials procurement, equipment selection, and cost control. With the emergence of integrated project delivery methods such as design-build construction, the role of the construction engineer is expanding the need for trained professionals that understand both aspects of the project delivery environment. The curriculum offers opportunities to study emphases concerned with building, heavy, mechanical, or electrical construction. The process of construction involves the organization, administration, and coordination of labor resource requirements, temporary and permanent materials, equipment, supplies and utilities, money, technology and methods. These must be integrated in the most efficient manner possible to complete construction projects on schedule, within the budget, and according to the standards of quality and performance specified by the project owner or designer. The curriculum blends engineering, management and business sciences into a study of the processes of construction whereby designer's plans and specifications are converted into physical structures and facilities.

The curriculum develops the ability of students to be team workers, creative thinkers, and effective communicators. This is achieved by encouraging students to:

- Interact with practicing professionals.
- Gain work experience during summer jobs, internship, and cooperative education assignments that emphasize the knowledge required of construction engineers.
- Develop leadership skills by participating in student organizations.
- Develop, analyze, and interpret alternative solutions to open-ended problems.
- Study abroad.

The construction industry is becoming increasingly global. Courses in humanities, social sciences, U.S. diversity, and international perspectives are included in the curriculum to broaden the student's perspective of the work environment. In addition, the department has several exchange program opportunities for students to participate in study abroad programs.

Qualified construction engineering students within 30 credits of completing their degree may apply for concurrent enrollment in the

Graduate College. See Civil Engineering (<http://www.ccee.iastate.edu/academics/graduate/>) Graduate Study for more information.

Curriculum in Construction Engineering

Administered by the Department of Civil, Construction and Environmental Engineering; leading to the degree bachelor of science.

Construction Engineering students will initially be considered construction undecided option when starting the degree and are encouraged to choose an option in Construction Engineering before their 5th semester. If not, option courses taken by the student will not be applied until the student chooses an option. Students must pick an option prior to graduation. The four options in the program are building, electrical, infrastructure, and mechanical. The Core courses for each option are the same whereas the option selections of the degree audit will be comprised of different classes that explore the particular focus the students have chosen.

Total credits required: Building Option -128.0, Electrical Option - 127.0, Infrastructure Option - 127.0, Mechanical Option - 127.0 cr.

The Construction Engineering program requires a grade of a C or better for any transfer credit course that is applied to the degree program (but will not be calculated into the ISU cumulative GPA, Basic Program GPA or Core GPA). Note: Department does not allow Pass/Not Pass credits to be used to meet graduation requirements for either required or elective courses.

International Perspectives: 3 cr. ¹

U.S. Cultures and Communities: 3 cr. ¹

Communication Proficiency/Library requirements:

ENGL 1500	Critical Thinking and Communication (Must have a C or better in this course)	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition (Must have a C or better in this course)	3
LIB 1600	Introduction to College Level Research	1
Business Communication Elective: one course of the following with a minimum grade of C.		3
ENGL 3020	Business Communication	
ENGL 3090	Proposal and Report Writing	
ENGL 3140	Technical Communication	

Total Credits 10

Social Sciences and Humanities: 12 cr.

Social Sciences and Humanities ²	6
International Perspectives ¹	3
U.S. Cultures and Communities ¹	3
Total Credits	12

Basic Program: 24 cr. ³

Minimum GPA of 2.00 required for this set of courses to graduate, (please note that transfer course grades will not be calculated into the Basic Program GPA).³

CHEM 1670	General Chemistry for Engineering Students	4
or CHEM 1770 General Chemistry I		
ENGL 1500	Critical Thinking and Communication (Must have a C or better in this course)	3
ENGR 1010	Engineering Orientation	R
CE 1600	Engineering Problems with Computational Laboratory ³	3
LIB 1600	Introduction to College Level Research	1
MATH 1650	Calculus I	4
MATH 1660	Calculus II	4
PHYS 2310	Introduction to Classical Physics I	4
PHYS 2310L	Introduction to Classical Physics I Laboratory	1
Total Credits		24

Math and Physical Science: 12 cr.

STAT 3050	Engineering Statistics	3
or STAT 2310 Probability and Statistical Inference for Engineers		
MATH 2670	Elementary Differential Equations and Laplace Transforms	4
PHYS 2320	Introduction to Classical Physics II	4
PHYS 2320L	Introduction to Classical Physics II Laboratory	1
Total Credits		12

Construction Engineering Core: 27 cr. Minimum 2.00 GPA for this set of courses to graduate (please note that transfer course grades will not be calculated into the Core GPA):

CONE 2410	Construction Materials and Methods	3
CE 2740	Engineering Statics	3
CE 3320	Structural Analysis I	3
EM 3240	Mechanics of Materials	3
CONE 4220	Construction Cost Estimating and Cost Engineering	3
CONE 4410	Construction Planning, Scheduling, and Control	3
ABE 3780	Mechanics of Fluids	3
CONE 4870	Construction Engineering Design I	3
CONE 4880	Construction Engineering Design II	3
Total Credits		27

Select remaining courses from one of the following options:**Building Option 27 cr:**

CE 3600	Geotechnical Engineering	4
CONE 3220	Construction Equipment and Heavy Construction Methods	3
CONE 3400	Concrete and Steel Construction	3
CE 3330	Structural Steel Design I	3
CE 3340	Reinforced Concrete Design I	3
CE 3830	Design of Portland Cement Concrete	1
CONE 3520	Mechanical Systems in Buildings	3
CONE 3530	Electrical Systems in Buildings	3
EM 3270	Mechanics of Materials Laboratory	1
Engineering Topics Elective ²		3
Total Credits		27

Electrical Option 26 cr:

EE 2010	Electric Circuits	4
EE 2300	Electronic Circuits and Systems	4
EE 3030	Energy Systems and Power Electronics	3
CONE 3520	Mechanical Systems in Buildings	3
CONE 3530	Electrical Systems in Buildings	3
EE 4560	Power System Analysis I	3
EE 4570	Power System Analysis II	3
Engineering Topics Elective ²		3
Total Credits		26

Infrastructure Option 26 cr:

CE 3600	Geotechnical Engineering	4
CONE 3220	Construction Equipment and Heavy Construction Methods	3
CONE 3400	Concrete and Steel Construction	3
CE 3330	Structural Steel Design I	3
CE 3340	Reinforced Concrete Design I	3
CE 3820	Design of Concretes	3
EM 3270	Mechanics of Materials Laboratory	1
Engineering Topics Elective ²		6
Total Credits		26

Mechanical Option 26 cr:

ME 2310	Engineering Thermodynamics I	3
ME 4360	Heat Transfer	4
CONE 3520	Mechanical Systems in Buildings	3
CONE 3530	Electrical Systems in Buildings	3
EE 4420	Introduction to Circuits and Instruments	2
EE 4480	Introduction to AC Circuits and Motors	2

ME 4410	Fundamentals of Heating, Ventilating, and Air Conditioning	3
ME 4420	Heating and Air Conditioning Design	3
Engineering Topics Elective ²		3
Total Credits		26

Additional Required Courses: 26 cr.

CONE 1210	Cornerstone Learning Community: Orientation to Academic Life	1
CONE 1220	Cornerstone Learning Community: Orientation to Professional Life	1
CONE 2220	Contractor Organization and Management of Construction	3
CONE 2510	Mechanical/Electrical Materials and Methods	1
CE 1110	Geomatics	3
CE 1700	Graphics for Civil Engineering	2
IE 3050	Engineering Economic Analysis	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition (Must have a C or better in this course)	3
Law Elective		3
CONE 3800	Engineering Law	
ACCT 2150	Legal Environment of Business	
Business Communication Elective (minimum grade of C)		3
ENGL 3020	Business Communication	
ENGL 3090	Proposal and Report Writing	
ENGL 3140	Technical Communication	
Complete one course from Math or Stat Elective ²		3
Total Credits		26

Co-op/Internships - Optional

1. These university requirements will add to the minimum credits of the program unless the university-approved courses are also approved by the department to meet other course requirements within the degree program. U.S. Cultures and Communities and International Perspectives courses may not be taken Pass/Not Pass.
2. Choose from department approved list (<http://www.ccee.iastate.edu/academics/advising/construction-engineering-student-forms/>).
3. See Basic Program for Engineering Curricula for accepted substitutions for curriculum designated courses in the Basic Program <https://www.engineering.iastate.edu/classification/students/basic-program/>.

See also: A 4-year plan of study grid showing course template by semester for a building option in Construction Engineering.

See also: A 4-year plan of study grid showing course template by semester for an electrical option in Construction Engineering.

See also: A 4-year plan of study grid showing course template by semester for a infrastructure option in Construction Engineering.

See also: A 4-year plan of study grid showing course template by semester for a mechanical option in Construction Engineering.

Construction Engineering, B.S. Building option

First Year

Fall	Credits	Spring	Credits
CONE 1210	1	CONE 1220	1
CE 1600	3	CE 1700	2
MATH 1650	4	MATH 1660	4
CHEM 1670	4	ENGL 2500	3
ENGL 1500	3	PHYS 2310	4
ENGR 1010	R	PHYS 2310L	1
		LIB 1600	1
15		16	

Second Year

Fall	Credits	Spring	Credits
CONE 2220	3	CONE 2410	3
CE 1110	3	CONE 2510	1
PHYS 2320	4	MATH 2670	4
PHYS 2320L	1	CE 2740	3
SSH Elective	3	IE 3050	3
MATH or STAT Elective	3		
17		14	

Third Year

Fall	Credits	Spring	Credits
CONE 3220	3	CONE 3400	3
CONE 3520	3	CE 3600	4
CONE 3530	3	CE 3320	3
STAT 2310 or 3050	3	ABE 3780	3
EM 3240	3	EM 3270	1
ECON 1010 or 1020	3	Law Elective (CONE 3800 or ACCT 2150)	3
18		17	

Fourth Year

Fall	Credits	Spring	Credits
CONE 4220	3	CONE 4870	3
CONE 4410	3	CONE 4880	3
CE 3830	1	CE 3340	3

CE 3330	3	International Perspective	3
Engr Topics Elective	3	Business Comm Elective (ENGL 3020 or 3090 or 3140)	3
US Cultures and Communities	3		
16		15	

Construction Engineering, B.S. Electrical option

First Year

Fall	Credits	Spring	Credits
CONE 1210	1	CONE 1220	1
CE 1600	3	CE 1700	2
MATH 1650	4	MATH 1660	4
CHEM 1670	4	ENGL 2500	3
ENGL 1500	3	PHYS 2310	4
ENGR 1010	R	PHYS 2310L	1
		LIB 1600	1
15		16	

Second Year

Fall	Credits	Spring	Credits
CONE 2220	3	CONE 2410	3
CE 1110	3	CONE 2510	1
PHYS 2320	4	MATH 2670	4
PHYS 2320L	1	CE 2740	3
SSH Elective	3	IE 3050	3
MATH or STAT Elective	3		
17		14	

Third Year

Fall	Credits	Spring	Credits
CONE 3520	3	EE 2300	4
CONE 3530	3	EE 3030	3
STAT 2310 or 3050	3	ABE 3780	3
EM 3240	3	ECON 1010 or 1020	3
EE 2010	4	Law Elective (CONE 3800 or ACCT 2150)	3
16		16	

Fourth Year

Fall	Credits	Spring	Credits
CONE 4220	3	CONE 4870	3
CONE 4410	3	CONE 4880	3
EE 4560	3	EE 4570	3

CE 3320	3 Business Comm Elective (ENGL 3020 or 3090 or 3140)	3	Engineering Topics Elective International Perspective	3 Engineering Topics Elective 3 Business Comm Elective (ENGL 3020 or 3090 or 3140)	3 3
Engineering Topics Elective	3 International Perspective	3			
US Cultures and Communities	3			15	15
	18	15			

Construction Engineering, B.S. Mechanical option

First Year

Fall	Credits	Spring	Credits
CONE 1210	1	CONE 1220	1
CE 1600	2	CE 1700	2
MATH 1650	4	MATH 1660	4
CHEM 1670	3	ENGL 2500	3
ENGL 1500	4	PHYS 2310	4
ENGR 1010	1	R PHYS 2310L	1
		LIB 1600	1
	15		16

Second Year

Fall	Credits	Spring	Credits
CONE 2220	3	CONE 2410	3
CE 1110	1	CONE 2510	1
PHYS 2320	4	MATH 2670	4
PHYS 2320L	3	CE 2740	3
ECON 1010 or 1020	3	IE 3050	3
MATH or STAT Elective	3		
	17		14

Third Year

Fall	Credits	Spring	Credits
CONE 3520	2	EE 4420	2
CONE 3530	2	EE 4480	2
STAT 2310 or 3050	3	CE 3320	3
EM 3240	3	ABE 3780	3
ME 2310	3	Law Elective (CONE 3800 or ACCT 2150)	3
SSH Elective	3	US Cultures and Communities	3
	18		16

Fourth Year

Fall	Credits	Spring	Credits
CONE 4220	3	CONE 4870	3
CONE 4410	3	CONE 4880	3
ME 4360	4	ME 4420	3

Construction Engineering, B.S. Infrastructure option

First Year

Fall	Credits	Spring	Credits
CONE 1210	1	CONE 1220	1
CE 1600	2	CE 1700	2
MATH 1650	4	MATH 1660	4
CHEM 1670	3	ENGL 2500	3
ENGL 1500	4	PHYS 2310	4
ENGR 1010	1	R PHYS 2310L	1
		LIB 1600	1
	15		16

Second Year

Fall	Credits	Spring	Credits
CONE 2220	3	CONE 2410	3
CE 1110	1	CONE 2510	1
PHYS 2320	4	MATH 2670	4
PHYS 2320L	3	CE 2740	3
SSH Elective	3	IE 3050	3
MATH or STAT Elective	3		
	17		14

Third Year

Fall	Credits	Spring	Credits
CONE 3220	3	CONE 3400	3
STAT 2310 or 3050	3	CE 3320	3
EM 3240	4	CE 3600	4
ABE 3780	3	CE 3820	3
ECON 1010 or 1020	1	EM 3270	1
Law Elective (CONE 3800 or ACCT 2150)	3	US Cultures and Communities	3
	18		17

Fourth Year

Fall	Credits	Spring	Credits
CONE 4410	3	CONE 4870	3
CONE 4220	3	CONE 4880	3
CE 3330	3	CE 3340	3

ME 4410	3 Business Comm Elective (ENGL 3020 or 3090 or 3140)	3
Engineering Topics Elective	3 International Perspective	3
16		15

A concurrent bachelor of science/master of science (B.S./M.S.) degree program is available to qualified seniors at Iowa State University.

Go to <https://www.ccee.iastate.edu/prospective-graduate-students/concurrent-programs/> for further information.

Graduate Study

An area of specialization in construction engineering and management is offered within the graduate program of the Department of Civil, Construction and Environmental Engineering. This specialization focuses on project management including and beyond the traditional iron triangle of scope, technical, and schedule to include context and financing, enabling project management of more complex projects. Three graduate degrees including, Master of Engineering (30 credits), Master of Science (30 credits), and Doctor of Philosophy (72 credits) are offered. The Master of Engineering degree is a coursework only option and the other degree programs require a research component at a level adjusted to the degree sought. All degrees are offered on-campus, and some degrees may be completed off-campus through distance education. All degrees require CE 5010, CE 5020, CE 5030, and a minimum of nine additional credits within construction focused CE courses. Course options include but are not limited to:

CE 5010	Preconstruction Project Engineering and Management	3
CE 5020	Construction Project Engineering and Management	3
CE 5030	Construction Finance and Business Management	3
CE 5050	Design of Construction Systems	3
CE 5940A	Special Topics Construction Engineering and Mgt.: Planning and Scheduling	3
CE 5940L	Special Topics Construction Engineering and Mgt.: Advanced Building Construction Topics - LEED for New Construction	3

Undergraduate students may also qualify for the concurrent Bachelor of Science/Master of Science (B.S./M.S.) degree program. Courses are offered for minor work to students taking major work in other curricula or in interdepartmental programs. A graduate certificate is also available which requires 12 credits of coursework. Courses required for the certificate are CE 5010, CE 5020, and CE 5030. For additional information

see Civil Engineering, Graduate Programs, <https://www.ccee.iastate.edu/academics/graduate/>.

Cyber Security Engineering

www.ece.iastate.edu (<http://www.ece.iastate.edu/>)

Administered by the Department of Electrical and Computer Engineering

For the undergraduate curriculum in Cyber Security Engineering leading to the degree Bachelor of Science. The Cyber Security Engineering Program is accredited by the Engineering Accreditation Commission of ABET, <https://www.abet.org> (<https://www.abet.org/>), under the commission's General Criteria and Program Criteria for Cybersecurity Engineering and Similarly Named Engineering Programs.

The Department of Electrical and Computer Engineering (ECPE) at Iowa State University provides undergraduate students with the opportunity to learn computer engineering fundamentals, study applications of the most recent advances in state-of-the-art technologies, and to prepare for the practice of cyber security engineering. The student-faculty interaction necessary to realize this opportunity occurs within an environment that is motivated by the principle that excellence in undergraduate education is enhanced by an integrated commitment to successful, long-term research and outreach programs.

Student Learning Outcomes: Graduates of the Cyber Security Engineering curriculum should have, at the time of graduation:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Program Educational Objectives: The program objectives for the cyber security engineering program describe accomplishments that graduates are expected to attain within five years after graduation. Graduates will have applied their expertise to contemporary problem solving, be engaged professionally, have continued to learn and adapt, and have contributed to their organizations through leadership and teamwork. More specifically, the objectives for expertise, engagement, learning, leadership and teamwork are defined below for the program.

The objectives of the cyber security engineering program at Iowa State University are:

- Graduates, within five years of graduation, should demonstrate peer-recognized **expertise** in computer security principles together with the ability to articulate that expertise and use it for contemporary problem solving in the analysis, design, and operation of the physical, software and human components of a system, including system integration and implementation.
- Graduates, within five years of graduation, should demonstrate **engagement** in the engineering profession, locally and globally, by contributing to the ethical, competent, and creative practice of engineering or other professional careers.
- Graduates, within five years of graduation, should demonstrate sustained **learning** and adapting to a constantly changing field through graduate work, professional development, and self-study.
- Graduates, within five years of graduation, should demonstrate **leadership** and initiative to ethically advance professional and organizational goals, facilitate the achievements of others, and obtain substantive results.
- Graduates, within five years of graduation, should demonstrate a commitment to **teamwork** while working with others of diverse cultural and interdisciplinary backgrounds.

As a complement to the instructional activity, the ECPE department provides opportunities for each student to have experience with broadening activities. Through the cooperative education and internship program, students have the opportunity to gain practical industry experience. Students have the opportunity to participate in advanced research activities, and through international exchange programs, students learn about engineering practices in other parts of the world. Well-qualified juniors and seniors in cyber security engineering who are interested in graduate study may apply for concurrent enrollment in the Graduate College to simultaneously pursue both the Bachelor of Science and Master of Science.

Curriculum in Cyber Security Engineering

Administered by the Department of Electrical and Computer Engineering.

Leading to the degree Bachelor of Science.

Total credits required: 125

Any transfer credit courses applied to the degree program require a grade of C or better (but will not be calculated into the ISU cumulative GPA, Basic Program GPA or Core GPA). See also Basic Program and Special Programs.

Note: Department does not allow Pass/Not Pass credits to be used to meet graduation requirements.

International Perspectives: 3 cr.¹

U.S. Cultures and Communities: 3 cr.¹

Communication Proficiency/Library requirement:

ENGL 1500	Critical Thinking and Communication (Must have a C or better in this course)	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition (Must have a C or better in this course)	3
LIB 1600	Introduction to College Level Research	1
One of the following:		3
ENGL 3140	Technical Communication (C or better in this course)	
ENGL 3090	Proposal and Report Writing (C or better in this course)	

General Education Electives: 21 cr.

³

ENGL 2500	Written, Oral, Visual, and Electronic Composition (Must have a C or better in this course.)	3
ENGL 3140	Technical Communication (Must have a C or better in this course.)	3
or ENGL 3090	Proposal and Report Writing	
Complete minimum of 3 cr. from Approved General Education Component 3000 level and above.		3
Complete additional 12 cr. from Approved General Education Component.		12
Total Credits		21

Basic Program: 24 cr.

A minimum GPA of 2.00 required for this set of courses (please note that transfer course grades will not be calculated into the Basic Program GPA). See Requirement for Entry into Professional Program in College of Engineering Overview section.

CHEM 1670	General Chemistry for Engineering Students	4
or CHEM 1770	General Chemistry I	
ENGL 1500	Critical Thinking and Communication (Must have a C or better in this course)	3
ENGR 1010	Engineering Orientation	R
CPRE 1850	Introduction to Computer Engineering and Problem Solving I	3
LIB 1600	Introduction to College Level Research	1
MATH 1650	Calculus I	4
MATH 1660	Calculus II	4
PHYS 2310	Introduction to Classical Physics I	4

PHYS 2310L	Introduction to Classical Physics I Laboratory	1
Total Credits		24

Math and Physical Science: 17 cr.

COMS 2270	Object-oriented Programming	4
COMS 2280	Introduction to Data Structures	3
MATH 2670	Elementary Differential Equations and Laplace Transforms	4
STAT 3300	Probability and Statistics for Computer Science	3
Math Elective ³		3
Total Credits		17

Cyber Security Engineering Core: 37 cr.

(A minimum GPA of 2.00 required for this set of courses, including any transfer courses; please note that transfer course grades will not be calculated into the Core GPA).

CYBE 2300	Cyber Security Fundamentals	3
CYBE 2310	Cyber Security Concepts and Tools	3
CYBE 2340	Legal, Professional, and Ethical Issues in Cyber Systems	3
CYBE 3310	Application of Cryptographic Concepts to Cyber Security	3
CPRE 2810	Digital Logic	4
CPRE 2880	Embedded Systems I: Introduction	4
CPRE 3080	Operating Systems: Principles and Practice	4
CPRE 3100	Theoretical Foundations of Computer Engineering	3
CPRE 3810	Computer Organization and Assembly Level Programming	4
COMS 3090	Software Development Practices	3
COMS 3110	Introduction to the Design and Analysis of Algorithms	3
Total Credits		37

Other Remaining Courses: 26 cr.

CPRE 4910	Senior Design Project I and Professionalism	3
CPRE 4920	Senior Design Project II	2
Cyber Security Technical Electives ³		12
Computer Engineering Technical Electives ³		3
Technical Electives ³		6
Total Credits		26

Seminar/Co-op/Internships⁴:

CPRE 1660	Professional Programs Orientation	
CPRE 4940	Portfolio Assessment	

Transfer Credit Requirements

The degree program must include a minimum of 30 credits at the 3000-level or above in professional and technical courses earned at ISU

in order to receive a B.S. in computer engineering. These 30 credits must include: CPRE 4910 Senior Design Project I and Professionalism, CPRE 4920 Senior Design Project II, and credits in the core professional curriculum and/or in technical electives. The Electrical and Computer Engineering Department requires a grade of C or better for any transfer credit course that is applied to the degree program.

1. These university requirements will add to the minimum credits of the program unless the university-approved courses are also approved by the department to meet other course requirements within the degree program. U.S. diversity and international perspectives courses may not be taken Pass/Not Pass but are used to meet the general education electives.
2. See Basic Program for Professional Engineering Curricula for accepted substitutions for curriculum designated courses in the Basic Program.
3. From department approved lists. (<http://www.ece.iastate.edu/academics/bachelors-degree-requirements/>)
4. Co-op / Internships are optional.

See also: A 4-year plan of study grid showing course template by semester.

Note: International perspectives and U.S. cultures and communities courses are used to meet the general education electives.

Cyber Security Engineering, B.S.

First Year

Fall	Credits Spring	Credits
CHEM 1670	4 COMS 2270	4
CPRE 1850	3 CPRE 1660	R
ENGL 1500	3 MATH 1660	4
ENGR 1010	R PHYS 2310	4
LIB 1600	1 PHYS 2310L	1
MATH 1650	4 General Education Elective	3
	15	16

Second Year

Fall	Credits Spring	Credits
CPRE 2810	4 CPRE 2880	4
COMS 2280	3 ENGL 2500	3
MATH 2670	4 Math Elective	3
CYBE 2300	3 CYBE 2310	3
	CYBE 2340	3
	14	16

Third Year

Fall	Credits Spring	Credits
CPRE 3810	4 CPRE 3080	4
CPRE 3100	3 COMS 3110	3
COMS 3090	3 ENGL 3140 or ENGL 3090	3
CYBE 3310	3 General Education Elective	3
General Education Elective	3 Cyber Security Elective	3
	16	16

Fourth Year

Fall	Credits Spring	Credits
CPRE 4910	3 CPRE 4920	2
CPRE 4940	R Tech Elective	6
STAT 3300	3 General Education Elective	3
Cyber Security Elective	6 Cyber Security Elective	3
CPRE Elective	3	
General Education Elective	3	
	18	14

Cyber Security Engineering Minor

The cyber security engineering minor is intended for students studying computer engineering, computer science, software engineering, or management information systems with the goal of enabling them to work in cyber security. The minor consists of a series of lab-based courses that are designed to provide students with both the technical background and the hands-on experiences along with the theoretical background to allow them to compete for jobs in cyber security.

The Professional Certificate in Cybersecurity is aimed at graduates with an AAS degree (two-year degree) who are working in a security or IT-related field. The certificate will provide the material needed to upskill students so that they can gain cybersecurity knowledge. The certificate will be offered online as a series of half-semester 2 credit courses (the professional communications course is 3 credits). The certificate will be 21 credits. The courses in the certificate will map to federal training standards as outlined in the NIST/NICE framework.

Cyber Security Engineering students have the opportunity to become a concurrent undergraduate/graduate student in a few programs.

CONCURRENT B.S./M.ENG OR M.S. IN COMPUTER ENGINEERING CONCURRENT B.S./M.ENG OR M.S. IN ELECTRICAL ENGINEERING CONCURRENT B.S./M.ENG OR M.S. IN CYBER SECURITY

Cyber Security Engineering students have the opportunity to begin their coursework towards their master's degree in computer engineering, cyber security during, or electrical engineering their final semester(s) of undergraduate coursework. In order to be eligible, student must have a 3.0 cumulative GPA or higher to begin a Master of Engineering ("M.ENG") degree or a 3.3 cumulative GPA to begin a Master of Science ("M.S.") degree. Students should meet with their academic advisor to discuss this option.

CONCURRENT B.S./MBA

Juniors and Seniors have the opportunity to continue their undergraduate coursework while also pursuing a Master of Business Administration (MBA) degree. For additional information please visit the concurrent MBA website www.ivybusiness.iastate.edu/full-time-concurrent-mba (<https://www.ivybusiness.iastate.edu/full-time-concurrent-mba/>).

The department offers work for the degrees Master of Science and Doctor of Philosophy with a major in cyber security and minor work to students with other majors. Minor work for cyber security majors is usually selected from a wide range of courses outside cyber security.

Master of Engineering degree is coursework only. It is recommended for off-campus students.

The degree Master of Science with thesis is recommended for students who intend to continue toward the Doctor of Philosophy degree or to undertake a career in research and development. The non-thesis Master of Science degree requires a creative component.

The department also offers a graduate certificate program in cyber security.

The normal prerequisite to major in graduate work in cyber security is the completion of undergraduate work substantially equivalent to that required of cyber security students at this university. Because of the diversification in the cyber security graduate program, however, it is possible for a student to qualify for graduate study in certain areas of cyber security even though the student's undergraduate or prior graduate training has been in a discipline other than cyber security. Supporting work, if required, will depend on the student's background and area of research interest. Prospective students from a discipline other than cyber

security are required to submit, with the application for admission, a statement of the proposed area of graduate study.

The department requires submission of GRE General test scores by applicants. All students whose first language is not English and who have no U.S. degree must submit TOEFL examination scores. Students pursuing the Doctor of Philosophy must complete the department qualifying process.

The Department of Electrical and Computer Engineering is a participating department in the interdepartmental Master of Science and Doctor of Philosophy degree programs in bioinformatics and computational biology. Students interested in these programs may earn their degrees while working under an advisor in electrical and computer engineering.

Well-qualified juniors or seniors in cyber security who are interested in graduate study may apply for concurrent enrollment in the Graduate College to simultaneously pursue both the Bachelor of Science and Master of Science degrees, the Bachelor of Science and Master of Business Administration, or the Bachelor of Science and Master of Engineering degrees. Under concurrent enrollment, students are eligible for assistantships and simultaneously take undergraduate and graduate courses. Details are available in the Student Services Office and on the department's website.

Cyber Security Certificate Overview

The Professional Certificate in Cyber Security is aimed at graduates with an AAS degree (two-year degree) who are working in a security or IT-related field. The certificate will provide the material needed to upskill students so that they can gain cybersecurity knowledge. The certificate will be offered online as a series of half-semester 2 credit courses (the professional communications course is 3 credits). The certificate will be 20 credits. The courses in the certificate will map to federal training standards as outlined in the NIST/NICE framework.

Undergraduate Certificate

ENGL 3140	Technical Communication	3
CYBSC 3700	Fundamentals of Network Security	2
CYBSC 3710	Adversarial Thinking	2
CYBSC 3720	Fundamentals of Data Security and Privacy	2
CYBSC 4890	Cybersecurity Capstone	3
8 credits from the following:		8
CYBSC 4600	Application of Security Literacy	
CYBSC 4610	Cyber Exercise Design	
CYBSC 4700	Threat Hunting and Intelligence	
CYBSC 4710	Digital Forensics and Incident Response	

CYBSC 4720	Applications of Cryptography
CYBSC 4730	Fundamentals of Operating Systems Security
CYBSC 4740	Fundamentals of Cloud Security
CYBSC 4750	Fundamentals of Software Security
CYBSC 4760	Fundamentals of Cybersecurity Scripting
CYBSC 4770	Fundamentals of Cyber Resilience
CYBSC 4780	Fundamentals of Cyber-Physical and Critical Infrastructure Security
CYBSC 4790	Fundamentals of Web Security

Total Credits

20

Cyber Security Minor

The minor requires students to have a program of study in computer engineering, computer science, software engineering, or management information systems with the goal of enabling them to work in cyber security. The minor consists of a series of lab based courses that are designed to provide students with both the technical background and the hands-on experiences along with the theoretical background to allow them to compete for jobs in cyber security.

Objectives

The minor in cyber security is designed to prepare students with the technical skills for entry into cybersecurity positions in industry or government agencies.

A few years after graduation, students completing the cyber security minor should be:

1. Contributing to their communities and society in the area of cyber security technology and applications and demonstrating an understanding of contemporary security issues, both technological and societal.
2. Advancing in their careers through application of their knowledge of cyber security
3. Working effectively as team members and demonstrating ethics and responsible behavior
4. Applying cyber security methods and concepts to the general area of their BS degree
5. Continuing their professional development through life-long learning

Learning Outcomes

After earning the minor in cyber security students will

1. Demonstrate the ability to apply knowledge of cyber security concepts, tools and technologies to computer systems.
2. Understand cyber security risks, threats and countermeasures and apply this understanding to develop cyber defense strategies.

3. Demonstrate the ability to design cyber security systems to meet organizational needs within realistic constraints such as economic, environmental, social, and ethical expectations.
4. Demonstrate the ability to function on teams.

The minor requires 15 credits, including at least 6 credits in courses numbered 3000 or above taken at Iowa State University. The minor must include at least 3 credits that are not used to meet any other department, college, or university requirement. Below is the list of courses used in the minor.

Core		
CYBE 2300	Cyber Security Fundamentals	3
CYBE 2310	Cyber Security Concepts and Tools	3
CYBE 3310	Application of Cryptographic Concepts to Cyber Security	3
Plus one of the following (3-4 cr.)		3
CPRE 3080	Operating Systems: Principles and Practice	
COMS 2520	Linux Operating System Essentials	
COMS 3520	Introduction to Operating Systems	
One Elective Course ¹		3
Total Credits		15

1. From department approved lists.

Cyber-Physical Systems Minor

Cyber-Physical Systems Minor

With the fourth industrial revolution upon us, physical systems are being designed to have a cyber component, that enables remote access, monitoring and control. In these systems, ubiquitous sensing, and advanced data management capability are taking us from automation to autonomy via a deep interconnection between the cyber and physical entities. Cyber-physical systems (CPS) are becoming abundant in many application sectors including manufacturing, energy, health care, transportation and agriculture. Safety-, time- and life-critical systems are relying on CPS concepts to become more efficient, robust, resilient, flexible and scalable. As CPS applications become more pervasive, the engineering education system needs to produce a next generation CPS workforce who can design, produce, and maintain these systems.

With this motivation and encouraged by the demand from the industry stakeholders of ISU College of Engineering, this CPS minor will focus on sensing, advanced information processing (data analytics and machine learning), and controls aspects of Cyber-Physical Systems. Specific CPS application sectors such as energy/power systems, manufacturing, biomedical devices, autonomous systems, transportation, and agriculture will be in focus.

The minor requires 15 credits, including at least 6 credits in courses numbered 3000 or above taken at Iowa State University. The minor must include 9 credits that are not used to meet any other department, college, or university requirement.

Required courses:

ME 2800	Design and Analysis of Cyber-Physical Systems	3
AERE 3640	Cyber-Physical Systems Application	3
CPRE 2870	Cyber-Physical System Fundamentals	3
Elective courses:		6
ME 3700	Engineering Measurements	
ME 4110	Automatic Controls	
ME 4180	Mechanical Considerations in Robotics	
ME 4210	System Dynamics and Control	
ME 4560	Machine Vision	
ME 4750	Modeling and Simulation	
EE 3240	Signals and Systems II	
EE 3330	Electronic Systems Design	
EE 4250	Machine learning: A Signal Processing Perspective	
EE 4760	Control System Simulation	
CPRE 2300	Cyber Security Fundamentals	
CPRE 3880	Embedded Systems II: Mobile Platforms	
CPRE 4140	Introduction to Software Systems for Big Data Analytics	
CPRE 4190	Software Tools for Large Scale Data Analysis	
CPRE 4210	Software Analysis and Verification for Safety and Security	
CPRE 4580	Real Time Systems	
CPRE 4880	Embedded Systems Design	
ABE 4030	Physical Modeling and Control of Dynamic Systems	
ABE 4040	Instrumentation for Agricultural and Biosystems Engineering	
ABE 4100	Electronic Systems Integration for Agricultural Machinery	
IE 4130	Stochastic Modeling, Analysis and Simulation	
IE 4320	Industrial Automation	
IE 4870	Big Data Analytics and Optimization	
AERE 4070	Applied Formal Methods	
AERE 4330	Spacecraft Dynamics and Control	
AERE 4630	Introduction to Multidisciplinary Design Optimization	
AERE 4640	Spacecraft Systems	
CE 4490	Structural Health Monitoring	

CE 4530	Highway Design
CE 5530	Traffic Engineering
CE 5560	Transportation Data Analysis

Total Credits**15**

Electrical Engineering

For the undergraduate curriculum in Electrical Engineering leading to the degree Bachelor of Science. The Electrical Engineering Program is accredited by the Engineering Accreditation Commission of ABET, <https://www.abet.org> (<https://www.abet.org>), under the commission's General Criteria and Program Criteria for Electrical, Computer, Communications, Telecommunication(s) and Similarly Named Engineering Programs.

The Department of Electrical and Computer Engineering (ECPE) at Iowa State University provides undergraduate students with the opportunity to learn electrical and computer engineering fundamentals, study applications of the most recent advances in state-of-the-art technologies and prepare for the practice of electrical engineering. The student-faculty interaction necessary to realize this opportunity occurs within an environment that is motivated by the principle that excellence in undergraduate education is enhanced by an integrated commitment to successful, long-term research and outreach programs.

The electrical engineering curriculum offers a number of emphasis areas at the undergraduate level, including control systems, electromagnetics and nondestructive evaluation, microelectronics and photonics, VLSI, electric power and energy systems, and communications and signal processing. Students are required to choose at least one course sequence that focuses on one of these areas; therefore, graduates have substantial depth in specific areas to complement the breadth obtained in the required curriculum. Students also may take elective courses in computer networking, security, computer architecture, digital systems, and software.

Student Learning Outcomes: Graduates of the Electrical Engineering curriculum should have at the time of graduation:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Program Educational Objectives: The program objectives for the electrical engineering program describe accomplishments that graduates are expected to attain within five years after graduation. Graduates will have applied their expertise to contemporary problem solving, be engaged professionally, have continued to learn and adapt, and have contributed to their organizations through leadership and teamwork. More specifically, the objectives for expertise, engagement, learning, leadership and teamwork are defined below for each program.

The objectives of the electrical engineering program at ISU are:

- Graduates, within five years of graduation, should demonstrate peer-recognized **expertise** together with the ability to articulate that expertise and use it for contemporary problem solving in the analysis, design, and evaluation of electrical and electronic devices and systems.
- Graduates, within five years of graduation, should demonstrate **engagement** in the engineering profession, locally and globally, by contributing to the ethical, competent, and creative practice of engineering or other professional careers.
- Graduates, within five years of graduation, should demonstrate sustained **learning** and adapting to a constantly changing field through graduate work, professional development, and self-study.
- Graduates, within five years of graduation, should demonstrate **leadership** and initiative to ethically advance professional and organizational goals, facilitate the achievements of others, and obtain substantive results.
- Graduates, within five years of graduation, should demonstrate a commitment to **teamwork** while working with others of diverse cultural and interdisciplinary backgrounds.

As a complement to the instructional activity, the ECPE department provides opportunities for each student to have experience with broadening activities. Through the cooperative education and internship program, students have the opportunity to gain practical industry experience.

Students have the opportunity to participate in advanced research activities, and through international exchange programs, students learn about engineering practices in other parts of the world. Well-qualified juniors and seniors in electrical engineering who are interested

in graduate study may apply for concurrent enrollment in the Graduate College to simultaneously pursue both the Bachelor of Science and Master of Science, the Bachelor of Science and Master of Business Administration, or the Bachelor of Science and Master of Engineering degrees.

Courses for students who are not in the electrical engineering program: EE 4420 Introduction to Circuits and Instruments, EE 4480 Introduction to AC Circuits and Motors. Credit in these courses may not be counted toward a degree in either electrical engineering or computer engineering.

Curriculum in Electrical Engineering

Administered by the Department of Electrical and Computer Engineering.

Leading to the degree Bachelor of Science.

Total credits required: 128.

Any transfer credit courses applied to the degree program require a grade of C or better (but will not be calculated into the ISU cumulative GPA, Basic Program GPA or Core GPA). See also Basic Program and Special Programs.

Note: Department does not allow Pass/Not Pass credits to be used to meet graduation requirements.

International Perspectives: 3 cr.¹

U.S. Cultures and Communities: 3 cr.¹

Communication Proficiency/Library requirement:

ENGL 1500	Critical Thinking and Communication (Must have a C or better in this course)	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition (Must have a C or better in this course)	3
LIB 1600	Introduction to College Level Research	1
One of the following:		3
ENGL 3140	Technical Communication (C or better in this course)	
ENGL 3090	Proposal and Report Writing (C or better in this course)	

General Education Electives: 18 cr.

ENGL 2500	Written, Oral, Visual, and Electronic Composition (Must have a C or better in this course.)	3
ENGL 3140	Technical Communication (Must have a C or better in this course.)	3
or ENGL 3090	Proposal and Report Writing	
Complete minimum of 3 cr. from Approved General Education Component 3000 level and above. ²		3
Complete additional 9cr. from Approved General Education Component. ²		9
Total Credits		18

Basic Program: 24 cr.

A minimum GPA of 2.00 required for this set of courses (please note that transfer course grades will not be calculated into the Basic Program GPA). See Requirement for Entry into Professional Program in College of Engineering Overview section.

CHEM 1670	General Chemistry for Engineering Students	4
or CHEM 1770 General Chemistry I		
ENGL 1500	Critical Thinking and Communication (Must have a C or better in this course)	3
ENGR 1010	Engineering Orientation	R
EE 1850	Introduction to Electrical Engineering and Problem-Solving I ³	3
LIB 1600	Introduction to College Level Research	1
MATH 1650	Calculus I	4
MATH 1660	Calculus II	4
PHYS 2310	Introduction to Classical Physics I	4
PHYS 2310L	Introduction to Classical Physics I Laboratory	1
Total Credits		24

Math and Physical Science: 16 cr.

MATH 2070	Matrices and Linear Algebra	3
MATH 2650	Calculus III	4
MATH 2670	Elementary Differential Equations and Laplace Transforms	4
PHYS 2320	Introduction to Classical Physics II	4
Total Credits		15

Electrical Engineering Core: 44 cr.

(A minimum GPA of 2.00 required for this set of courses, including any transfer courses; please note that transfer course grades will not be calculated into the Core GPA).

CPRE 2810	Digital Logic	4
CPRE 2880	Embedded Systems I: Introduction	4
EE 2010	Electric Circuits	4
EE 2240	Signals and Systems I	4
EE 2300	Electronic Circuits and Systems	4
EE 2320	Professional and Ethical Issues in Electrical and Computer Engineering	3
EE 2850	Problem Solving Methods and Tools for Electrical Engineering	4
EE 3030	Energy Systems and Power Electronics	3
EE 3110	Electromagnetic Fields and Waves	4
EE 3220	Probabilistic Methods for Electrical Engineers	3
Core Elective: one of the following:		7
EE 3210	Communication Systems I	
EE 3240	Signals and Systems II	
Core Elective: one of the following:		

EE 3300	Integrated Electronics	
EE 3320	Semiconductor Materials and Devices	

Total Credits **44**

Note: EE 3210 and EE 3320 are 3-credit courses, whereas EE 3240 and EE 3300 are 4-credit courses. The core credit requirement (44 credits) assumes 7 credits taken for these options. Any core credit surplus or deficiency can be used as credits for EE technical electives.

Other Remaining Courses: 27 cr.

EE 4910	Senior Design Project I and Professionalism	3
EE 4920	Senior Design Project II	2
Econ Elective (ECON 1010, 1020 or IE 3050)		3
EE/CPRE Technical Electives including one approved sequence ²		12
Technical Electives ²		7
Total Credits		27

Seminar/Co-op/Internships:

EE 1660	Professional Programs Orientation	R
EE 4940	Portfolio Assessment	R

Co-op or internship is optional

Outcomes Assessment - Students are required to prepare and to maintain a portfolio of their technical and non-technical skills. This portfolio is evaluated for student preparation during the student's curriculum planning process. Results of the evaluation are used to advise students of core strengths and weaknesses.

Transfer Credit Requirements

The degree program must include a minimum of 30 credits at the 3000-level or above in professional and technical courses earned at ISU in order to receive a B.S. in electrical engineering. These 30 credits must include EE 4910 Senior Design Project I and Professionalism, EE 4920 Senior Design Project II, and credits in the core professional curriculum and/or in technical electives. The Electrical and Computer Engineering Department requires a grade of C or better for any transfer credit course that is applied to the degree program.

1. These university requirements will add to the minimum credits of the program unless the university-approved courses are also approved by the department to meet other course requirements within the degree program. U.S. Cultures and Communities and International Perspectives courses may not be taken Pass/Not Pass.
2. From department approved lists (<http://www.ece.iastate.edu/academics/bachelors-degree-requirements/>).
3. See Basic Program for Professional Engineering Curricula for accepted substitutions for curriculum designated courses in the Basic Program.

See also: A 4-year plan of study grid showing course template by semester.

Note: International perspectives and U.S. diversity courses are used to meet the general education electives.

Electrical Engineering, B.S.

First Year

Fall	Credits Spring	Credits
ENGR 1010	R MATH 1660	4
EE 1850	3 EE 2850	4
MATH 1650	4 PHYS 2310	4
CHEM 1670	4 PHYS 2310L	1
ENGL 1500	3 EE 1660	R
LIB 1600	1 General Education Elective	3
	15	16

Second Year

Fall	Credits Spring	Credits
EE 2010	4 CPRE 2810	4
PHYS 2320	4 EE 2300	4
MATH 2670	4 EE 2240	4
ENGL 2500	3 MATH 2650	4
	15	16

Third Year

Fall	Credits Spring	Credits
CPRE 2880	4 EE 3300 or EE 3320	3-4
EE 2320	3 EE 3210 or EE 3240	3-4
EE 3030	3 EE 3220	3
EE 3110	4 ENGL 3140 or ENGL 3090	3
MATH 2070	3 General Education Elective	3
	17	15-17

Fourth Year

Fall	Credits Spring	Credits
EE 4910	3 EE 4920	2
EE 4940	R Technical Electives	10
Technical Electives	9 General Education Electives	6
Econ Elective (ECON 1010, 1020 or IE 3050)	3	
	15	18

Actual Total Credits: 128

Electrical Engineering students have the opportunity to become a concurrent undergraduate/graduate student in a few programs.

CONCURRENT B.S./M.ENG OR M.S. IN COMPUTER ENGINEERING

CONCURRENT B.S./M.ENG OR M.S. IN CYBER SECURITY

CONCURRENT B.S./M.ENG OR M.S. IN ELECTRICAL ENGINEERING

Electrical engineering students have the opportunity to begin their coursework towards their master's degree in computer, cyber security or electrical engineering during their final semester(s) of undergraduate coursework. In order to be eligible, student must have a 3.0 cumulative GPA or higher to begin a Master of Engineering ("M.ENG") degree or a 3.3 cumulative GPA to begin a Master of Science ("M.S.") degree. Students should meet with their academic advisor to discuss this option.

CONCURRENT B.S./MBA

Juniors and Seniors have the opportunity to continue their undergraduate coursework while also pursuing a Master of Business Administration (MBA) degree. For additional information please visit the concurrent MBA website www.ivybusiness.iastate.edu/full-time-concurrent-mba (<https://www.ivybusiness.iastate.edu/full-time-concurrent-mba/>).

Graduate Study

The department offers work for the degrees Master of Engineering, Master of Science, and Doctor of Philosophy with a major in electrical engineering and minor work to students with other majors. Minor work for electrical engineering majors is usually selected from a wide range of courses outside electrical engineering.

Master of Engineering degree is coursework only. It is recommended for off-campus students.

The degree Master of Science with thesis is recommended for students who intend to continue toward the Doctor of Philosophy degree or to undertake a career in research and development. The non-thesis Master of Science degree requires a creative component.

The department also offers a graduate certificate program in power systems engineering.

The normal prerequisite to major in graduate work in electrical engineering is the completion of undergraduate work substantially equivalent to that required of electrical engineering students at this university. Because of the diversification in the electrical engineering graduate program, however, it is possible for a student to qualify for graduate study in certain areas of electrical engineering even though the student's undergraduate or prior graduate training has been in a discipline other than electrical engineering. Supporting work, if required, will depend on the student's background and area of research interest.

Prospective students from a discipline other than electrical engineering are required to submit, with the application for admission, a statement of the proposed area of graduate study.

The department requires submission of GRE General test scores by applicants. All students whose first language is not English and who have no U.S. degree must submit TOEFL examination scores. Students pursuing the Doctor of Philosophy must complete the department qualifying process.

The Department of Electrical and Computer Engineering is a participating department in the interdepartmental Master of Science and Doctor of Philosophy degree programs in bioinformatics and computational biology. Students interested in these programs may earn their degrees while working under an advisor in electrical and computer engineering.

Well-qualified juniors or seniors in electrical engineering who are interested in graduate study may apply for concurrent enrollment in the Graduate College to simultaneously pursue both the Bachelor of Science and Master of Science degrees, the Bachelor of Science and Master of Business Administration, or the Bachelor of Science and Master of Engineering degrees. Under concurrent enrollment, students are eligible for assistantships and simultaneously take undergraduate and graduate courses. Details are available in the Student Services Office and on the department's website.

Energy Systems Minor

Energy Systems Engineering Minor

Energy systems are pervasive in our society. A list of energy-related subjects and applications in the engineering curriculum would be nearly endless, but here are some examples:

- Mechanical engineers have a core area in thermo-fluids where courses in thermodynamics, fluid mechanics, and heat transfer form a base for energy systems.
- Electrical engineers address power transmission and distribution as well as electric motors and power systems.
- Civil engineers develop structures for wind turbines and hydroelectric dams.
- Construction engineers need to understand how building systems impact energy utilization.
- Chemical engineers develop alternative fuels and clean burning technologies.
- Material engineers develop new materials for batteries and fuel cells.
- Aerospace engineers develop wind turbines.
- Industrial engineers address manufacturing efficiency and energy reduction.
- Agricultural engineers develop biorenewable energy sources.

Energy systems are also a significant focus of the grand challenges of engineering (<http://www.engineeringchallenges.org/>), and this minor will help our students address these issues in their engineering careers.

The goal of the minor in energy systems is to provide ISU engineering students with focused educational opportunities in the broad area of energy systems. Successful energy systems minor students will understand broad energy perspectives, the language of energy systems, and the economic, environmental, and policy issues related to energy in the two required courses (six credits) for the minor (ECON 3800 and EE 3510 **OR** ME 4330). *Note that credit for both EE 3510 and ME 4330 is no longer accepted.* The remaining nine credits in the minor can be selected from a list of approved engineering courses related to energy systems to give students the opportunity to extend their knowledge.

The Energy Systems minor is administered by the mechanical engineering department and is open to all undergraduates in the College of Engineering. The minor may be earned by completing 15 credits from the following course list. The minor must include at least 9 credits that are not used to meet any other department, college, or university requirement. A complete list of approved elective courses can be found below.

Required Courses

ECON 3800	Energy, Environmental and Resource Economics	3
EE 3510	Analysis of Energy Systems	3
or ME 4330	Alternative Energy	
Electives: Choose from list of approved courses as outlined below		9
Total Credits		15

Approved list of electives are as follows:

ABE 3250 Biorenewable Systems
 ABE 3420 Agricultural Tractor Power
 ABE 3630 Agri-Industrial Applications of Electric Power and Electronics
 ABE 3800 Principles of Biological Systems Engineering
 ME 4130 Fluid Power Engineering
 ABE 4720 Controlled Environments for Animals and Plants
 ABE 4800 Engineering Analysis of Biological Systems
 ABE 5720 Controlled Environments for Animals and Plants
 ABE 5800 Engineering Analysis of Biological Systems
 AERE 3810 Introduction to Wind Energy
 AERE 5700 Wind Engineering
 CHE 3560 Transport Phenomena I
 CHE 3570 Transport Phenomena II
 CHE 3580 Separations
 CHE 3810 Chemical Engineering Thermodynamics
 CHE 3820 Chemical Reaction Engineering
 CHE 4150 Biochemical Engineering
 CHE 5150 Biochemical Engineering

CHE 5540 Integrated Transport Phenomena
 CHE 5830 Advanced Thermodynamics
 CHE 5870 Advanced Chemical Reactor Design
 CONE 3520 Mechanical Systems in Buildings
 CONE 3530 Electrical Systems in Buildings
 CONE 3540 Building Energy Performance
 EE 3030 Energy Systems and Power Electronics
 EE 4480 Introduction to AC Circuits and Motors
 EE 4520 Electrical Machines and Power Electronic Drives
 EE 4550 Introduction to Energy Distribution Systems
 EE 4560 Power System Analysis I
 EE 4570 Power System Analysis II
 EE 4580 Economic Systems for Electric Power Planning
 EE 4590 Electromechanical Wind Energy Conversion and Grid Integration
 EE 5520 Energy System Planning
 EE 5530 Steady State Analysis
 EE 5540 Power System Dynamics
 EE 5550 Advanced Energy Distribution Systems
 EE 5560 Power Electronic Systems
 EE 5590 Electromechanical Wind Energy Conversion and Grid Integration
 EM 5700 Wind Engineering
 ENSCI 4800 Engineering Analysis of Biological Systems
 ME 3320 Engineering Thermodynamics II
 ME 3350 Fluid Flow
 ME 4130 Fluid Power Engineering
 ME 4360 Heat Transfer
 ME 4370 Introduction to Combustion Engineering
 ME 4410 Fundamentals of Heating, Ventilating, and Air Conditioning
 ME 4420 Heating and Air Conditioning Design
 ME 4440 Elements and Performance of Power Plants
 ME 4480 Fluid Dynamics of Turbomachinery
 ME 4490 Internal Combustion Engines
 ME 5010 Fundamentals of Biorenewable Resources
 ME 5300 Advanced Thermodynamics
 ME 5320 Compressible Fluid Flow
 ME 5350 Thermochemical Processing of Biomass
 ME 5360 Advanced Heat Transfer
 ME 5380 Advanced Fluid Flow
 ME 5420 Advanced Combustion
 ME 5450 Thermal Systems Design
 MATE 3110 Thermodynamics in Materials Engineering
 MSE 5200 Thermodynamics and Kinetics in Multicomponent Materials
 WESEP 5010 Wind Energy Resources
 WESEP 5020 Wind Energy Systems

<http://www.me.iastate.edu/energy-systems-minor/>

Engineering Mechanics

Administered by the Department of Aerospace Engineering

Undergraduate Study

The undergraduate courses in mechanics are intermediate between those in physics and mathematics and the professional and design courses of the several engineering curricula. In these courses the student is expected to acquire an understanding of the basic principles and analysis techniques pertaining to the static and dynamic behavior of rigid media, deformable solids, fluids, and gasses. Physical properties of engineering materials are studied in the classroom and are tested in the laboratory. General physical laws are given mathematical expression and are made suitable for use in the solution of specific problems in machine and structural design, and in the flow and measurement of fluids.

Graduate Study

The department offers graduate programs that lead to the degrees master of science, master of engineering, and doctor of philosophy with major in engineering mechanics, and minor work to students taking major work in other departments.

The master of science degree requires a thesis and has strong research emphasis. The master of science degree is recommended for students who anticipate entering a doctoral program later. The master of engineering degree does not require either research credits or a thesis. The program is intended to give students additional instruction at the graduate level to better qualify them for advanced professional engineering work. By careful selection of electives and perhaps additional courses during the senior undergraduate year, students should be able to qualify for the master of engineering degree with an additional year of full-time study after receiving their baccalaureate degree in one of the several engineering curricula.

The master of engineering degree does require a creative component which will be obtained by registering for EM 5990 Creative Component. A written report and an oral presentation will be given to the student's graduate committee.

At least 30 credits of acceptable graduate work are required for both the master of science and the master of engineering degrees. For specific course, research, and creative component requirements, see the departmental Graduate Student Handbook (<http://www.aere.iastate.edu/wp-content/blogs.dir/13/files/2011/09/Graduate-Handbook-Fall-2011.pdf>).

The normal prerequisite to major graduate work is the completion of a curriculum substantially equivalent to that required of undergraduate students in engineering at this university. However, because of the diversity of interests in graduate work in engineering mechanics, it

is possible for a student to qualify for graduate study even though undergraduate or prior graduate training has been in a discipline other than engineering—e.g., physics or mathematics.

Courses primarily for undergraduates:

EM 3000 M 00: Engineering Mechanics Military Transfer Credit

Credits: 0-99. Contact Hours: Lecture 0.

Repeatable.

(Typically Offered: Fall, Spring, Summer)

EM 3240: Mechanics of Materials

Credits: 3. Contact Hours: Lecture 3.

Prereq: CE 2740

Plane stress, plane strain, stress-strain relationships, and elements of material behavior. Application of stress and deformation analysis to members subject to centric, torsional, flexural, and combined loadings. Elementary considerations of theories of failure, buckling. (Typically Offered: Fall, Spring, Summer)

EM 3270: Mechanics of Materials Laboratory

Credits: 1. Contact Hours: Laboratory 2.

Prereq: EM 3240

Experimental determination of mechanical properties of selected engineering materials. Experimental verification of assumptions made in 3240. Use of strain measuring devices. Preparation of reports. (Typically Offered: Fall, Spring)

EM 3620: Principles of Nondestructive Testing

(Cross-listed with MATE 3620).

Credits: 3. Contact Hours: Lecture 3.

Prereq: PHYS 1320 OR PHYS 2320 or PHYS 2320H

Radiography, ultrasonic testing, magnetic particle inspection, eddy current testing, dye penetrant inspection, and other techniques. Physical bases of nondestructive tests, materials to which applicable, effects of material condition, types of defects detectable, calibration standards, and reliability safety precautions. (Typically Offered: Fall, Spring)

EM 3620L: Nondestructive Testing Laboratory

(Cross-listed with MATE 3620L).

Credits: 1. Contact Hours: Laboratory 2.

Prereq: Credit or enrollment in MATE 3620 or EM 3620

Application of nondestructive testing techniques to the detection and sizing of flaws in materials and to the characterization of material's microstructure. Included are experiments in hardness, dye penetrant, magnetic particle, x-ray, ultrasonic and eddy current testing. (Typically Offered: Fall, Spring)

EM 4170: Experimental Mechanics

(Dual-listed with EM 5170/ AERE 5170). (Cross-listed with AERE 4170).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: EM 3240, and MATE 2730

Introduction to fundamental concepts for force, displacement, stress and strain measurements for structures and materials applications. Strain gage theory and application. Full field deformation measurements with laser interferometry and digital image processing. Advanced experimental concepts at the micro- and nano-scale regimes. Selected laboratory experiments. Offered even-numbered years. (Typically Offered: Fall)

EM 4240: Intermediate Mechanics of Materials

Credits: 3. Contact Hours: Lecture 3.

Prereq: EM 3240

Analysis of stresses, strains, and deflections. Torsion and bending of unsymmetrical members. Analysis of thick wall pressure vessels and shrink fit problems. Dynamic load effects, fatigue and fracture mechanics introduction. Work-strain energy methods. (Typically Offered: Fall, Spring)

EM 4250: Introduction to the Finite Element Method

Credits: 3. Contact Hours: Lecture 3.

Prereq: EM 3240 and MATH 2660 or MATH 2670

Introduction of finite element analysis through applications to one-dimensional, steady-state problems such as elastic deformation, heat and fluid flow, consolidation, beam bending, and mass transport. Transient heat conduction and wave propagation. Two-dimensional triangular and quadrilateral elements. Plane problems of torsion, thermal and potential flow, stress analysis. Simple computer programs for one- and two-dimensional problems. (Typically Offered: Spring)

EM 4510: Engineering Acoustics

(Cross-listed with EE 4510/ ME 4510).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 2660 or MATH 2670; PHYS 2310 and 2310L

The basics of acoustic wave propagation in fluids with an emphasis on sound propagation in air. Topics include transmission and reflection of sound at a boundary; role of acoustic sources in directing sound fields; diffraction of sound around solid objects; reverberation of sound in a room; and the measurement of sound fields. (Typically Offered: Fall)

EM 4800: Ultrasonic Nondestructive Evaluation

(Cross-listed with AERE 4800/ MATE 4800).

Credits: 3. Contact Hours: Lecture 3.

Prereq: EM 3240 or MATE 3190; MATH 2660 or MATH 2670; PHYS 2320

Introduction to stress/strain, Hooke's law, and elastic wave propagation in two dimensions in isotropic media. Ultrasonic plane-wave reflection and transmission; and simple straight-crested guided waves. Transducer construction, behavior, and performance. Simple signal analysis and discrete signal processing. The last few weeks of the course are devoted to case studies. (Typically Offered: Spring)

EM 4900: Independent Study

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

EM 4900H: Independent Study: Honors

Credits: 1-30. Repeatable.

Prereq: Permission of Instructor; Membership in the University Honors Program

(Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

EM 5100: Continuum Mechanics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to Cartesian tensors as linear vector transformations. Kinematics of continuous deformations, Lagrangian and Eulerian descriptions of motion. Fundamental equations or balance laws of continuous media, linear and angular momentum balance. Conservation laws of momentum and energy. Introduction to constitutive equations of classical elastic solids and simple fluids. Formulations and solutions of some canonical problems. (Typically Offered: Fall)

EM 5140: Advanced Mechanics of Materials

(Cross-listed with AERE 5140).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Theory of stress and strain, stress-strain relationships. Unsymmetrical bending, curved beams, shear center. Torsion of thin-walled noncircular sections. Equilibrium, compatibility equations. Airy stress functions. Membrane stresses in shells, thick-walled cylinders. (Typically Offered: Fall)

EM 5160: Applied Elasticity and Mechanics of Deformable Solids

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Fundamental mechanics of linear elasticity, formulation and solution of simple elastostatic boundary value problems. Kinematics of small deformations, constitutive equations for isotropic and anisotropic media. Field equations for elastic solids, plane strain/plane stress and some classic analytical solutions such as Boussinesq, Hertz, Kirsch, Lamé, and Mitchell. Stress functions and potential methods and introduction to finite elements. (Typically Offered: Spring)

EM 5170: Experimental Mechanics

(Dual-listed with EM 4170/ AERE 4170). (Cross-listed with AERE 5170).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Introduction to fundamental concepts for force, displacement, stress and strain measurements for structures and materials applications. Strain gage theory and application. Full field deformation measurements with laser interferometry and digital image processing. Advanced experimental concepts at the micro- and nano-scale regimes. Selected laboratory experiments. Offered even-numbered years. (Typically Offered: Fall)

EM 5180: Waves in Elastic Solids with Applications to Ultrasonic Nondestructive Evaluation

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Propagation of bulk waves, surface waves, and guided waves in isotropic and anisotropic elastic media. Transmission and reflection of waves at plane and curved interfaces. Radiation of sources with application to ultrasonic transducer beam modeling. Elastic wave scattering from cracks and inclusions. Reciprocity principles and their use in the development of an ultrasonic measurement model. Characterization and measurement of material attenuation. (Typically Offered: Fall)

EM 5250: Finite Element Analysis

(Cross-listed with AERE 5250).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Variational and weighted residual approach to finite element equations. Emphasis on two- and three-dimensional problems in solid mechanics. Isoparametric element formulation, higher order elements, numerical integration, imposition of constraints and penalty, convergence, and other more advanced topics. Use of two- and three-dimensional computer programs. Dynamic and vibrational problems, eigenvalues, and time integration. Introduction to geometric and material nonlinearities. (Typically Offered: Spring)

EM 5260: Boundary Element Methods in Engineering

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introductory boundary element methods through plane problems. Singular integrals, Cauchy principal values, integral representations and boundary integrals in one dimension. Direct and indirect formulations. Plane potential and elastostatic problems. Higher order elements, numerical integration. Regularizations. Body forces and infinite regions. Specialized fundamental solutions, half-plane and axisymmetric problems. Diffusion and wave problems. Coupling with finite elements. Offered even-numbered years. (Typically Offered: Fall)

EM 5430: Introduction to Random Vibrations and Nonlinear Dynamics

(Cross-listed with ME 5430).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Vibrations of continuous systems. Nonlinear vibration phenomena, perturbation expansions; methods of multiple time scales and slowly-varying amplitude and phase. Characteristics of random vibrations; random processes, probability distributions, spectral density and its significance, the normal or Gaussian random process. Transmission of random vibration, response of simple single and two-degree-of-freedom systems to stationary random excitation. Fatigue failure due to random excitation. Offered odd-numbered years. (Typically Offered: Spring)

EM 5480: Advanced Engineering Dynamics

Credits: 3. Contact Hours: Lecture 3.

Prereq: EM 3450, MATH 2660 or MATH 2670

3-D kinematics and dynamics of particles and rigid bodies. Coordinate systems, calculus of variations. Lagrange's equations with constraints, modified Euler's equations, torque-free motion of rigid bodies in 3-D, moment equations with constraints. Offered even-numbered years. (Typically Offered: Spring). (Typically Offered: Spring)

EM 5500: Nondestructive Evaluation

(Cross-listed with MSE 5500).

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Principles of five basic NDE methods and their application in engineering inspections. Materials behavior and simple failure analysis. NDE reliability, and damage-tolerant design. Advanced methods such as acoustic microscopy, laser ultrasonics, thermal waves, and computed tomography are analyzed. Computer-based experiments on a selection of methods: ultrasonics, eddy currents, x-rays are assigned for student completion. (Typically Offered: Spring)

EM 5640: Fracture and Fatigue

(Cross-listed with AERE 5640/ ME 5640/ MSE 5640).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Materials and mechanics approach to fracture and fatigue.

Fracture mechanics, brittle and ductile fracture, fracture and fatigue characteristics, fracture of thin films and layered structures. Fracture and fatigue tests, mechanics and materials designed to avoid fracture or fatigue. Offered even-numbered years. (Typically Offered: Fall)

EM 5660: Phase Transformation in Elastic Materials

(Cross-listed with ME 5660).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Continuum thermodynamics and kinetics approaches to phase transformations. Phase field approach to stress- and temperature-induced martensitic transformations and twinning at the nanoscale. Nucleation and growth. Nanostructural evaluation. Analytical and numerical solutions. Surface stresses and energy. Surface-induced phase transformations. Large Strain formulation. (Typically Offered: Spring)

EM 5670: Nanomechanics of Materials

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Continuum theoretical and computational approaches to material deformation and nanostructure evolution. Thermodynamics and kinetics. Nucleation and growth. Surface and interface tension and phenomena. Chemical reactions, phase transformations, and dislocation evolution. (Typically Offered: Spring)

EM 5690: Mechanics of Composite and Combined Materials

(Cross-listed with AERE 5690/ MSE 5690).

Credits: 3. Contact Hours: Lecture 3.

Prereq: EM 3240

Mechanics of fiber-reinforced materials. Micromechanics of lamina. Macromechanical behavior of lamina and laminates. Strength and interlaminar stresses of laminates. Failure criteria. Stress analysis of laminates. Thermal moisture and residual stresses. Joints in composites. Offered even-numbered years. (Typically Offered: Spring)

EM 5700: Wind Engineering

(Cross-listed with AERE 5700).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ABE 3780 and ME 3450

Atmospheric circulations, atmospheric boundary layer wind, bluff-body aerodynamics, aeroelastic phenomena, wind-tunnel and full-scale testing, wind-load code and standards, effect of tornado and thunderstorm winds, design applications. Offered odd-numbered years. (Typically Offered: Spring)

EM 5800: Phase Transformations and Plasticity

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Continuum approaches to phase transformations and plasticity at nano-, micro-, and macroscales. Interaction between phase transformations and plasticity and different scales. Temperature-, stress-, and strain-induced phase transformations. Transformation-induced plasticity. Thermodynamics and kinetics. Nucleation and growth. Large strain formulation. High pressure phenomena and theories. (Typically Offered: Fall)

EM 5840: High Pressure Mechanics and Phase Transformations

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Techniques for producing static high pressure and measurements. Traditional and rotational diamond anvil cell. Phase diagrams. Pressure, stress, and plastic strain induced phase transformations: continuum thermodynamics and kinetics. Elasticity and plastic flow under high pressure. Transformation pressure hysteresis. Material synthesis and search for new phases. Interaction between phase transformations and plasticity under high pressure. High pressure mechanochemistry. Multiscale modeling.

EM 5860: Micromechanics of Structural Changes in Materials

Credits: 3. Contact Hours: Lecture 2, Discussion 1.

Prereq: Graduate Standing or Permission of Instructor

Continuum and micromechanical approaches to material deformation, phase transformations, and microstructure evolution. Thermodynamics and kinetics. Eshelby inclusion. Interface propagation and reorientation. Microscale phase field approach. Large strain formulation. Phase transformations, chemical reactions, twinning, and fracture. (Typically Offered: Fall)

EM 5900F: Engineering Mechanics Special Topics: Introduction to Dislocation and Plasticity

Credits: 1-4. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

(Typically Offered: Fall, Spring, Summer)

EM 5900H: Engineering Mechanics Special Topics: Mechanics of Thin Films and Adhesives

Credits: 1-4. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

EM 5900I: Engineering Mechanics Special Topics: Mechanics of Cellular and Porous Media

Credits: 1-4. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

EM 5900J: Engineering Mechanics Special Topics: Other

Credits: 1-4. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

EM 5990: Creative Component

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

Courses for graduate students:**EM 6900N: Engineering Mechanics Special Topics: Advanced Experimental Methods**

Credits: 1-6. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

EM 6900O: Engineering Mechanics Special Topics: Advanced Wave Propagation

Credits: 1-6. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

EM 6900P: Engineering Mechanics Special Topics: Advanced Materials

Credits: 1-6. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

EM 6900Q: Engineering Mechanics Special Topics: Advanced Computational Methods

Credits: 1-6. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

EM 6900R: Engineering Mechanics Special Topics: Reliability and Failure

Credits: 1-6. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall)

EM 6900S: Engineering Mechanics Special Topics: Other

Credits: 1-6. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

EM 6970: Engineering Internship

Credits: Required. Repeatable.

One semester and one summer maximum per academic year professional work period. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

EM 6990: Research

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

Engineering Sales Minor

With approximately 15% of engineering job postings involving product sales, marketing or customer field support, a minor in engineering sales can be a critical step towards a great job offer. Besides being one of the best paid positions in engineering, technical sales offers substantial travel opportunities and the ability to solve customers' engineering problems in the field working with people. Talk to your advisor to see how just a few additional courses could fit into your schedule and fast-track your job prospects.

To fill this need, the Department of Industrial and Manufacturing Systems Engineering has developed a minor in sales engineering. The engineering sales minor is a 15 credit minor that complements the technical training in the student's major discipline by providing the tools and knowledge required for technical (i.e. business-to-business) sales careers. The minor is available only to engineering students and is administered by a supervisory faculty committee. No more than 6 of the 15 credits can be used to meet any other department, college or university requirements.

Requirements:

- IE 4500 Technical Sales for Engineers
- IE 4300 Entrepreneurial Product Engineering
- MKT 3400 Principles of Marketing
- MKT 4500 Advanced Professional Selling

AND

One of the following:

- IE 3050 Engineering Economic Analysis
- CE 2060 Engineering Economic Analysis and Professional Issues in Civil Engineering

The objectives of the minor are to provide a broad understanding of the technical sales process, primarily from the business-to-business perspective. At the conclusion of the minor, students will be able to:

- Calculate a return on investment and communicate this to the customer
- Determine payback period for a given solution and communicate this to the customer
- Perform a market segmentation
- Develop a client value analysis
- Perform prospecting and business-to-business marketing
- Identify decision makers and processes

- Manage a sales process
- Use sales automation software
- Apply knowledge of underlying international sales issues
- Prepare written and verbal sales presentations
- Provide information about product/service pricing
- Lead a team selling process
- Establish sales channel management procedures
- Develop sound distribution strategies and global sales processes
- Formulate bid strategies/negotiation strategies
- Employ good time management skills

Those students interested in pursuing this minor should contact an academic advisor in their home department and fill out a REQUEST FOR MINOR form. Evaluation of all students requesting this minor will be conducted in the Department of Industrial and Manufacturing Systems Engineering. Any questions should be directed to Ms. Devna Popejoy-Sheriff at devna@iastate.edu.

Environmental Engineering

<http://www.ccee.iastate.edu/>

Administered by the Department of Civil, Construction and Environmental Engineering

For undergraduate curriculum in Environmental Engineering leading to the degree Bachelor of Science. The Environmental Engineering Program is accredited by the Engineering Accreditation Commission of ABET, <https://www.abet.org> (<https://www.abet.org/>), under the commission's General Criteria and Program Criteria for Environmental Engineering and Similarly Named Engineering Programs.

Students in the environmental engineering bachelor's degree program will complete a curriculum covering the engineering and science knowledge necessary to design and implement effective, affordable solutions for environmental challenges involving water, air, and land. The environmental engineering curriculum equips students with a broad education that includes technical skills in analysis and design and professional practices such as communication, teamwork, leadership, and ethics. Graduates will have a strong foundation necessary to solve complex current and future infrastructure challenges within the diverse areas of environmental engineering.

Graduates of this program will be prepared to work in environmental engineering positions within the private and public (e.g., federal, military, state, and community) sectors that deal with pollution and contamination in all aspects of the built and natural environment. Examples of this work include analyzing and designing systems for water supply and distribution, collecting and processing waste, controlling air quality, recycling residuals, and protecting public health. Students interested in

a more general education in civil engineering should consider the B.S. in civil engineering with environmental emphasis.

Student Learning Outcomes: Graduates of the Environmental Engineering curriculum should have, at the time of graduation:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Program Educational Objectives: Three to five years after graduation, graduates of the environmental engineering program will have:

1. Pursued successful careers and expertise in environmental engineering or a related profession that includes professionalism and increasing responsibility.
2. Collaborated effectively on multi-disciplinary teams to address the needs of society and the environment.
3. Pursued lifelong learning, professional development, advanced studies, and licensure as appropriate for their career goals and for developments in the field.

The faculty encourages the students to develop their professional skills by participating in cooperative education, internships, or progressive summer engineering employment and study abroad programs. Qualified juniors and seniors interested in graduate studies may apply to the Graduate College to pursue concurrently the bachelor's degree and either a Master of Science in Civil Engineering or a Master of Business Administration in the College of Business Administration. These students would have an opportunity to graduate in five years with both degrees.

Curriculum in Environmental Engineering

Administered by the Department of Civil, Construction and Environmental Engineering.

Leading to the degree Bachelor of Science.

Total credits required: 131.

Any transfer credit courses applied to the degree program require a grade of C or better (but will not be calculated into the ISU cumulative GPA, Basic Program GPA or Core GPA). See also Basic Program and Special Programs. Note: Department does not allow Pass/Not Pass credits to be used to meet graduation requirements.

International Perspectives: 3 cr.¹

U.S. Cultures and Communities: 3 cr.¹

Communication Proficiency/Library requirement

ENGL 1500	Critical Thinking and Communication (Must have a C or better in this course)	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition (Must have a C or better in this course)	3
LIB 1600	Introduction to College Level Research	1

Social Sciences and Humanities: 12 cr.

²

Complete 12 cr. with 6 cr. at 2000-level or above.

Basic Program: 24 cr.³ **Minimum GPA of 2.00 required for this set of courses to graduate, including any transfer courses (please note that transfer course grades will not be calculated into the Basic Program GPA).**

CHEM 1770	General Chemistry I	4
	or CHEM 1670 General Chemistry for Engineering Students	
ENGL 1500	Critical Thinking and Communication (Must have a C or better in this course)	3
ENGR 1010	Engineering Orientation	R
CE 1600	Engineering Problems with Computational Laboratory ³	3
LIB 1600	Introduction to College Level Research	1
MATH 1650	Calculus I	4
MATH 1660	Calculus II	4
PHYS 2310	Introduction to Classical Physics I	4
PHYS 2310L	Introduction to Classical Physics I Laboratory	1
Total Credits		24

Math and Physical Science: 27 cr.

CHEM 1770L	Laboratory in General Chemistry I	1
CHEM 1780	General Chemistry II ⁴	3
CHEM 1780L	Laboratory in College Chemistry II ⁴	1
CHEM 2310	Elementary Organic Chemistry	3
CHEM 2310L	Laboratory in Elementary Organic Chemistry	1
BIOL 2510	Biological Processes in the Environment	3
GEOL 2010	Geology for Engineers and Environmental Scientists	3

MATH 2650	Calculus III	4
MATH 2660	Elementary Differential Equations	3
MICRO 2010	Introduction to Microbiology	2
Statistics Elective ²		3
Total Credits		27

Env Engineering Core: 30 cr. Minimum GPA of 2.00 required for this set of courses to graduate (including transfer courses; please note that transfer course grades will not be calculated into the Core GPA).

ENVE 2010	Environmental Engineering Measurements and Analysis	3
ENVE 3260	Principles of Environmental Engineering	3
CE 3720	Engineering Hydrology and Hydraulics	3
ABE 3780	Mechanics of Fluids	3
ME 2310	Engineering Thermodynamics I	3
ENVE 4260	Environmental Engineering Science	3
ENVE 4270	Environmental Engineering Systems	3
ENVE 4280	Water and Wastewater Treatment Plant Design	3
ENVE 4290	Air Pollution and Control	3
ENVE 4300	Solid and Hazardous Waste Management	3
Total Credits		30

Other Remaining Courses: 38 cr.

ENGL 2500	Written, Oral, Visual, and Electronic Composition (Must have a C or better in this course)	3
SPCM 2120	Fundamentals of Public Speaking	3
ENVE 1200	Environmental Engineering Learning Community	1
ENVE 1900	Introduction to Undergraduate Research in Civil and Environmental Engineering	2
CE 3060	Project Management for Civil Engineers	3
CE 2060	Engineering Economic Analysis and Professional Issues in Civil Engineering	3
CE 2740	Engineering Statics	3
CE 3600	Geotechnical Engineering	4
EM 3240	Mechanics of Materials	3
ABE 3780L	Mechanics of Fluids Laboratory	1
Engineering Topics Electives ²		6
Sustainability Elective ²		3
Technical Communication Elective ²		3
Total Credits		38

Seminar/Co-op/Internships: R cr.

Co-op/Internship optional.

Notes.

1. These university requirements will add to the minimum credits of the program unless the university-approved courses are also approved by the department to meet other course requirements within the

degree program. U.S. Cultures and Communities and International Perspectives courses may not be taken Pass/Not Pass.

2. Choose from department approved list. (<http://www.ccee.iastate.edu/academics/advising/civil-engineering-student-forms/>)

3. See Basic Program for Professional Engineering Curricula for accepted substitutions for curriculum designated courses in the Basic Program.

Engineering Topics Elective	3 Engineering Topics Elective	3
International Perspective	3 US Cultures and Communities	3
		15 15

Industrial Engineering

Administered by the Department of Industrial and Manufacturing Systems Engineering

The undergraduate curriculum in Industrial Engineering leads to the Bachelor of Science degree.

The Industrial Engineering Program is accredited by the Engineering Accreditation Commission of ABET, <https://www.abet.org> (<https://www.abet.org/>), under the commission's "General Criteria and Program Criteria for Industrial and Similarly Named Engineering Programs."

Industrial engineering is a versatile engineering profession that improves processes to help people around the world. Industrial engineers integrate technical expertise with business acumen and effectual people skills.

They improve processes, organizations, and integrated systems of materials, methods, equipment, information, energy, transportation, and people by reducing waste and increasing quality, safety, and productivity. All industries employ industrial engineers, including, but not limited to, manufacturing, healthcare, entertainment, supply chain, banking, energy, and transportation.

Program Educational Objectives

The Industrial Engineering (IE) Program educates its future graduates to accomplish its program educational objectives (PEOs) in their early careers.

Specifically, the IE Program prepares its majors so that, within a few years after graduation, graduates' attainments are:

1. Industrial engineering solutions that are effectively created and communicated and consider relevant stakeholders and ramifications.
2. Team goal accomplishment through productive and inclusive interactions and leadership.
3. New capabilities, skills, and knowledge that advance professional practice and enable career advancement.

Student Learning Outcomes

The IE Program currently has the following student outcomes describing what IE majors are expected to know and be able to do by the time of graduation.

Freshman

Fall	Credits Spring	Credits
CE 1600	3 ENVE 1900	2
CHEM 1770	4 CHEM 1780	3
CHEM 1770L	1 CHEM 1780L	1
ENGL 1500	3 MATH 1660	4
MATH 1650	4 PHYS 2310	4
LIB 1600	1 PHYS 2310L	1
ENGR 1010	R BIOL 2510	3
ENVE 1200	1	
		17 18

Sophomore

Fall	Credits Spring	Credits
ENGL 2500	3 ENVE 3260	3
CE 2740	3 CE 3060	3
CHEM 2310	3 ABE 3780	3
CHEM 2310L	1 ABE 3780L	1
MATH 2650	4 MATH 2660	3
ENVE 2010	3 SSH Elective	3
		17 16

Junior

Fall	Credits Spring	Credits
CE 2060	3 CE 3720	3
EM 3240	3 CE 3600	4
GEOL 2010	3 MICRO 2010	2
SSH Elective	3 ME 2310	3
Statistics Elective	3 Technical Communication Elective	3
Sustainability Elective	3	
		18 15

Senior

Fall	Credits Spring	Credits
ENVE 4260	3 ENVE 4280	3
ENVE 4300	3 ENVE 4270	3
SPCM 2120	3 ENVE 4290	3

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

The Industrial Engineering undergraduate curriculum provides students with fundamental knowledge in mathematics and science, engineering science, social science, and humanities as well as professional industrial engineering coursework. In particular, the curriculum includes design, analysis, operation and improvement of integrated systems that produce or supply products or services in an effective, efficient, sustainable and socially responsible manner. A capstone design course provides students with an opportunity to solve open-ended problems with an industrial partner.

Students are strongly encouraged to participate in one or more key activities outside of the regular curriculum. The first is industry internships and cooperative education positions, which provide students with real-world experiences in the profession and an excellent perspective on career choices. The second is international experience through either study or work abroad. The third is undergraduate research working with faculty and graduate students on cutting-edge problems.

Qualified juniors and seniors interested in graduate studies may apply to the Graduate College to concurrently pursue both 1) B.S. and M.S. or M.Eng. degrees in Industrial Engineering, Systems Engineering, or Engineering Management, or 2) B.S. and M.B.A. degrees. For further information, please refer to the Graduate / Graduate College / Concurrent Programs tab.

Curriculum in Industrial Engineering

Administered by the Department of Industrial and Manufacturing Systems Engineering.

Leading to the degree Bachelor of Science.

Total credits required: 123 cr.

See also Basic Program and Special Programs. Grades of C or better are required for any transfer credit course that is applied to the degree program but will not be calculated into the ISU cumulative GPA, Basic Program GPA or Core GPA. Note: Department does not allow Pass/Not Pass credits to be used to meet graduation requirements.

International Perspectives: 3 cr.¹

U.S. Cultures and Communities: 3 cr.¹

¹These university requirements will add to the minimum credits of the program unless the university-approved courses are also allowed by the department to meet other course requirements within the degree program.

U.S. cultures and communities and international perspectives courses may not be taken Pass/Not Pass.

Communication Proficiency/Library requirements: 7 CR.:

ENGL 1500	Critical Thinking and Communication (Must have a C or better in this course)	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition (Must have a C or better in this course)	3
LIB 1600	Introduction to College Level Research	1

Remaining Communication courses: 9 cr.

ENGL 2500	Written, Oral, Visual, and Electronic Composition (Must have a C or Better in this course)	3
SPCM 2120	Fundamentals of Public Speaking	3
ENGL 3140	Technical Communication	3

Total Credits		9

Social Sciences and Humanities Electives: 12 cr.

²

Six of twelve credits must be from 2000-level or above courses. Six credits must be sequential or related courses.

²For Social Sciences and Humanities, and IE Program Electives, choose from the department approved list. (https://www.imse.iastate.edu/files/2023/08/Elective_List_23-24.pdf)

Basic Program: 24 cr.

³

A minimum GPA of 2.00 required for this set of courses (please note that transfer course grades will not be calculated into the Basic Program GPA). See Requirement for Entry into Professional Program in College of Engineering Overview section.

³See Basic Program for Professional Engineering Curricula for accepted substitutions for curriculum designated courses in the Basic Program.

CHEM 1670	General Chemistry for Engineering Students	4
ENGL 1500	Critical Thinking and Communication (Must have a C or better in this course)	3
ENGR 1010	Engineering Orientation	R
LIB 1600	Introduction to College Level Research	1
MATH 1650	Calculus I	4
MATH 1660	Calculus II	4
PHYS 2310	Introduction to Classical Physics I	4
PHYS 2310L	Introduction to Classical Physics I Laboratory	1
IE 1600	Information Engineering	3

Total Credits 24

Math and Physical Science: 17 cr.

MATH 2650	Calculus III	4
MATH 2670	Elementary Differential Equations and Laplace Transforms	4
STAT 2310	Probability and Statistical Inference for Engineers	4
PHYS 2320	Introduction to Classical Physics II	4
PHYS 2320L	Introduction to Classical Physics II Laboratory	1

Total Credits 17

Industrial Engineering Core: 37 cr.

A minimum GPA of 2.00 required for this set of courses (please note that transfer course grades will not be calculated into the Core GPA):

IE 2220	Design & Analysis Methods for System Improvements	3
IE 2480	Engineering System Design, Manufacturing Processes and Specifications	3
IE 2710	Applied Ergonomics and Work Design	3
IE 3050	Engineering Economic Analysis	3
IE 3120	Optimization	3
IE 3410	Production Systems	3
IE 3480	Solidification Processes	3
IE 3610	Statistical Quality Assurance	3
IE 4130	Stochastic Modeling, Analysis and Simulation	4
IE 4320	Industrial Automation	3
IE 4410	Industrial Engineering Design	3
IE 4480	Manufacturing Systems Engineering	3

Total Credits 37

Other Remaining Courses: 24 cr. ²

MATE 2730	Principles of Materials Science and Engineering	3
CE 2740	Engineering Statics	3
ME 2310	Engineering Thermodynamics I	3

IE Program Elective	IE Program Elective	15

Total Credits 24

IE PROGRAM ELECTIVES: 15 cr.

Six of 15 IE program elective credits must be from IMSE Courses in Advanced Manufacturing, Operations Research and Analytics, or Human Factors and Ergonomics. Three of 15 credits must be from IMSE Courses in System Engineering/Engineering Management. Three of 15 credits must be from Non-IMSE STEM courses.

Seminar/Co-op/Internships:

Optional co-op/internship courses

IE 1020	Industrial Engineering Profession	R

See also the following grid showing course template by semester:

4-Year Plan of Study for Industrial Engineering

Industrial Engineering, B.S.

First Year

Fall	Credits Spring	Credits
SSH Elective	3 SSH Elective	3
IE 1600	3 MATH 1660	4
MATH 1650	4 ENGL 1500	3
CHEM 1670	4 LIB 1600	1
ENGR 1010	R IE 1020	R
	PHYS 2310	4
	PHYS 2310L	1
	14	16

Second Year

Fall	Credits Spring	Credits
MATH 2650	4 MATH 2670	4
IE 2480	3 STAT 2310	4
MATE 2730	3 IE 2220	3
PHYS 2320	4 IE 2710	3
PHYS 2320L	1	
ENGL 2500	3	
	18	14

Third Year

Fall	Credits Spring	Credits
IE 3050	3 SSH Elective	3
IE 3410	3 IE 3480	3
IE 3120	3 IE 3610	3
SPCM 2120	3 CE 2740	3

IE 4320	3 IE Program Elective	3
15		15

Fourth Year

Fall	Credits Spring	Credits
SSH Elective	3 IE 4410	3
IE 4130	4 IE 4480	3
ENGL 3140	3 IE Program Elective	3
ME 2310	3 IE Program Elective	3
	IE Program Elective	3
13		15

Engineering Sales Minor

The Engineering Sales Minor is multidisciplinary and open to undergraduates in the College of Engineering. The minor requires 15 credits, including at least 6 credits in courses numbered 3000 or above taken at Iowa State University. The minor must include at least 9 credits that are not used to meet any other department, college, or university requirement.

IE 4500	Technical Sales for Engineers	3
IE 4300	Entrepreneurial Product Engineering	3
MKT 3400	Principles of Marketing	3
MKT 4500	Advanced Professional Selling	3
And one of the following:		3
IE 3050	Engineering Economic Analysis	
CE 2060	Engineering Economic Analysis and Professional Issues in Civil Engineering	
Total Credits		15

Concurrent B.S./Master's Industrial Engineering Degree

If you are considering going to graduate school, the concurrent bachelor's-master's in industrial engineering is an excellent opportunity to obtain both degrees within five years. In this program six credits of graduate course work can be used to satisfy your undergraduate program requirements. After completing the B.S. program, you will be a full-time graduate student for the remainder of the master's program. The following concurrent bachelor's-master's degree program combinations are available to qualified students:

- B.S. IE – M.S. IE (thesis required)
- B.S. IE – M.Eng. IE (coursework-only)
- B.S. IE – M.Eng. Systems Engineering (coursework-only)
- B.S. IE – M.Eng. Engineering Management (coursework-only)

Program Policies

1. Up to two semesters of concurrent enrollment are allowed.
2. Students can enroll in up to nine credits of coursework at the 5000-level in industrial engineering for both the B.S. and M.S./M.Eng. degrees. Six credits will be shared with your undergraduate degree. The remaining three credits will be applied to your M.S. or M.Eng. degree.
3. Students must take at least three credits of 5000-level courses each semester during concurrent enrollment and will be paying graduate tuition and fees.
4. Students participating in the concurrent program must adhere to the requirements for the graduate degree program in which they are enrolled.

Admission Requirements

Students must have a record of high academic achievement and should have a GPA of at least 3.00 on a 4.00 scale. Students must be within 30 credits of completing the requirements for the B.S. degree before applying to the concurrent program. Prospective students **must** speak with their undergraduate advisor prior to applying.

Concurrent B.S. in Industrial Engineering and MBA in the College of Business**Accelerate Your Career with an MBA**

Today's successful engineers often need strong business management skills to complement their degree in engineering. These skills are especially important for engineers who are interested in working for technical companies, launching their own business ventures, or pursuing nontraditional jobs such as consulting. The MBA provides an opportunity for competitive advantage for advancement into management positions.

The Colleges of Business and Engineering offer an integrated, concurrent program leading to Bachelor of Science and Master of Business Administration degrees. The program is designed to be completed in a minimum of five academic years or ten semesters.

The actual time for completion may be longer depending upon semester course loads, internships, and course sequencing. Careful planning with an academic advisor is essential throughout the program. This program is slightly accelerated through the first six semesters to complete the general education requirements. The remaining four semesters integrate the B.S. in IE requirements and the MBA courses. Twelve credits will be shared in common and will fulfill the requirements for both the B.S. in IE and the MBA.

Summer study is possible, although students are strongly encouraged to complete at least two internships or co-ops in engineering and business for practical experience during their academic program.

Preparation for the B.S. IE/MBA

Students interested in pursuing the MBA need to demonstrate exemplary academic performance throughout their undergraduate program. Mastery of communications, economic theory, global and diversity perspectives, statistical data analysis, and the core professional curriculum is of particular importance.

The Selection Process

The program is demanding, and admission is selective. Students are expected to exhibit superior intellectual ability, strong leadership attributes, and must be highly motivated and career focused. Although not absolute minimums, admitted students typically will have earned a cumulative GPA of 3.00 or above and have scored 600 or higher on the Graduate Management Admissions Test (GMAT). All application materials, however, are taken into account collectively in the applicant review and student selection process.

GRADUATE STUDY

The department offers three industrial engineering graduate degrees: Master of Engineering (M.Eng. IE), Master of Science (M.S. IE), and Doctor of Philosophy (Ph.D.). A graduate minor is available to graduate students having a major in another department. The M.Eng. degree consists of coursework designed to improve professional expertise in industrial engineering. The M.S. and Ph.D. degrees are designed to improve the student's capability to conduct research as well as advancing their professional expertise. In conjunction with the Department of Mechanical Engineering, the department offers a certificate in advanced manufacturing.

To be considered for admission into the graduate program, the applicant should have a bachelor's degree in industrial engineering or related field from a college, university, or technical school of recognized standing. Other educational backgrounds will be considered on an individual basis. High academic achievement or other persuasive evidence of professional accomplishments is expected for admission to the program. An applicant may apply as a direct-entry Ph.D. applicant when they have not earned a master's degree.

The graduate program offers advanced study in advanced manufacturing, ergonomics/human factors, operations research/analytics, systems engineering and engineering management.

Well-qualified juniors and seniors in industrial engineering who are interested in graduate study may apply for concurrent enrollment to simultaneously pursue both the industrial engineering bachelor's degree and an M.Eng. IE or M.S. IE degree. Two other attractive concurrent degree options are the industrial engineering bachelor's degree concurrent with a M.Eng. Engineering Management degree or an M.Eng. Systems Engineering degree. For those more interesting in

business management, we also offer a concurrent Master of Business Administration degree from the business college. For additional information about graduate degree programs, admission criteria, and procedures refer to <https://www.imse.iastate.edu/graduate-program/>.

Materials Engineering

For the undergraduate curriculum in Materials Engineering leading to the degree Bachelor of Science. The Materials Engineering Program is accredited by the Engineering Accreditation Commission of ABET, <https://www.abet.org> (<https://www.abet.org/>), under the commission's General Criteria and Program Criteria for Materials (1), Metallurgical (2), Ceramics (3) and Similarly Named Engineering Programs. Materials engineering is a broadly-based discipline relating the composition, structure, and processing of materials to their properties, uses and performance. Materials engineering includes a variety of traditional and modern technologies involving metals, ceramics, polymers, composites, and electronic materials.

Because of its interdisciplinary nature, career opportunities for materials engineers bridge all industrial and government sectors including: advanced manufacturing, materials for energy and power, biomaterials and biomedical technology, functional materials and devices, nanomaterials and coatings, durable goods, infrastructure, and vehicle technologies (automotive, aerospace).

Student Learning Outcomes

Graduates of the Materials Engineering curriculum should have at the time of graduation:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.

6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Program Educational Objectives

Within a few years of completing the Materials Engineering degree program, our graduates are expected to:

- *Work*-competently engage in professional employment, applying knowledge and skills related to the structure, properties, processing, and performance of materials.
- *Learn*-invest in broad life-long learning activities, such as advanced academic or professional degree programs, practical training, professional development, and leadership training.
- *Serve*-actively contribute to professional communities in their chosen career paths, including professional societies, advisory boards, standards and regulatory boards, and internal company organizations.

Graduates in materials engineering are able to apply scientific and engineering principles to select or design the best materials to solve engineering problems. They are also able to control the microstructure of materials through processing to optimize properties and performance. They are skilled in creative, independent problem solving under time and resource constraints. Graduates have the opportunity to gain experience in materials engineering practice through cooperative work experience or internships in industry, national laboratories, or another funded research. Graduates can develop a global perspective of engineering through various study abroad opportunities. Classes provide hands-on skills with a broad range of modern materials processing and characterization equipment and methods.

A degree in materials engineering relies on a strong foundation of math, chemistry and physics. The core materials courses include fundamentals of materials, kinetics and thermodynamics, mechanical properties, computational methods, design, and professional practice experience. Students tailor their programs to their goals and interests through the selection of a specialization from the three available: ceramic materials, metallic materials and polymeric materials. Additional technical electives can be taken in other areas of interest. The breadth and depth of the program provide excellent preparation for immediate entry into industry, further study in graduate school, as well as many other unique career paths (i.e. law, military service, art conservation, museum conservatorship, etc.).

Curriculum in Materials Engineering

Administered by the Department of Materials Science and Engineering.

Leading to the degree Bachelor of Science.

Total credits required: 128 cr. Any transfer credit courses applied to the degree program require a grade of C or better (but will not be calculated into the ISU cumulative GPA, Basic Program GPA or Core GPA). See also Basic Program and Special Programs.

International Perspectives: 3 cr.¹

U.S. Cultures and Communities: 3 cr.¹

Communication Proficiency/Library requirement:

ENGL 1500	Critical Thinking and Communication (Must have a C or better in this course)	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition (Must have a C or better in this course)	3
LIB 1600	Introduction to College Level Research	1
Complete one of the following courses (Must earn a grade of C or better)		3
ENGL 3020	Business Communication	
ENGL 3090	Proposal and Report Writing	
ENGL 3140	Technical Communication	

Advanced Communication Courses: 6 cr.

ENGL 2500	Written, Oral, Visual, and Electronic Composition (Must have a C or better in this course)	3
Complete one of the following courses (Must earn a grade of C or better)		3
ENGL 3140	Technical Communication	
ENGL 3090	Proposal and Report Writing	
ENGL 3020	Business Communication	

General Education Electives: 12 cr.

Complete 12 cr. from approved list with a minimum of 3 cr. from 2000+ level courses and maximum of 9 cr. from the same designator².

Basic Program: 24 cr.³

A minimum GPA of 2.00 is required for this set of courses. (Please note that transfer course grades will not be calculated into the Basic Program GPA.) See Requirement for Entry into Professional Program in College of Engineering Overview section.

CHEM 1770	General Chemistry I	4
or CHEM 1670 General Chemistry for Engineering Students		
ENGL 1500	Critical Thinking and Communication (Must have a C or better in this course)	3
ENGR 1010	Engineering Orientation	R
ENGR 1600	Engineering Problems with Computer Applications Laboratory ³	3
LIB 1600	Introduction to College Level Research	1
MATH 1650	Calculus I	4

MATH 1660	Calculus II	4
PHYS 2310	Introduction to Classical Physics I	4
PHYS 2310L	Introduction to Classical Physics I Laboratory	1
Total Credits		24

Math and Physical Science: 18 cr.

CHEM 1770L	Laboratory in General Chemistry I	1
CHEM 1780	General Chemistry II	3
CHEM 1780L	Laboratory in College Chemistry II	1
MATH 2650	Calculus III	4
MATH 2670	Elementary Differential Equations and Laplace Transforms	4
PHYS 2320	Introduction to Classical Physics II	4
PHYS 2320L	Introduction to Classical Physics II Laboratory	1
Total Credits		18

Materials/Specialties Engineering Core: 47 cr.

A minimum average GPA of 2.00 is required for this set of courses.
(Please note that transfer course grades will not be calculated into the Core/Specialization GPA.)

MATE 1700	Numeric, Symbolic, and Graphical Methods for Materials Engineering	3
MATE 2140	Structural Characterization of Materials	3
MATE 2150	Introduction to Materials Science and Engineering I	3
MATE 2150L	Introduction to Materials Science and Engineering I - Lab	1
MATE 2160	Introduction to Materials Science and Engineering II	3
MATE 2160L	Introduction to Materials Science and Engineering II - Lab	1
MATE 3110	Thermodynamics in Materials Engineering	3
MATE 3140	Kinetics and Phase Equilibria in Materials	3
MATE 3170	Introduction to Electronic Properties of Materials	3
MATE 3190	Mechanics of Structures and Materials	3
MATE 4130	Materials Design and Professional Practice I	3
MATE 4140	Materials Design and Professional Practice II	3
MATE 4180	Mechanical Behavior of Materials	3
Students must choose one from the three areas of specialization (12 cr.): ceramic, metallic or polymeric materials.		12
Total Credits		47

The courses below meet the specialization requirement. Students select one of the following tracks (ceramics, metals, polymers):

Ceramic Materials:

MATE 3210	Introduction to Ceramic Science	3
MATE 3220	Introduction to Ceramic Processing	3
MATE 4250	Glass Science and Engineering	3
MATE 4330	Advanced Ceramics and Electronic Materials	3

Metallic Materials:

MATE 3410	Metals Processing	3
MATE 3420	Structure/Property Relations in Nonferrous Metals	3
MATE 4430	Physical Metallurgy of Ferrous Alloys	3
MATE 4440	Corrosion and Failure Analysis	3

Polymeric Materials:

MATE 3500	Polymers and Polymer Engineering.	3
MATE 3510	Introduction to Polymeric Materials	3
MATE 4530	Physical and Mechanical Properties of Polymers	3
MATE 4540	Polymer Composites and Processing	3

Other Courses: 21 cr.

STAT 3050	Engineering Statistics	3
In-department electives from list of materials courses ²		6
Technical electives from approved departments ²		12
Total Credits		21

Seminar/Co-op/Internships

Co-op and internships are optional

MATE 3010	Materials Engineering Professional Planning	R

1. These university requirements will add to the minimum credits of the program unless the university-approved courses are also approved by the department to meet other course requirements within the degree program. U.S. Cultures and Communities and International Perspectives courses may not be taken Pass/Not Pass.
2. Choose from department approved list.
3. See Basic Program for Professional Engineering Curricula for accepted substitutions for curriculum designated courses in the Basic Program.

Note: A MATE student may take up to 6 credit hours from General Education electives on a P/NP basis, except for courses used to meet the U.S. Cultures and Communities and International Perspectives requirements. S/F courses (different from P/NP) will be considered for these requirements on a course-by-course basis.

See also: A 4-year plan of study grid showing course template by semester.

Materials Engineering, B.S.

First Year

Fall	Credits Spring	Credits
CHEM 1770	4 CHEM 1780	3
CHEM 1770L	1 CHEM 1780L	1
ENGL 1500	3 MATH 1660	4
ENGR 1010	R MATE 1700	3
ENGR 1600	3 Gen Ed Elective	3
MATH 1650	4 U.S. Cultures and Communities	3
LIB 1600	1	
	16	17

Second Year

Fall	Credits Spring	Credits
MATH 2650	4 MATE 3010	R
MATE 2150	3 MATH 2670	4
MATE 2150L	1 MATE 2140	3
PHYS 2310	4 MATE 2160	3
PHYS 2310L	1 MATE 2160L	1
ENGL 2500	3 PHYS 2320	4
	PHYS 2320L	1
	16	16

Third Year

Fall	Credits Spring	Credits
MATE 3110	3 MATE 3140	3
MATE 3170	3 MATE 3190	3
Specialization	3 Specialization	3
Materials Elective	3 STAT 3050	3
Technical Elective	3 International Perspective	3
	15	15

Fourth Year

Fall	Credits Spring	Credits
MATE 4130	3 MATE 4140	3
MATE 4180	3 Specialization	3
Specialization	3 Materials Elective	3
Technical Elective	3 Technical Elective	3
Technical Writing	3 Technical Elective	3
	Gen Ed Elective	3
	15	18

Areas of specialization:

- Ceramic Materials: 3210, 3220, 4250, 4330
- Metallic Materials: 3410, 3420, 4430, 4440
- Polymeric Materials: 3500, 3510, 4530, 4540

The MSE Department offers concurrent enrollment program opportunities for students wishing to enroll in either the M.S. degree program or the M. Eng. degree program during the final stages of their B.S. program completion. Minimum admission requirements for these concurrent programs are the same as those for the regular M.S. and M. Eng. admission. Concurrently enrolled students are considered graduate students for official enrollment and tuition/fee purposes. MSE students concurrently enrolled as B.S./M.S. students are eligible for Graduate Research Assistantships (GRA), but these require Major Professor sponsorship and are not guaranteed with admission to the program. Assistantships are not available for B.S./M.Eng. students.

Undergraduate students should visit with both their academic advisor and the MSE Director of Graduate Education to discuss interest in a concurrent program, to learn more about blending the undergraduate and graduate curricula, and to obtain guidance related to the application process. For additional details about the MSE concurrent enrollment program, please visit: <https://www.mse.iastate.edu/concurrent/>.

The MSE Department also offers a B.S. MATE and MBA concurrent enrollment program in collaboration with the Ivy College of Business.

For more information about this program, please visit: <https://www.ivybusiness.iastate.edu/full-time-concurrent-mba/>.

Pursuing next-generation technologies and robust solutions in areas such as energy, transportation, infrastructure, cyber-security, manufacturing, wearables, agriculture, nanomaterials, and medicine, graduate students work with our interdisciplinary faculty to address some of the world's most critical challenges and to explore exciting new opportunities for innovation.

- **MSE Graduate Students** – Our students come from all over the world and from a wide variety of technical fields, including all engineering disciplines as well as physics, chemistry, biology, computer science, and mathematics. Their career paths are equally diverse, and many go on to become leaders and innovators in academics, research, industry, medicine, business, and public service.
- **MSE Advanced Degree Options** – The Department of Materials Science and Engineering offers three advanced degree options, including Ph.D, M.S. and M. Eng. degrees. We also offer two concurrent enrollment options (BS/MS and BS/MEng), where qualified students can begin to pursue an advanced degree while working on the final stages of the MSE undergraduate program.
- **MSE Research Assistantships** – Nearly all of our graduate students enrolled in a thesis-based program (M.S. or Ph.D.) complete their

graduate studies under some form of Research Assistantship, helping to offset all or part of their tuition and living expenses while pursuing an advanced degree.

To learn more about MSE Graduate Programs, please visit: <https://www.mse.iastate.edu/graduate-programs/>.

Materials Science and Engineering Graduate Studies

The Materials Science and Engineering Department offers three graduate degree programs representing a range of opportunities for advanced study. While they share several common features, the programs are designed to serve students with a variety of academic backgrounds, technical interests, and career aspirations. In all three programs, it is expected that our graduate students will acquire fundamental understanding of the structure, properties, processing, and performance of materials, underpinned by the foundational pillars of thermodynamics and kinetics and manifested by the immense landscape of engineered materials and the broad range of physical, chemical, and mechanical functionalities that may be realized in them. Our degree programs include a combination of classroom instruction, seminars, laboratory training, guided teaching experiences, individually mentored independent study, and various forms of materials research experiences, all intended to serve students with a wide range of educational goals. Students are admitted with undergraduate or prior graduate qualifications in a variety of technical areas, and each program of study is tailored to meet the needs of the individual student. The accomplishments of our alumni demonstrate that our graduate training enables a wide range of career paths, but certain types of technical employment opportunities are targeted by the specific components within each degree program, as summarized below.

The Master of Engineering (M. Eng.) program in Materials Science and Engineering is a coursework-only degree program intended to provide broad knowledge related to materials processing, structure, properties, and performance, coupled with an understanding of the various materials challenges associated with existing and emerging technologies and industry/business sectors. The program is delivered mainly through classroom-based instruction but may also include laboratory-based courses and/or online courses. The curriculum combines a core of fundamental coursework with a highly flexible set of electives, which may include MSE courses and courses from other fields of study. This flexible coursework-only degree option is intended to provide advanced knowledge of fundamental and contemporary issues in Materials Science and Engineering relevant to a broad range of career paths.

The Master of Science (M.S.) program in Materials Science and Engineering is an intensive advanced degree program combining graduate coursework and project-based research. The program is

intended to provide broad-based knowledge related to materials processing, structure, properties, and performance, coupled with an understanding of the various materials challenges associated with existing and emerging technologies and industry sectors. The program is delivered mainly through classroom-based instruction but may also include laboratory-based courses and/or online courses. The curriculum combines a core of fundamental coursework and a complement of MSE and non-MSE electives.

Two program options are available, and students enrolled in the MS degree program will select either the *Research Thesis* track or the *Research Portfolio* track. Both tracks include a substantial research component but with different focus.

- The *Research Thesis* track provides an opportunity for the student to complete a full-scale research project from beginning to end, including literature review, project design, planning, laboratory and/or computational investigation, data analysis, decision-making, formulation of conclusions, and appropriate reporting of outcomes. The research, culminating in a thesis document, will be conducted under the supervision of a major professor. In this track, the research efforts are aimed at making an identifiable contribution toward solving a relevant problem in a selected area of science and/or engineering. Project success is judged on the scientific soundness of the contribution and the quality with which it is presented in the Thesis document and in a final oral presentation/examination.
- The *Research Portfolio* track provides an opportunity for the student to complete several separate research projects involving multiple selected topics and methods of experimental and/or computational investigation in accordance with the student's interests. In this track, research is conducted through a sequence of three 3-credit project-based courses, each supervised by a specific faculty member and focused on a different area of research and related methods and analysis techniques. Each project has specific scientific objectives, but the focus of the overall portfolio is for the student to develop expertise in a targeted set of laboratories and/or computational research skills. Assessment is based on practical examinations and documented research results associated with each project. The program also requires a comprehensive presentation and oral examination covering all of the student's project work. Each student's overall program is overseen by a major professor.

The Doctor of Philosophy (Ph.D.) degree is the highest academic credential in the field. ISU's robust multi-faceted program is intended to develop state-of-the-art competencies in academic scholarship, enabling graduates to make high-level career-based contributions in fields related to Materials Science and Engineering. The Ph.D. program combines graduate coursework with intensive and specialized project-based research expected to result in significant reportable scientific

contributions in one or more selected areas, as evidenced by publication in peer-reviewed journals, industry standards, patents, or other forms of recognizable technical contributions.

The MSE department boasts excellent facilities for academic materials research, maintaining a wide range of faculty laboratories across the ISU campus. In addition, departmental research is highly integrated with the operation of several Research Centers, such as the Ames Laboratory, the Center for Nondestructive Evaluation, the Microelectronics Research Center, the Center for Advanced Nonferrous Structural Materials, the Caloric Materials Consortium, the Critical Materials Institute, and the Sensitive Instruments Facility. These laboratories provide excellent resources for our graduate students in advanced materials research.

Graduate Majors

The Materials Science and Engineering Department offers three graduate degree programs:

- *Master of Engineering* in Materials Science and Engineering
- *Master of Science* in Materials Science and Engineering
- *Doctor of Philosophy* in Materials Science and Engineering

Eligibility: Enrollment in a graduate degree program requires prior* completion of an undergraduate curriculum in Materials Science and Engineering or any discipline of engineering, physical science, or biological science. Graduate students from disciplines other than materials science and engineering may expect that supplemental coursework will be needed, in addition to the required graduate coursework.

Requirements: Program requirements include:

- Required core and elective coursework
- Research (M.S. and Ph.D. only)
- Research proposal (M.S. and Ph.D. only)
- Qualifying examination (Ph.D. only)
- Preliminary oral examination (Ph.D. only)
- Thesis/dissertation (M.S. and Ph.D. only)
- Final oral examination (M.S. and Ph.D. only)

Specific requirements for each degree program are specified in the MSE Graduate Handbook and Graduate College Handbook.

Minor: The MSE Department offers a graduate minor in Materials Science and Engineering. The graduate minor requires 12 credits of MSE graduate coursework, including 6 credits selected from MSE 5100, MSE 5200, MSE 5300, and MSE 5400. In addition, the minor program requires that the POS committee includes at least one member of the MSE Graduate Faculty.

* Qualified students enrolled in the undergraduate materials engineering program at Iowa State University are eligible to apply to the Graduate College for admission to the concurrent enrollment program, where students may simultaneously pursue undergraduate and graduate degrees.

Courses primarily for graduate students, open to qualified undergraduates:

MSE 5010: Fundamentals of Materials Science and Engineering I

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

An examination of structure-property-process relationships in materials, focusing on control and measurement of end-use performance characteristics. Materials design fundamentals are discussed as they pertain to various critical industries, applications, and manufacturing technologies. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

MSE 5020: Fundamentals of Materials Science and Engineering II

Credits: 1. Contact Hours: Lecture 1.

Repeatable, maximum of 1 credits.

Prereq: Graduate Standing or Permission of Instructor

An examination of the physical behavior of materials, as underpinned by multiphase multicomponent thermodynamics, transport phenomena, interfaces, defect structures, the kinetics of phase transformations, and the mechanistic origins of structure-property-processing relationships in various types of materials. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

MSE 5030: Fundamentals of Materials Science and Engineering III

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Prereq: MSE 5010 and MSE 5020

Directed study of advanced topics in Materials Science and Engineering. Fundamental principles and relationships connecting structure, chemistry, stability, physical behavior, properties, and processing response are reviewed. Experimental and computational methods for materials research are emphasized. Offered on a satisfactory-fail basis only. (Typically Offered: Summer)

MSE 5100: Fundamentals of Structure and Chemistry of Materials

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Crystal structure and symmetry operations, including geometric and algebraic representations of symmetry. Structure, chemistry, and basic properties of covalent, ionic, and metallic solids, glasses and liquids, and polymers. Interactions of materials with particles and waves. Relationships between direct and reciprocal spaces. The kinematical theory of diffraction, with an introduction to the dynamical theory. (Typically Offered: Fall)

MSE 5190: Magnetism and Magnetic Materials

(Dual-listed with EE 4190/ MATE 4190). (Cross-listed with EE 5190).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Magnetic fields, flux density and magnetization. Magnetic materials, magnetic measurements. Magnetic properties of materials. Domains, domain walls, domain processes, magnetization curves and hysteresis. Types of magnetic order, magnetic phases and critical phenomena. Magnetic moments of electrons, theory of electron magnetism. Technological application, soft magnetic materials for electromagnets, hard magnetic materials, permanent magnets, magnetic recording technology, magnetic measurements of properties for materials evaluation. Offered odd-numbered years. (Typically Offered: Fall)

MSE 5200: Thermodynamics and Kinetics in Multicomponent Materials

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

A review of the fundamental principles of heat, work, basic thermodynamic relations, and criteria for equilibrium. Analytical treatments for the thermodynamic description of multicomponent chemical solutions and reacting systems are developed and employed to predict phase equilibria in materials systems. Builds on the thermodynamic construction to treat the kinetics of chemical reactions and phase transformations. Topics include general first order and second order transitions, along with chemical diffusion. Detailed examples involving nucleation and diffusion limited growth, spinodal decomposition, martensitic transformations, magnetic and electric transitions, and glass formation will be considered. (Typically Offered: Fall)

MSE 5210: Mechanical Behavior and Manufacturing of Polymers and Composites

(Cross-listed with ME 5210).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior, Senior, or Graduate Standing

Effect of chemical structure and morphology on properties. Linear viscoelasticity, damping and stress relaxation phenomena. Structure and mechanics of filler and fiber reinforced composites. Mechanical properties and failure mechanisms. Material selection and designing with polymers. Processing of polymer and composite parts. (Typically Offered: Spring)

MSE 5300: Solid State Science

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Development of a quantitative description of the electronic structure of solids starting with fundamentals of atoms, atomic bonding, basic crystallography, and band theory of solids. Continuum properties of solids in response to electromagnetic fields and thermal gradients. Quantitative description of the atomistic properties of solids through electron-electron interactions, electron-phonon interactions, and dipole interactions. (Typically Offered: Spring)

MSE 5320: Microelectronics Fabrication Techniques

(Dual-listed with EE 4320/ MATE 4320). (Cross-listed with EE 5320).

Credits: 4. Contact Hours: Lecture 2, Laboratory 4.

Prereq: Graduate Standing or Permission of Instructor

Techniques used in modern integrated circuit fabrication, including diffusion, oxidation, ion implantation, lithography, evaporation, sputtering, chemical-vapor deposition, and etching. Process integration. Process evaluation and final device testing. Extensive laboratory exercises utilizing fabrication methods to build electronic devices. Use of computer simulation tools for predicting processing outcomes. Recent advances in processing CMOS ICs and micro-electro-mechanical systems (MEMS).

MSE 5370: Electronic Properties of Materials

(Dual-listed with EE 4370/ MATE 4370). (Cross-listed with EE 5370).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Magnetic fields, flux density and magnetization. Magnetic materials, magnetic measurements. Magnetic properties of materials. Domains, domain walls, domain processes, magnetization curves and hysteresis. Types of magnetic order, magnetic phases and critical phenomena. Magnetic moments of electrons, theory of electron magnetism. Technological application, soft magnetic materials for electromagnets, hard magnetic materials, permanent magnets, magnetic recording technology, biomedical applications of magnetism, magnetic evaluation of materials. (Typically Offered: Spring)

MSE 5400: Mechanical Behavior of Materials

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Mechanical behavior of materials with emphasis on micromechanics of deformation in three generic regimes: elasticity, plasticity, and fracture. A materials science approach is followed to understand and model the mechanical behavior that combines continuum mechanics, thermodynamics, kinetics, and microstructure. Some topics include elastic properties of materials, permanent deformation mechanisms at different temperatures (e.g., via dislocation motion and creep), and fracture in ductile and brittle materials. Specific classes of materials that are studied: metals, ceramics, polymers, glasses and composites. (Typically Offered: Spring)

MSE 5500: Nondestructive Evaluation

(Cross-listed with EM 5500).

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Principles of five basic NDE methods and their application in engineering inspections. Materials behavior and simple failure analysis. NDE reliability, and damage-tolerant design. Advanced methods such as acoustic microscopy, laser ultrasonics, thermal waves, and computed tomography are analyzed. Computer-based experiments on a selection of methods: ultrasonics, eddy currents, x-rays are assigned for student completion. (Typically Offered: Spring)

MSE 5510: Characterization Methods in Materials Science

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Characterization of ceramic, metal, polymer and glassy materials using modern analytical techniques. Spectroscopic (IR, Raman, UV/VIS/NIR, and NMR), thermal (DSC, DTA/TGA, and DMA) methods, mechanical and rheological testing, magnetic and electrical characterization, and powder characterization. (Typically Offered: Spring)

MSE 5520: Scanning and Auger Electron Microscopy

(Dual-listed with MATE 4520).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Characterization of materials using scanning electron microscopes (SEM) and variants thereof, including electron microprobe, Auger spectrometer, and DualBeam focused ion beams (FIB)/SEMs). Compositional determination using energy and wavelength dispersive x-ray and Auger spectroscopies. Orientation determination using electron backscattered diffraction. Specimen preparation. Laboratory covers SEM operation. (Typically Offered: Fall)

MSE 5530: Physical and Mechanical Properties of Polymers

(Dual-listed with MATE 4530).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Overview of polymer chemical composition, microstructure, thermal and mechanical properties, rheology, and principles of polymer materials selection. Intensive laboratory experiments include chemical composition studies, microstructural characterization, thermal analysis, and mechanical testing. (Typically Offered: Fall)

MSE 5540: Polymer Composites and Processing

(Dual-listed with MATE 4540).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Basic concepts in polymer composites, blends, and block copolymers. Phase separation and miscibility, microstructures and mechanical behavior. Fiber reinforced and laminated composites. Viscosity, rheology, viscoelasticity of polymers. Polymer melt processing methods such as injection molding and extrusion; selection of suitable processing methods and their applications. (Typically Offered: Spring)

MSE 5560: Biomaterials

(Dual-listed with BME 4560/ MATE 4560).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Presentation of the basic chemical and physical properties of biomaterials, with special emphasis on metallic, ceramic, polymeric, and composite biomaterials, as they are related to their manipulation by the engineer for incorporation into living systems. Role of microstructure and properties needed to select and design biomaterials used in medical devices, artificial organs, implants, and prostheses. Overview of medical science vis-à-vis materials science. (Typically Offered: Fall)

MSE 5570: Chemical and Physical Metallurgy of Rare Earth Metals

(Dual-listed with MATE 4570).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Electronic configuration, valence states, minerals, ores, beneficiation, extraction, separation, metal preparation and purification. Crystal structures, phase transformations and polymorphism, and thermochemical properties of rare earth metals. Chemical properties: inorganic and organometallic compounds, alloy chemistry, nature of the chemical bonding. Physical properties: mechanical and elastic properties, magnetic properties, resistivity, and superconductivity. (Typically Offered: Spring)

MSE 5640: Fracture and Fatigue

(Cross-listed with AERE 5640/ ME 5640/ EM 5640).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Materials and mechanics approach to fracture and fatigue.

Fracture mechanics, brittle and ductile fracture, fracture and fatigue characteristics, fracture of thin films and layered structures. Fracture and fatigue tests, mechanics and materials designed to avoid fracture or fatigue. Offered even-numbered years. (Typically Offered: Fall)

MSE 5690: Mechanics of Composite and Combined Materials

(Cross-listed with AERE 5690/ EM 5690).

Credits: 3. Contact Hours: Lecture 3.

Prereq: EM 3240

Mechanics of fiber-reinforced materials. Micromechanics of lamina.

Macromechanical behavior of lamina and laminates. Strength and interlaminar stresses of laminates. Failure criteria. Stress analysis of laminates. Thermal moisture and residual stresses. Joints in composites. Offered even-numbered years. (Typically Offered: Spring)

MSE 5800: Introduction of Project Management for Thesis Research

(Cross-listed with CHE 5800/ IE 5800).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Tools and skills of Project Management (PM) adapted from industry to improve efficiency in thesis research. Project charter initiation for thesis, timeline and meeting scheduling tools, expectation management, and communication with advisors. Practice of the PM skills using student's own thesis. Presentation of a project charter. Demonstration of knowledge of related PM skills and the ability of utilizing these skills for thesis research. Sharing thesis ideas and learning experience in the Graduate for Advancing Professional Skills (GAPS) learning community. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

MSE 5810: Computational Modeling of Materials

(Dual-listed with MATE 4810).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to the basic methods used in the computational modeling and simulation of materials, from atomistic simulations to methods at the mesoscale. Students will be expected to develop and run sample programs. Topics to be covered include, for example, electronic structure calculations, molecular dynamics, Monte Carlo, phase-field methods, etc. (Typically Offered: Fall)

MSE 5820X: Data Analytics and Machine Learning in Materials Research

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Basics of data mining and machine learning as applied to materials data from both experiment and computational modeling. Focus on determining the correlation of structures and properties in a wide range of materials systems, with an emphasis on mesoscale structures (e.g., microstructures). Understanding of and proficiency in these tools to apply them in their research. Applications oriented, with those applications taken from real-world materials data.

MSE 5880: Eddy Current Nondestructive Evaluation

(Dual-listed with EE 4880/ MATE 4880). (Cross-listed with EE 5880).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Electromagnetic fields of various eddy current probes. Probe field interaction with conductors, crack and other material defects. Ferromagnetic materials. Layered conductors. Elementary inversion of probe signals to characterize defects. Special techniques including remote-field, transient, potential drop nondestructive evaluation and the use of Hall sensors. Practical assignments using a 'virtual' eddy current instrument will demonstrate key concepts. Offered odd-numbered years. (Typically Offered: Fall)

MSE 5900: Special Topics

Credits: 1-30. Repeatable.

Prereq: Department Permission for Course

(Typically Offered: Fall, Spring, Summer)

MSE 5990: Creative Component

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

Courses for graduate students:**MSE 6010: Materials Seminar**

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Seminar course - presentations given on a weekly basis by leading U.S. and International researchers that are experts in their respective fields closely related to Materials Science. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

MSE 6200: Fundamentals of Phase Transformations

Credits: 3. Contact Hours: Lecture 3.

Prereq: MSE 5200

Explores various advanced theoretical treatments of the energetics and kinetics of multicomponent materials. Topics include analytical and computational descriptions of thermodynamic quantities, experimental measurement of essential physical properties, analytical and computational treatments of kinetic processes, and the use of theoretical predictions of phase equilibria and evolution in materials systems. (Typically Offered: Spring)

MSE 6300: Physical Properties of Solids

Credits: 3. Contact Hours: Lecture 3.

Prereq: MSE 5300

Advanced course in the behavior of solids within the framework of solid state physics and chemistry. Includes magnetic, dielectric, transport, and optical phenomena in solids. Influence of phase transformations and crystal symmetry on the physical properties.

MSE 6510: Powder Diffraction Methods

Credits: 3. Contact Hours: Lecture 3.

Prereq: MSE 5100 or instructor permission

Advanced structural characterization of materials using powder diffraction. Production of X-ray and neutron radiation. Review of symmetry, group and kinematical theories of diffraction. Mathematical and computational backgrounds of powder diffraction data. Introduction to single crystal diffraction methods, origin of powder diffraction pattern, history of the technique. Modern powder diffraction methods. Indexing of powder diffraction patterns, figures of merit, precise lattice parameters. Phase problem, determining crystal structures from symmetry and geometry, Patterson, direct and Fourier methods. Rietveld method, precise crystal structures: atomic parameters, qualitative and quantitative phase identification, preferred orientation, grain size, strain, residual stress, order-disorder. Powder diffraction at non-ambient conditions. Applications of powder diffraction: data bases, phase transformations, phase diagrams, local structures, magnetism. (Typically Offered: Spring, Summer)

MSE 6520: Transmission Electron Microscopy

Credits: 3. Contact Hours: Lecture 3.

Prereq: MSE 5100

Theory and application of transmission electron microscopy to inorganic materials. Specimen preparation, selected area and convergent beam electron diffraction, bright field/dark field/high resolution imaging, scanning transmission electron microscopy, in-situ/operando electron microscopy, compositional analysis using X-ray and electron energy loss spectroscopy. (Typically Offered: Spring)

MSE 6900: Advanced Topics in Materials Science

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

Prereq: Department Permission for Course

(Typically Offered: Fall, Spring, Summer)

MSE 6970: Engineering Internship

Credits: Required. Repeatable.

One semester and one summer maximum per academic year professional work period. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

MSE 6990: Research

Credits: 1-30. Repeatable.

Prereq: Department Permission for Course

(Typically Offered: Fall, Spring, Summer)

Mechanical Engineering

For the undergraduate curriculum in mechanical engineering leading to the degree Bachelor of Science. The Mechanical Engineering Program is accredited by the Engineering Accreditation Commission of ABET, <https://www.abet.org> (<https://www.abet.org/>), under the commission's General Criteria and Program Criteria for Mechanical and Similarly Named Engineering Programs.

Mechanical engineers apply the principles of motion, energy, and force to create mechanical solutions to technological problems, thereby realizing devices and systems that make life better. About one-fifth of all engineers practicing today are mechanical engineers. Their skills are used in research, development, design, testing, production, technical sales, technical management, as well as medicine, law, and business. Mechanical engineers are characterized by personal creativity, breadth of knowledge, and versatility. For these reasons they are found to function and thrive as valuable members and leaders of multidisciplinary teams. Mechanical engineers are employed in a wide range of industries; examples include agricultural/heavy equipment, biomedical, consulting, energy and power, manufacturing, product design and transportation.

Student Learning Outcomes:

Graduates of the Mechanical Engineering curriculum should have at the time of graduation:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audiences.

4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Program Educational Objectives:

The mechanical engineering curriculum is organized to provide students with a broad foundation in mathematics, science, engineering, social science and humanities. Areas emphasized in the curriculum are design and optimization, dynamic systems and control, materials processing and mechanics, and thermo-fluid sciences. Elective courses provide additional emphasis in terms of the student's unique educational goals, whether they include immediate entry into industry or further professional or graduate study.

The mechanical engineering curriculum at Iowa State University is dedicated to preparing students for productive careers in the state, nation, and the world and has the following objectives:

1. Graduates will have utilized a foundation in engineering and science to improve lives and livelihoods through a successful career in mechanical engineering or other fields.
2. Graduates will have become effective leaders, collaborators, and innovators solving social, technical, business, and global challenges.
3. Graduates will have engaged in life-long learning and professional development through self-study, continuing education, or graduate and professional studies in engineering, business, law, medicine, or other fields.
4. Graduates will have fostered inclusive and diverse environments and functioned effectively in inclusive and diverse environments.

A major focus throughout the mechanical engineering curriculum is a series of experiences that emphasize engineering design, culminating in a capstone design experience in the senior year. Students will develop engineering judgment through open-ended problems that require establishment of reasonable engineering assumptions and realistic constraints. Development of skills needed to be independent, creative thinkers, effective communicators, and contributing team members is integrated throughout the curriculum. Students also develop an understanding of the societal context in which they will practice

engineering, including environmental, legal, aesthetic, and human aspects.

Students are encouraged to participate in the cooperative education program or to obtain engineering internships, both domestically and abroad. Study abroad is encouraged, and the department has exchange programs with several universities around the world. These experiences help students to round out their education and to better prepare for careers in the increasingly global practice of engineering.

Curriculum in Mechanical Engineering

Administered by the Department of Mechanical Engineering. Leading to the degree Bachelor of Science.

Total credits required: 129 cr.

Any transfer credit courses applied to the degree program require a grade of C or better (but will not be calculated into the ISU cumulative GPA, Basic Program GPA, me foundations gpa, or Core GPA). See also Basic Program and Special Programs.

International Perspectives: 3 cr.¹

U.S. Cultures and Communities: 3 cr.¹

Communication Proficiency/Library requirement:

ENGL 1500	Critical Thinking and Communication (Must have a C or better in this course)	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition (Must have a C or better in this course)	3
LIB 1600	Introduction to College Level Research	1
Choose one of the following communication courses (minimum grade of C)		3
ENGL 3020	Business Communication	
ENGL 3090	Proposal and Report Writing	
ENGL 3140	Technical Communication	
SPCM 2120	Fundamentals of Public Speaking	

General Education Electives: 15 cr.

No more than three 1000-level courses for this set of courses can be applied to the Bachelor of Science Degree in Mechanical Engineering.

Choose one course from the following:		3
ECON 1010	Principles of Microeconomics	
	or ECON 102 Principles of Macroeconomics	
Social Science ²		3
Humanities ²		6
Humanities or Social Science ²		3
Total Credits		15

Basic Program: 24 cr.

A minimum GPA of 2.00 is required for this set of courses (please note that transfer course grades will not be calculated into the Basic Program

GPA). See Requirement for Entry into Professional Program in College of Engineering Overview section.

CHEM 1670	General Chemistry for Engineering Students	4
or CHEM 1770 General Chemistry I		
ENGL 1500	Critical Thinking and Communication (Must have a C or better in this course)	3
ENGR 1010	Engineering Orientation	R
ME 1600	Mechanical Engineering Problem Solving with Computer Applications ³	3
LIB 1600	Introduction to College Level Research	1
MATH 1650	Calculus I	4
MATH 1660	Calculus II	4
PHYS 2310	Introduction to Classical Physics I	4
PHYS 2310L	Introduction to Classical Physics I Laboratory	1
Total Credits		24

Mechanical Engineering Foundations: 25 cr.

A minimum GPA of 2.00 for the complete group of Foundations courses is required before students are permitted to enroll in the following Mechanical Engineering Core courses (please note that transfer course grades will not be calculated into the ME Foundations GPA): ME 3240, ME 3250, ME 3320, ME 3350, ME 3700 and ME 4210.

MATH 2650	Calculus III	4
4 credits from the following:		4
MATH 2670	Elementary Differential Equations and Laplace Transforms	
MATH 2660 & MATH 2680	Elementary Differential Equations and Laplace Transforms	
PHYS 2320	Introduction to Classical Physics II	4
PHYS 2320L	Introduction to Classical Physics II Laboratory	1
EM 3240	Mechanics of Materials	3
MATE 2730	Principles of Materials Science and Engineering	3
ME 2310	Engineering Thermodynamics I	3
CE 2740	Engineering Statics	3
Total Credits		25

Mechanical Engineering Core: 38 cr.

A minimum GPA of 2.00 is required for this set of courses (please note that transfer course grades will not be calculated into the Core GPA):

ME 3450	Engineering Dynamics	3
EE 4420	Introduction to Circuits and Instruments	2
EE 4480	Introduction to AC Circuits and Motors	2
ME 2700	Introduction to Mechanical Engineering Design	3
ME 3240	Manufacturing Engineering Laboratory	3

ME 3240L	Manufacturing Engineering Laboratory	1
ME 3250	Mechanical Component Design	3
ME 3320	Engineering Thermodynamics II	3
ME 3350	Fluid Flow	4
ME 3700	Engineering Measurements	3
ME 4210	System Dynamics and Control	4
ME 4360	Heat Transfer	4
One Senior Capstone Design course from the following		3
ME 4150	Mechanical Systems Design	
ME 4420	Heating and Air Conditioning Design	

Total Credits 38

Other Remaining Courses: 27 cr.

Complete 15 cr. Technical Electives ²		15
ME 1700	Engineering Graphics and Introductory Design	3
ME 2020	Mechanical Engineering - Professional Planning	R
ENGL 2500	Written, Oral, Visual, and Electronic Composition (Must have a C or better in this course)	3
STAT 3050	Engineering Statistics	3
Complete one of the following communication courses with a minimum grade of C.		3
ENGL 3020	Business Communication	
ENGL 3090	Proposal and Report Writing	
ENGL 3140	Technical Communication	
SPCM 2120	Fundamentals of Public Speaking	

Total Credits 27

Co-op/Internships (Optional)

1. These university requirements will add to the minimum credits of the program unless the university-approved courses are also approved by the department to meet other course requirements within the degree program.
U.S. Cultures and Communities and International Perspectives courses may not be taken Pass/Not Pass.
2. Choose from department approved list of technical electives (<https://www.me.iastate.edu/undergraduate-program/advising/degree-planning/>) and general education electives (<https://www.me.iastate.edu/undergraduate-program/advising/degree-planning/>). Note: electives used to meet graduation requirements may not be taken Pass-Not Pass (P-NP).
3. See Basic Program for Professional Engineering Curricula for accepted substitutions for curriculum designated courses in the Basic Program.

Transfer Credit Requirements

The Mechanical Engineering Department requires a grade of a C or better for any transfer credit course that is applied to the degree program.

The degree program must include a minimum of 15 credits taken from courses offered through the Mechanical Engineering Department at Iowa State University. Of these 15 credits, 3 must be from one of the senior capstone design courses. The remaining 12 credits may be from the core curriculum program (if a student is deficient in these courses) or from 4000-level ME technical electives. No more than 3 credits of independent study shall be applied to meet the 12-credit requirement.

See also: A 4-year plan of study grid showing course template by semester.

Mechanical Engineering, B.S.

First Year

Fall	Credits Spring	Credits
CHEM 1670	4 ENGL 1500	3
ME 1600	3 ME 1700	3
MATH 1650	4 MATH 1660	4
ENGR 1010	R LIB 1600	1
General Education Elective	3 PHYS 2310	4
	PHYS 2310L	1
	14	16

Second Year

Fall	Credits Spring	Credits
CE 2740	3 EM 3240	3
MATE 2730	3 MATH 2670	4
MATH 2650	4 ME 2310	3
PHYS 2320	4 ME 2700	3
PHYS 2320L	1 General Education Elective	3
ENGL 2500	3 ME 2020	R
	18	16

Third Year

Fall	Credits Spring	Credits
EE 4420	2 ME 3250	3
EE 4480	2 ME 3350	4
ME 3450	3 ME 3700	3
ME 3320	3 ME 3240	3
STAT 3050	3 Communication Requirement	3
ME 3240L	1	
General Education Elective	3	
	17	16

Fourth Year

Fall	Credits Spring	Credits
Gen Ed Elective (Intl Perspective)	3 Gen Ed Elective (U.S. Cultures and Communities)	3
ME 4210	4 Technical Elective	3
ME 4360	4 Technical Elective	3
Technical Elective	3 Technical Elective	3
Technical Elective	3 Capstone Design	3
	17	15

Energy Systems Minor

The Energy Systems minor is administered by the mechanical engineering department and is open to all undergraduates in the College of Engineering. The minor may be earned by completing 15 credits from the following courses. The complete list of approved elective courses can be found below. The minor must include at least 3 credits that are not used to meet any other department, college, or university requirement.

<http://www.me.iastate.edu/energy-systems-minor/>

Required courses

ECON 3800	Energy, Environmental and Resource Economics	3
EE 3510	Analysis of Energy Systems	3
or ME 4330	Alternative Energy	
Electives: Choose from a list of approved courses		9
Total Credits		15

Approved Elective Courses

ABE 3250	Biorenewable Systems	3
ABE 3420	Agricultural Tractor Power	3
ABE 3630	Agri-Industrial Applications of Electric Power and Electronics	4
ABE 3800	Principles of Biological Systems Engineering	3
ME 4130	Fluid Power Engineering	3
ABE 4720	Controlled Environments for Animals and Plants	3
ABE 4800	Engineering Analysis of Biological Systems	3
ABE 5720	Controlled Environments for Animals and Plants	3
ABE 5800	Engineering Analysis of Biological Systems	3
AERE 3810	Introduction to Wind Energy	3
AERE 5700	Wind Engineering	3
CHE 3560	Transport Phenomena I	3
CHE 3570	Transport Phenomena II	3
CHE 3580	Separations	3
CHE 3810	Chemical Engineering Thermodynamics	3
CHE 3820	Chemical Reaction Engineering	3

CHE 4150	Biochemical Engineering	3
CHE 5150	Biochemical Engineering	3
CHE 5540	Integrated Transport Phenomena	4
CHE 5830	Advanced Thermodynamics	3
CHE 5870	Advanced Chemical Reactor Design	3
CONE 3520	Mechanical Systems in Buildings	3
CONE 3530	Electrical Systems in Buildings	3
CONE 3540	Building Energy Performance	3
EE 3030	Energy Systems and Power Electronics	3
EE 4480	Introduction to AC Circuits and Motors	2
EE 4520	Electrical Machines and Power Electronic Drives	3
EE 4550	Introduction to Energy Distribution Systems	3
EE 4560	Power System Analysis I	3
EE 4570	Power System Analysis II	3
EE 4580	Economic Systems for Electric Power Planning	3
EE 4590	Electromechanical Wind Energy Conversion and Grid Integration	3
EE 5520	Energy System Planning	3
EE 5530	Steady State Analysis	3
EE 5540	Power System Dynamics	3
EE 5550	Advanced Energy Distribution Systems	3
EE 5560	Power Electronic Systems	3
EE 5590	Electromechanical Wind Energy Conversion and Grid Integration	3
EM 5700	Wind Engineering	3
ME 3320	Engineering Thermodynamics II	3
ENSCI 3240	Energy and the Environment	3
ENSCI 4800	Engineering Analysis of Biological Systems	3
ME 3350	Fluid Flow	4
ME 4130	Fluid Power Engineering	3
ME 4360	Heat Transfer	4
ME 4370	Introduction to Combustion Engineering	3
ME 4410	Fundamentals of Heating, Ventilating, and Air Conditioning	3
ME 4420	Heating and Air Conditioning Design	3
ME 4440	Elements and Performance of Power Plants	3
ME 4480	Fluid Dynamics of Turbomachinery	3
ME 4490	Internal Combustion Engines	3
ME 5010	Fundamentals of Biorenewable Resources	3
ME 5300	Advanced Thermodynamics	3
ME 5320	Compressible Fluid Flow	3
ME 5350	Thermochemical Processing of Biomass	3
ME 5360	Advanced Heat Transfer	3

ME 5380	Advanced Fluid Flow	3
ME 5420	Advanced Combustion	3
ME 5450	Thermal Systems Design	3
MSE 5200	Thermodynamics and Kinetics in Multicomponent Materials	3
MATE 3110	Thermodynamics in Materials Engineering	3
WESEP 5010	Wind Energy Resources	3
WESEP 5020	Wind Energy Systems	3

Concurrent Mechanical Engineering BS/MS Degree

The Department of Mechanical Engineering (ME) provides B.S./M.S. concurrent degrees that allow well-qualified students to be admitted to the graduate program while still working on their undergraduate degrees during their senior year. Concurrent degrees allow well-qualified students to begin their graduate studies before completing their undergraduate degree to complete their graduate degree on an accelerated timeline. Students in concurrent status must be making good progress toward a bachelor's degree. The minimum requirements for admission to concurrent-student status are the same as those required for admission to the Graduate College. Other aspects of concurrent status include:

- Official enrollment and fee payment will be as a graduate student.
- The graduate credential will be awarded at the same time or after the undergraduate degree is conferred.
- Students may be appointed to graduate research assistantships.
- With the approval of a student's Program of Study (POS) Committee, up to 6 ISU credits taken while in concurrent status may be applied to a bachelor's degree and a graduate degree.

Details on the master's degree requirements and graduate admission in mechanical engineering may be found at: <https://www.me.iastate.edu/graduate-admissions/>. (<https://www.me.iastate.edu/graduate-admissions/>)

Details on the graduate college policies on concurrent degrees may be found at: <https://www.grad-college.iastate.edu/handbook/chapter.php?id=4#4.3>. (<https://www.grad-college.iastate.edu/handbook/chapter.php?id=4#4.3>)

Graduate Study

The department offers programs for the degrees Master of Engineering (M. Eng.), Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) with a major in mechanical engineering. The M.Eng. degree is a coursework-only degree designed to improve professional expertise in mechanical engineering. The M.S. and Ph.D. degrees are designed to improve the

student's capability to conduct research as well as their professional expertise. Although co-major and formal minor programs are not offered in mechanical engineering, courses may be used for minor work by students taking major work in other departments.

Well-qualified juniors and seniors in mechanical engineering who are interested in graduate study may apply for concurrent enrollment in the Graduate College to simultaneously pursue both the Bachelor of Science and Master of Science, the Bachelor of Science and Master of Business Administration. Under concurrent enrollment, students are eligible for assistantships and simultaneously take undergraduate and graduate courses. Details are available in the Graduate Programs Office and on the department's website (<http://www.me.iastate.edu/>).

The graduate program offers advanced study in a variety of thrust areas, including biological and nanoscale sciences, clean energy technologies, complex fluid systems, design and manufacturing innovation, and simulation and visualization.

The department offers students the opportunity to broaden their education by participating in minor programs in established departments, interdepartmental programs, or other experiences as approved by their program of study committees.

The requirements for advanced degrees are established by the student's program of study committee within established guidelines of the Graduate College. Graduate students who have not completed an undergraduate program of study substantially equivalent to that required of undergraduate students in the department can expect that additional supporting coursework will be required.

Program requirements can be found on the department webpage (<http://www.me.iastate.edu/>) and in the Mechanical Engineering Graduate Student Handbook.

Non-destructive Evaluation Minor

Minor supervised by an interdisciplinary faculty committee, administered by Materials Science and Engineering. The NDE minor is a unique opportunity for engineering students to acquire a multidisciplinary engineering qualification in the rapidly evolving field of Nondestructive Evaluation.

Undergraduate Study

Students interested in completing the NDE engineering minor must be enrolled in the College of Engineering at Iowa State University. They must submit a "Curriculum Change" form and complete the minimum prescribed 16 credit hours of coursework defined below. Acceptance is based on approval by the administering department, Materials Science and Engineering.

A combined average grade of C or higher is required in courses applied to the minor. The minor must include at least 3 credits that are not used to meet any other department, college, or university requirement.

The course requirements for the undergraduate minor in NDE are:

EM 3620/3620	Principles of Nondestructive Testing	3
MATE/EM 3620L	Nondestructive Testing Laboratory	1
At least one of the following NDE specific courses		3-4

CE 4490	Structural Health Monitoring
EM 4800	Ultrasonic Nondestructive Evaluation
MATE 4850X	Penetrating Radiation Methods in Nondestructive Evaluation
MATE 4880	Eddy Current Nondestructive Evaluation
MSE/EM 5500	Nondestructive Evaluation

Independent Study courses on NDE projects from other engineering disciplines will need to be approved by the NDE Minor Coordinator

AERE 4900J	Aerospace Engineering Independent Study: Non-destructive Evaluation (Research Topic related to NDE for any 4900)
or EE 4900	Independent Study
or MATE 4900	Independent Study
or ME 4900H	Independent Study: Honors
or ME 4900M	Independent Study: Non Technical Elective
or ME 4900T	Independent Study: Technical Elective

Up to three of the following or additional NDE specific courses from the list above

AERE 3210	Flight Structures Analysis
AERE 4210	Advanced Flight Structures
AERE 4220	Vibrations and Aeroelasticity
AERE 4230	Composite Flight Structures
AERE 4260	Design of Aerospace Structures
CPRE 4180	High Speed System Engineering Measurement and Testing
EE 2240	Signals and Systems I
EE 3110	Electromagnetic Fields and Waves
EE 3140	Electromagnetics for non Electrical Engineers
EE 4180	High Speed System Engineering Measurement and Testing
EM 4240	Intermediate Mechanics of Materials
EM 4250	Introduction to the Finite Element Method
IE 3480	Solidification Processes
IE 3610	Statistical Quality Assurance
ME 4170	Advanced Machine Design
ME 4180	Mechanical Considerations in Robotics

MATE 4180	Mechanical Behavior of Materials	
MATE 4430	Physical Metallurgy of Ferrous Alloys	
MATE 4440	Corrosion and Failure Analysis	
STAT 2310	Probability and Statistical Inference for Engineers	
STAT 3050	Engineering Statistics	
STAT 3220	Probabilistic Methods for Electrical Engineers	
Total Credits		16-20

Software Engineering

Administered by the College of Engineering and the College of Liberal Arts and Sciences.

For the undergraduate curriculum in Software Engineering (<http://www.se.iastate.edu>) leading to the degree Bachelor of Science. The Software Engineering Program is accredited by the Engineering Accreditation Commission of ABET, <https://www.abet.org> (<https://www.abet.org/>), under the commission's General Criteria and Program Criteria for Software and Similarly Named Engineering Programs.

A software engineer uses their expertise to design, develop, and evaluate software, configure and install computer systems, and build and maintain software systems throughout their lifecycle. Specific tasks software engineers perform evolve quickly, reflecting changes in technology, as well as the needs of employers. Software engineers work as members of teams that may include experts in engineering, marketing, manufacturing, accounting, training, and design.

The Software Engineering Program provides undergraduate students with the opportunity to learn Software Engineering fundamentals, to study applications of state-of-the-art software technologies, and to prepare for the practice of Software Engineering. The student-faculty interaction necessary to realize this opportunity occurs within an environment motivated by the principle that excellence in undergraduate education is enhanced by an integrated commitment to successful, long-term research, and outreach programs.

Student learning outcomes

Graduates of the Software Engineering curriculum should have, at the time of graduation:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.

3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

PROGRAM EDUCATIONAL Objectives

Within five years of graduation, the graduates should:

1. Attain a **productive career** in Software Engineering or related fields.
2. Attain **leadership** roles and become **effective collaborators and innovators** to advance professional and organizational goals.
3. Engage in **lifelong learning** and professional development.
4. Encourage and support **diversity** and **inclusiveness** in their workplace.

We expect that these objectives will be manifested in our graduates through the following five key attributes: (a) *peer-recognized expertise*, (b) *engagement in professional practice*, (c) *sustained learning*, (d) *leadership* and (e) *teamwork*.

Demonstration of expertise involves applying state-of-the-art practices for solving problems in the design, development, validation, evolution and sustainment of (software) products. Demonstration of professional engagement involves contributing locally and globally to the use of ethical, competent, and creative practices in industry, academia or the public sector. Demonstration of sustained learning involves the ability to adapt to rapid technological, environmental, and organizational changes through self-study and group study and through opportunities of professional development or graduate study. Demonstration of leadership involves the ability to take initiative, and to facilitate the advancements of individuals and the community by influencing others and by having a widespread, positive impact on critical issues and projects. Finally, demonstration of teamwork involves the ability to work with collaborators who have varied expertise, and with diverse cultural and interdisciplinary backgrounds.

As a complement to the instructional activity, the College of Engineering and the College of Liberal Arts and Sciences provide opportunities for

each student to have experience with broadening activities. Students have the opportunity to gain practical industry experience in the cooperative education and internship program. Students have the opportunity to participate in advanced research activities. Through international exchange programs, students learn about engineering practices in other parts of the world.

Curriculum in Software Engineering

Degree requirements leading to the degree Bachelor of Science in Software Engineering.

Total credits required: 125 cr.

Any transfer credit courses applied to the degree program require a grade of C or better (but will not be calculated into the ISU cumulative GPA, Engineering Basic Program GPA, or Software Engineering Core GPA). See also Engineering Basic Program and Special Programs. Note: Pass/Not Pass credits cannot be used to meet graduation requirements.

International Perspectives: 3 cr.¹

U.S. Cultures and Communities: 3 cr.¹

Communication Proficiency/Library requirement:

ENGL 1500	Critical Thinking and Communication (C or better in this course)	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition (C or better in this course)	3
LIB 1600	Introduction to College Level Research	1
Choose one of the following:		3
ENGL 3090	Proposal and Report Writing (C or better in this course)	
ENGL 3140	Technical Communication (C or better in this course)	
Total Credits		10

General Education Requirements: 21 cr.

²

Choose 1 course from the following:		3
ECON 1010	Principles of Microeconomics	
ECON 1020	Principles of Macroeconomics	
ECON 1030X	Introduction to Economics: Real World Applications	
IE 3050	Engineering Economic Analysis	
Approved Arts and Humanities or Social Sciences courses		9
ENGL 2500	Written, Oral, Visual, and Electronic Composition (C or better in this course)	3
Choose one of the following ENGL courses (C or better in this course)		3
ENGL 3090	Proposal and Report Writing	
ENGL 3140	Technical Communication	

SPCM 2120	Fundamentals of Public Speaking	3
Total Credits		21

Engineering Basic Program: 24 cr.

A minimum GPA of 2.00 is required for this set of courses (please note that transfer course grades will not be calculated into the Engineering Basic Program GPA). See Requirement for Entry into Professional Program in College of Engineering Overview section.

CHEM 1670	General Chemistry for Engineering Students	4
or CHEM 1770 General Chemistry I		
ENGL 1500	Critical Thinking and Communication (C or better in this course)	3
SE 1010	Software Engineering Orientation	R
SE 1850	Problem Solving in Software Engineering ³	3
LIB 1600	Introduction to College Level Research	1
MATH 1650	Calculus I	4
MATH 1660	Calculus II	4
PHYS 2310	Introduction to Classical Physics I	4
PHYS 2310L	Introduction to Classical Physics I Laboratory	1
Total Credits		24

Math and Physical Science: 17 cr.

COMS 2270	Object-oriented Programming (C- or better in this course)	4
COMS 2280	Introduction to Data Structures (C- or better in this course)	3
MATH 2670	Elementary Differential Equations and Laplace Transforms	4
Math Elective: Choose one of the following:		3
MATH 2070	Matrices and Linear Algebra	
MATH 2650	Calculus III	
MATH 3040	Combinatorics	
MATH 3140	Graph Theory	
MATH 3170	Theory of Linear Algebra	
STAT 3300	Probability and Statistics for Computer Science	3
Total Credits		17

Software Engineering Core: 37 cr.

A minimum GPA of 2.00 is required for this set of courses, including any transfer courses (please note that transfer course grades will not be calculated into the Software Engineering Core GPA):

CPRE 2810	Digital Logic	4
Choose one of the following:		3
COMS 3270	Advanced Programming Techniques	

CPRE 2880	Embedded Systems I: Introduction	
Choose one of the following:		3
COMS 3210	Introduction to Computer Architecture and Machine-Level Programming	
CPRE 3810	Computer Organization and Assembly Level Programming	
Choose one of the following:		3
COMS 3520	Introduction to Operating Systems	
CPRE 3080	Operating Systems: Principles and Practice	
Choose one of the following:		3
COMS 2300	Discrete Computational Structures	
CPRE 3100	Theoretical Foundations of Computer Engineering	
COMS 3110	Introduction to the Design and Analysis of Algorithms	3
COMS 3630	Introduction to Database Management Systems	3
SE 3090	Software Development Practices	3
SE 3170	Introduction to Software Testing	3
SE 3190	Construction of User Interfaces	3
SE 3390	Software Architecture and Design	3
SE 4210	Software Analysis and Verification for Safety and Security	3

Note: CPRE 2880, CPRE 3810, and CPRE 3080 are 4-credit courses. The Software Engineering Core credit requirement (37 credits) is given in terms of 3-credit courses. If the 4-credit courses are taken instead, then the extra credits will be used as credits for Supplemental Electives.

Total Credits	37

Other Remaining Courses: 26 cr.

SE 1660	Careers in Software Engineering	R
SE 4910	Senior Design Project I and Professionalism	3
SE 4920	Senior Design Project II	2
Software Engineering Electives ²		9
Supplemental Electives ²		9
Open Elective ²		3
Total Credits		26

Optional Co-op/Internships

Co-op (ENGR 3980) or internship (ENGR 3960 or ENGR 3970) is optional

Transfer Credit Requirements

The degree program must include a minimum of 30 credits at the 3000-level or above in professional and technical courses earned at ISU in order to receive a Bachelor of Science in Software Engineering. These 30

credits must include SE 4910 Senior Design Project I and Professionalism and SE 4920 Senior Design Project II. The Software Engineering degree program requires a grade of C or better for any transfer credit course that is applied to the degree program.

1. These university requirements will add to the minimum credits of the program unless the university-approved courses are also approved by the department to meet other course requirements within the degree program. U.S. Cultures and Communities and International Perspectives courses may not be taken Pass/Not Pass.
2. Choose from approved lists (<http://www.se.iastate.edu/academics/>).
3. See Basic Program for Professional Engineering Curricula for accepted substitutions for curriculum designated courses in the Engineering Basic Program.

See also: A 4-year plan of study grid showing course template by semester.

Note: International Perspectives and U.S. Cultures and Communities courses are used to meet the General Education Electives (<http://www.se.iastate.edu/academics/>).

Software Engineering, B.S.

Freshman

Fall	Credits Spring	Credits
SE 1010	R SE 1660	R
SE 1850	3 COMS 2270	4
MATH 1650	4 MATH 1660	4
CHEM 1670 or 1770	4 PHYS 2310	4
LIB 1600	1 PHYS 2310L	1
Economics Elective	3 ENGL 1500	3
15		16

Sophomore

Fall	Credits Spring	Credits
COMS 2280	3 SE 3190 ¹	3
CPRE 2810 ¹	4 COMS 3270 or CPRE 2880 ^{1,2}	3
MATH 2670	4 CPRE 3100 or COMS 2300	3
SPCM 2120	3 Math Elective	3
ENGL 2500	3 General Education Elective	3
17		15

Junior

Fall	Credits Spring	Credits
SE 3090 ¹	3 SE 3170 ¹	3
COMS 3210 or CPRE 3810 ^{1,2}	3 SE 3390 ¹	3

COMS 3110	3 COMS 3520 or CPRE 3080 ¹ , 2	3
COMS 3630 ¹	3 ENGL 3140 or 3090	3
General Education Elective	3 General Education Elective	3
15		15

Senior

Fall	Credits Spring	Credits
SE 4910	3 SE 4920	2
SE 4210 ¹	3 Software Engineering Elective	3
Software Engineering Elective	3 Software Engineering Elective	3
Supplemental Elective	3 Supplemental Elective	3
STAT 3300	3 Supplemental Elective Open Elective	3
15		17

Total Credits: 125

* Total credits required - 125 credits. Any transfer credit courses applied to the degree program require a grade of C or better (but will not be calculated into the ISU Cumulative GPA, Engineering Basic Program GPA, or Software Engineering Core GPA). See also Basic Program and Special Programs.

Engineering Basic Program - A minimum GPA of 2.00 is required for this set of courses, including any transfer courses (please note that transfer course grades will not be calculated into the Engineering Basic Program GPA)

Must receive a C or better grade in required English classes.

Must receive a C- or better grade in MATH 1650, MATH 1660, COMS 2270, and COMS 2280.

General Educational Elective courses to be selected in consultation with Software Engineering Academic Advisors from a list of approved courses. They must include courses that satisfy university and college general education requirements. These courses include courses or categories of courses such as International Perspectives and U.S. Cultures and Communities, World Language, Arts and Humanities, and Social Sciences. Pass/Not Pass credit is not accepted.

Software Engineering Electives and Supplemental Electives must be selected from the program-approved list (<http://www.se.iastate.edu/academics/>).

¹ Software Engineering Core (A minimum GPA of 2.00 is required for this set of courses, including any transfer courses but transfer course grades will not be calculated into the Software Engineering Core GPA)

² Students who take the 4-credit lab courses CPRE 2880, CPRE 3080, and CPRE 3810 instead of the corresponding 3-credit alternatives can apply the additional credits toward Supplemental Electives. The total number

of credits required in the Software Engineering Program remains the same for all students.

The Software Engineering Program has established concurrent undergraduate and graduate programs with the Department of Computer Science, the Department of Electrical and Computer Engineering, and the Ivy College of Business. Please visit <https://se.iastate.edu/academics/> for details.

Systems Engineering

Systems Engineering Master's Degree

Administered by the Department of Industrial and Manufacturing Systems Engineering

The Systems Engineering Program focuses on developing an individual's analytical skills to design, evaluate, and build modern complex engineered systems. Engineers who can conceptualize, model, and integrate hardware, software, data, and humans are critical in technology driven multi-disciplinary design teams. The Iowa State University Master of Engineering in Systems Engineering program is designed to train engineers to excel in the technology driven design environment commonly found in developing modern complex engineered systems. The program can be completed online or in residence, part-time or full-time.

Admission Requirements

To be considered for admission, the applicant should have a bachelor's degree in engineering or related field from a college, university, or technical school of recognized standing. Non-engineering backgrounds will be considered on a case-by-case basis. High academic achievement or other persuasive evidence of professional accomplishments is expected for admission to the program. The GRE is not required.

Applicants for admission to this program apply through the ISU Graduate College. Each applicant must submit:

- Application and application fee
- Official academic transcripts
- Three letters of recommendation
- Resume

Applications should be submitted as early as possible before the beginning of the semester for which admission is sought. Individuals may also take up to nine credits at Iowa State as a non-degree seeking student and then transfer them to the program when they are admitted. (<https://iowastateonline.iastate.edu/apply-and-enroll/>).

Degree Requirements

(10 courses total = 30 credits)

Intro Core (required first year)

IE 5630	Engineering and Systems Management	3
IE 5650	Systems Engineering and Analysis	3

Core (required)

IE 5640	Decision Analysis	3
IE 5700	Systems Engineering and Project Management	3
IE 5850	Requirements and Architecture Engineering	3

Electives

IE 4480	Manufacturing Systems Engineering	3
IE 4520	Introduction To Systems Engineering And Analysis	3
IE 5030	Introduction to Sustainable Production Systems	3
IE 5200	Engineering Problem Solving with R	3
IE 5600	Engineering Risk Analysis	3
IE 5610	Total Quality Management	3
IE 5720	Design and Evaluation of Human-Computer Interaction	3
IE 5770	Human Factors	3
IE 5810	e-Commerce Systems Engineering	3
IE 5820	Enterprise Modeling and Integration	3
ME 5250	Optimization Methods for Complex Designs	3
AERE 5630	Introduction to Multidisciplinary Design Optimization	3
One course from any graduate program		3

Students working in research and development who are interested in furthering their research skills may select a creative component option as part of their supporting courses.

Systems Engineering Certificate

(4 courses total = 12 credits)

Intro Core (required first year)

IE 5630	Engineering and Systems Management	3
IE 5650	Systems Engineering and Analysis	3

Core (required to pick 2)

IE 5600	Engineering Risk Analysis	3
IE 5640	Decision Analysis	3
IE 5700	Systems Engineering and Project Management	3
IE 5850	Requirements and Architecture Engineering	3

Other focus areas in related disciplines, such as systems engineering, human factors, supply chain management, or manufacturing, may - with the pre-approval of the major professor - be substituted for supporting courses. A program of study is developed by the student and academic advisor to fit individual needs.

Students working in research and development who are interested in furthering their research skills may select a creative component option as part of their supporting courses.

COLLEGE OF HEALTH AND HUMAN SCIENCES

Laura Jolly, Dean, Dean's Chair

Jennifer Margrett, Associate Dean Research and Graduate Education

Robert D. Reason, Associate Dean Undergraduate Academic Affairs

Debra Sellers, Associate Dean and Director of Human Sciences Extension and Outreach

www.hs.iastate.edu/ (<http://www.hs.iastate.edu/>)

The College of Health and Human Sciences provides an integrative approach to improving the quality of life for individuals, families, schools and communities by linking discovery, science, creativity, and practice; applying the knowledge of learning in all endeavors; and developing leaders for roles in research, education, business and industry, and health and human services.

The College of Health and Human Sciences, founded in 2005, fosters innovative synergies in teaching and learning in addition to the discovery of new knowledge. Members of the college work to enhance human potential in many ways and strive to improve the quality of people's lives - helping them learn better, live longer, and lead lives that are more productive and fulfilling.

Departments/School

- Apparel, Events, and Hospitality Management (<http://www.aeshm.hs.iastate.edu/>)
- Food Science and Human Nutrition (<http://www.fshn.hs.iastate.edu/>)
- Human Development and Family Studies (<http://www.hdfs.hs.iastate.edu/>)
- Kinesiology (<http://www.kin.hs.iastate.edu/>)
- School of Education (<http://www.education.iastate.edu/>)

Recommended High School Preparation

Recommended preparation for students entering most departments in the College of Health and Human Sciences should include 4 years of English (including speech) with emphasis in composition and communication skills; 3 years each of mathematics and natural sciences, and at least 2 years of social sciences and/or humanities. In addition, students interested in Elementary Education are advised to complete two or more years of high school study in one foreign language.

Information for Prospective Students

Each student in the College of Health and Human Sciences works closely with an academic advisor who is associated with the program in which the student is majoring. Advisors assist students in developing academic programs and in adjusting to university life. They also provide information and guidance about career choices. Advisors attempt to assist students

as they develop their schedule of classes to meet their goals, interests, and capabilities.

The college offers a number of orientation sessions during the summer for students planning to enter in the fall. Students who enter in spring or summer terms are also offered orientation sessions which are held prior to the beginning of the student's first term. Incoming students are encouraged to attend an orientation session so that academic assessments can be made, and appropriate classes may be scheduled for the following term.

Undecided Students

The College of Health and Human Sciences offers an academic support program for students who are considering several majors in CHS. This program is administered to undecided Health and Human Sciences students through the MINDS Learning Community. Students in the MINDS Learning Community take coursework together, including an orientation and career exploration course which is taught by college advisors. This course provides opportunities for students to evaluate their interests, skills, and strengths while also receiving additional support through a peer mentor program. All undecided majors in the College of Health and Human Sciences are required to participate in MINDS Learning Community and will sign up for the program during orientation. For more information, visit the MINDS webpage: <https://hs.iastate.edu/learning-community/minds/>. (<https://hs.iastate.edu/learning-community/minds/>)

Planned Transfer Programs

By planning carefully, students may begin their education at another college and then transfer their courses to a curriculum within the College of Health and Human Sciences with maximum efficiency in meeting the degree requirements. The college works closely with community colleges in Iowa and surrounding states to facilitate a transfer to Iowa State University. For more information, email hs@iastate.edu or visit the College of Health and Human Sciences Recruitment Office.

Accreditation and Licensure

The following program-specific accreditation/ licensure/registrations have been attained by departments or School of Education within the college:

Department of Apparel, Events, and Hospitality Management:

Apparel, Merchandising, and Design major is endorsed by the American Apparel and Footwear Association's Education Foundation. The Design primary option is accredited by the National Association of Schools in Art and Design.

Hospitality Management is accredited by the Accreditation Commission for Programs in Hospitality Administration.

Department of Food Science and Human Nutrition:

The Food Science degree, including Industry and Technology options are approved by the Institute of Food Technologists.

The Didactic Program in Dietetics and Dietetics Internship are accredited by the Accreditation Council for Education in Nutrition and Dietetics, the accrediting agency of the Academy of Nutrition and Dietetics.

The Baccalaureate Degree in Nursing at Iowa State University is pursuing initial accreditation by the Commission on Collegiate Nursing Education (CCNE), One Dupont Circle, NW, Suite 530, Washington, DC 20036, (202) 887-6791. Applying for accreditation does not guarantee that accreditation will be granted. The program has interim approval from the Iowa Board of Nursing.

Department of Human Development and Family Studies:

The Child Development Laboratory School is accredited by the National Association for the Education of Young Children (NAEYC), Academy for Early Childhood Programs, is licensed by the Iowa Department of Human Services, and maintains a 5 Star Rating from the Iowa Quality Rating System.

The Early Childhood Education Program (administered in collaboration with the School of Education) and the Family and Consumer Sciences Education Teacher Licensure Program are accredited by the Iowa Department of Education and students may be recommended for licensure to the Iowa Board of Educational Examiners.

Financial Counseling and Planning (FCP) is a registered education program with the Certified Financial Planner Board of Standards and the Association for Financial Counseling and Planning Education. With these registrations FCP students are eligible to sit for the Certified Financial Planner™ and Accredited Financial Counselor® examinations.

Department of Kinesiology:

The Athletic Training program is accredited by the Commission on Accreditation of Athletic Training Education.

The Physical Education Educator Preparation Program is recommended for approval by the Iowa Department of Education and approved by the State of Iowa Board of Education.

School of Education - Educator Preparation

All Iowa State University Educator Preparation Programs are recommended for approval by the Iowa Department of Education and approved by the State of Iowa Board of Education.

Each student will be enrolled in the School or Department in which he or she plans to major and must meet the graduation

requirements of that department and the college in which it is located.

All candidates must meet the program completion requirements of the Iowa State University Educator Preparation Program in order to be recommended for teacher or educational leadership licensure by Iowa State University.

For details about Teacher Education programs, requirements, and endorsement areas, see Teacher Education. (<https://education.iastate.edu/current-students/educator-preparation-program/>)

For details about Educational Leadership programs and requirements, see Educational Leadership (<https://education.iastate.edu/graduate-students/graduate-programs/division-of-teaching-learning-leadership-and-policy/>)

Undergraduate Core Curriculum Purpose

The College of Health and Human Sciences has established core learning outcomes to provide the unifying foundation critical to personal and professional success for all College of Health and Human Sciences undergraduate students. Assessment of College of Health and Human Sciences' core learning outcomes will measure student competence in four (4) areas. Assessment results will be used by CHHS faculty and staff to enhance student learning experiences.

Four components

The core identifies the expected minimum outcomes that each undergraduate in the college must meet:

Communication - Communicate with clear purpose, workable organization and effective style in written, oral, visual and electronic (WOVE) formats without distracting errors in usage or convention.

Self-Assessment/Self Reflection - Consistently and realistically analyze and evaluate one's own knowledge, abilities and actions in comparison to professional standards and create action plans to enhance personal and professional efficacy.

Critical Thinking - Generate, acquire and evaluate information based on scientific evidence, creative processes, and logical and ethical reasoning to make decisions and solve problems in one's personal, professional and community endeavors.

Social Justice - Articulate and demonstrate a clear concept of a just society in which individuals and groups equitably share in societal benefits within a global community.

Expectations for Departments/School of Education/Programs

Departments/schools/programs formally participate in outcomes assessment. Programs identify courses at three levels (introductory, intermediate, and advanced) where at least one significant educational activity is identified and assessed. Increased achievement and level of mastery at advanced levels is discussed and incorporated through continuous improvement efforts.

General Education

Students in the College of Human Sciences are required to complete a program in general education which is integrated in their professional training and extends through the undergraduate curriculum.

The general education program emphasizes intellectual growth and personal development as contrasted with specific career preparation.

The program aims to stimulate a desire for learning and intellectual endeavor, develop understanding and appreciation for the physical and cultural world, encourage independent thinking and analysis, increase competence in all aspects of communication, and create an understanding of individuals as social, psychological, and physical beings.

The student is expected to complete studies in three groups in general education. Areas represented below are not departmental titles. In some cases, courses relating to a given area may be found in several different departments. Credits listed are minimum requirements.

Minimum Group Requirements in the College of Health and Human Sciences

I. Communication Skills (10 cr.): ENGL 1500, ENGL 2500; LIB 1600; and 3 credits in oral communication

II. Biological and physical sciences and mathematical disciplines (9 cr.): at least 3 credits in mathematical disciplines

III. Social sciences and humanities (15 cr.): at least 6 credits in social sciences and at least 6 credits in humanities

Double Majors

Undergraduate students may elect a second major from the departments or school and program areas listed above, or from a major field offered for the bachelor's degree in another college of the university. Double majors may be prohibited between majors as determined by the appropriate curriculum committees.

The major departments must approve the degree program, and if those majors involve two colleges, both deans must approve. Such programs must fulfill the general education requirements of the college of the primary major. If one major leads to the B.A. degree and the other to the

B.S. degree, the degree awarded will be the one offered by the department of the primary major. If the primary major may lead to either a B.A. or a B.S., a student may choose to receive either degree. In this case, the student must satisfy the requirements of each major and of the degree that is chosen for the primary major.

Students with a primary major in another college who wish to take a second major in the College of Health and Human Sciences are required to meet all requirements for the major, prerequisites and supporting courses.

Two Bachelor's Degrees

Any degree offered by the College of Health and Human Sciences may be earned together with a degree in this or any other college of the university. For the requirements for two degrees, see Index (<http://catalog.iastate.edu/azindex/>), bachelor's degree, Two.

International Programs

The College of Health and Human Sciences encourages students to participate in international programs that will help them to become life-long learners of other cultures and perspectives, to enhance their global citizenship, and to expand their opportunities for employment after graduation. The College offers short-term faculty-led study abroad programs, semester-long programs, international student teaching placements, and dietetic internship rotations.

International opportunities change each year, and students should visit <http://intl.hs.iastate.edu> to review the list of available programs and to explore which offerings are designed for specific majors. The College offers several study abroad scholarships and last year over \$73,000 was awarded to support student participation in our international programs.

Faculty members also bring diversity and global perspectives to instruction through research and collaborations with scholars and institutions abroad, and the College employs faculty members from many different countries.

Honors Program

High achieving students, with a grade point average of above 3.50, are invited to apply to the Honors Program. Honors students are encouraged to develop a creative program of study expanding their interests while meeting individual educational objectives. Students in the Honors Program also participate in University Honors Seminars, Honors Courses and collaborate with a faculty member to complete an honors project. For further information, contact the College Honors Committee or academic advisor. See <https://hs.iastate.edu/current-students/academics/honors-program/> or look in the Index (<http://catalog.iastate.edu/azindex/>), under Honors Program.

Human Sciences Extension and Outreach

Students may prepare for a career in the Cooperative Extension System by enrolling in a curriculum in the College of Health and Human Sciences that provides them with a subject matter base for conducting educational programs for families. Advice on choice of courses should be sought from the Family and Consumer Sciences Education and Studies program, the Associate Dean and Director of Iowa State University Human Sciences Extension and Outreach, and/or the Iowa State University Extension and Outreach 4-H Youth Development Program Leader.

Undergraduate Majors

For more information about a major, see:

1. The curriculum descriptions in this section of the catalog
2. The department catalog section under Courses and Programs
3. Department websites.

Apparel, Events, and Hospitality Management

Apparel, Merchandising, and Design

Options: Merchandising and Retail Analytics; Creative and Technical Design; Fashion Communication; and Product Development and Innovation See Curriculum in Apparel, Merchandising, and Design

Event Management

See Curriculum in Event Management

Hospitality Management

See Curriculum in Hospitality Management

Food Science and Human Nutrition

Culinary Food Science

See Curriculum in Culinary Food Science

Diet and Exercise B.S./M.S.

Jointly administered with the Department of Kinesiology. See Curriculum in Diet and Exercise

Dietetics

See Curriculum in Dietetics

Food Science

Options: Food Science and Industry; Food Science and Technology. See Curriculum in Food Science

Nursing: See Curriculum in Nursing

Nutritional Science

Options: Pre-Health Professional and Research; Family Health; Food Service; Global Health and Policy; Health Coach; and Nutrition and Wellness. See Curriculum in Nutritional Science

Human Development and Family Studies

Human Development and Family Studies

See Human Development and Family Studies

Early Childhood Education - Unified

See Curriculum in Early Childhood Education - Unified

Family and Consumer Sciences Education and Studies

Options: Communications; Professional Studies; Teacher Licensure. See Curriculum in Family and Consumer Sciences Education and Studies

Financial Counseling and Planning

See Curriculum in Financial Counseling and Planning

Affiliated Program: Early Childcare Education and Programming.

Offered by the Great Plains Interactive Distance Education Alliance (GPIDEA). See Curriculum in Early Childcare Education and Programming

Kinesiology

Athletic Training

See Curriculum in Athletic Training

Diet and Exercise B.S./M.S.

Jointly administered with the Department of Food Science and Human Nutrition. See Curriculum in Diet and Exercise

Kinesiology & Health

Options: Community and Public Health; Exercise Science; Physical Activity and Health Promotion; Physical Education Teacher Education; and Pre-Health Professions. See Curriculum in Kinesiology & Health

School of Education

Early Childhood Education - Unified

Administered jointly by the School of Education and the Department of Human Development and Family Studies. See Curriculum in Early Childhood Education - Unified

Elementary Education

Administered by the School of Education. See Curriculum in Elementary Education

K-12/Secondary Education

The Secondary Education program has three routes, an undergraduate route, a post bachelor route, and a graduate route.

- Undergraduate Secondary Education

Offered in conjunction with subject matter areas, or majors, offered by various departments across the university campus. These subject matter areas include agriculture, biology, chemistry, earth sciences, English, family and consumer sciences, health, history-social sciences, mathematics, music, physics, physical education, and world languages. See Teacher Education

- Post-Bachelor Secondary Education

Coordinated by departments/programs across the university campus. These subject matter areas include agriculture, biology, chemistry, earth sciences, English, family and consumer sciences, health, history-social sciences, mathematics, music, physics, physical education, and world languages. See Teacher Education

- Graduate Secondary Education in the School of Education

Masters of Arts in Teaching in Science Education and Masters of Education in Mathematics Education are coordinated by the School of Education. Other education programs, such as agriculture education, family consumer sciences education, and physical education teacher education, offer masters programs to pursue program completion through their own departments.

International Studies (secondary major only)

The International Studies Program is an interdisciplinary program which may be taken only as a second major. Students pursuing a second major in international studies must complete the International Studies Program as described in this catalog (see International Studies).

Undergraduate Minors

Minors are available to all Iowa State students. Minors consist of at least 15 credits including 6 credits taken at Iowa State University in courses numbered 3000 or above. A student may not apply the same course to two different minors. The minor must include 9 credits that are not used to meet any other department, college or university requirement. Minors are available in the following areas:

Apparel, Merchandising, and Design

Culinary Food Science

Dance

Educational Services in Family and Consumer Sciences

Event Management

Exercise Science

Financial Counseling and Planning

Food and Society

Food Safety (interdepartmental minor)

Food Science

Gerontology (interdisciplinary minor)

Global Human Sciences

Health Promotion

Hospitality Management

Human Development and Family Studies

Learning and Leadership Sciences

Learning Technologies

Kinesiology

Nutrition

Graduate Programs

The College of Health and Human Sciences offers a variety of programs leading to a Master's degree, a Ph.D., or a graduate certificate. Each unit offers a variety of program options, as well as opportunities for interdisciplinary study in the areas of gerontology, toxicology, nutritional studies, and genetics. Multiple opportunities for on-campus and distance education programs are available.

Preparation for Graduate Study

Students considering graduate studies should gain background knowledge in basic subjects related to their area of interest.

Undergraduate mathematics, statistics, and research methods courses are useful as preparation for advanced study in graduate school. Upon completion of graduate programs, students are qualified for leadership positions in business; government agencies; and public and private agencies and institutions; as well as for teaching, research, and extension positions in colleges and universities.

Information for Prospective Students

Graduate study in the College of Health and Human Sciences is conducted through collaboration with the Graduate College, and application is completed through the Graduate College. Details regarding the application process and general information about graduate studies at ISU are found in the Graduate College section of this catalog, (<http://www.grad-college.iastate.edu/>). Details regarding the curricula and specific expectations for each program are found on department websites.

Each graduate student in the College of Health and Human Sciences works closely with an academic advisor and a Program of Study (POSC) committee. The POSC assists students in developing academic programs tailored to meet individual needs, guide research and/or internship activities, and provide information and guidance about career choices. Graduate assistantship support is available for many students and involves them in research, teaching, and administrative experiences. Incoming students are encouraged to work with departmental advisors to develop appropriate class and assistantship activities.

Graduate Curricula

Information about curricula and degree options for each College of Health and Human Sciences unit is available on the unit websites below.

•Apparel, Events, and Hospitality Management – <http://www.aeshm.hs.iastate.edu/graduate-programs/>

•Food Science & Human Nutrition – <http://www.fshn.hs.iastate.edu/graduate-program/>

•Human Development & Family Studies – <https://www.hdfs.hs.iastate.edu/graduate-programs/>

•Kinesiology – <https://www.kin.hs.iastate.edu/graduate-programs/kinesiology/>

•School of Education - <https://education.iastate.edu/graduate-students/graduate-programs/>

Distance Education Opportunities

The College of Health and Human Sciences offers several online courses and programs. Degrees include PhD, Master's, Undergraduate, and Certificates. Many courses incorporate a blended or hybrid approach, where online students interact with students on campus in real time using webinar services. Some degree programs are provided with a combination of online and condensed schedules that require limited time on campus. Details about these offerings are found on the website at <https://hs.iastate.edu/graduate-students/academics-graduate/online-programs-graduate/>.

Of these programs, six Certificates, one Undergraduate, and four Masters programs are offered through collaboration with the Great Plains Interactive Distance Education Alliance (GP-IDEA; <http://www.gpidea.org/>). These online programs allow students to earn a graduate degree from ISU while taking courses and interacting with students from a number of participating universities. The CHHS also offers a Masters of Family and Consumer Sciences-Comprehensive degree online where students have the flexibility to design a program of study the best meets their professional goals.

Undergraduate Certificates

An undergraduate certificate provides a way to give formal recognition of focused study in a specialized area that is less comprehensive than required for an undergraduate major. At Iowa State University, an undergraduate certificate is awarded concurrently or after baccalaureate requirements are finished. The following undergraduate certificate is available in the College of Health and Human Sciences:

Health Coach Certificate

Graduate Certificates

Graduate certificates provide formal recognition of focused graduate study in an area of specialization that is less comprehensive than required for a master's degree. At Iowa State University, a graduate certificate may be earned either before, after, or concurrently with the master's or doctoral degree. The following graduate certificates are available in the College of Health and Human Sciences:

Applied Research Methods in Human Sciences Certificate - see <https://www.education.iastate.edu/graduate-programs/applied-research/>

Community College Teaching Certificate - see <https://education.iastate.edu/graduate-students/graduate-programs/division-of-higher-education/ed-d-in-education/>

Development and Family Sciences Advanced Research Design and Methods - see <https://hdfs.hs.iastate.edu/graduate-students/graduate-programs/graduate-certificates/>

* Dietetics Internship Certificate - see www.dietetics.iastate.edu/ (<http://www.dietetics.iastate.edu/>)

Education for Social Justice Certificate - see <https://education.iastate.edu/graduate-students/graduate-programs/school-of-education-certification-programs/education-for-social-justice-graduate-certificate/>

* Family Financial Planning Certificate - see www.online.hs.iastate.edu/graduate-programs/masters/mfcs-ffp/ (<http://www.online.hs.iastate.edu/graduate-programs/masters/mfcs-ffp/>)

* Financial and Housing Counseling Certificate - see www.online.hs.iastate.edu/graduate-programs/masters/mfcs-ffp/ (<http://www.online.hs.iastate.edu/graduate-programs/masters/mfcs-ffp/>)

* Gerontology Certificate - see www.hdfs.hs.iastate.edu/graduate-curriculum/ms-fcs/ (<http://www.online.hs.iastate.edu/graduate-programs/masters/mfcs-gerontology/>)

* Instructional Design Certificate - see <https://education.iastate.edu/graduate-students/graduate-programs/division-of-teaching-learning->

leadership-and-policy/graduate-certificates/instructional-design-certificate/

* Literacy Coaching Certificate - see <https://education.iastate.edu/graduate-students/graduate-programs/division-of-teaching-learning-leadership-and-policy/graduate-certificates/literacy-coaching-certificate/>

Principal Endorsement (Pre-LEAD) - see <https://education.iastate.edu/graduate-students/graduate-programs/division-of-teaching-learning-leadership-and-policy/educator-prep-programs-for-licensure-recommendation/transformative-school-leadership-program-licensure-recommendation-m-ed/>

Special Education Certificate - see <https://education.iastate.edu/graduate-students/graduate-programs/division-of-teaching-learning-leadership-and-policy/graduate-certificates/special-education-instructional-strategist-certificate/>

Superintendent Licensure - see <https://education.iastate.edu/graduate-students/graduate-programs/division-of-teaching-learning-leadership-and-policy/ed-d-in-education/>

* Youth Development Specialist - see <http://www.online.hs.iastate.edu/graduate-programs/masters/mfcs-youth-development/>

* Youth Program Management & Evaluation - see <http://www.online.hs.iastate.edu/graduate-programs/masters/mfcs-youth-development/>

* Online certificate

Apparel, Events, and Hospitality Management Department

The Apparel, Events, and Hospitality Management department offers courses that provide opportunities for students to learn about interdisciplinary areas including aesthetics, leadership, entrepreneurship, and multi-channel retailing at both undergraduate and graduate levels. AESHM courses serve to complement the student's major area of study whether it be Apparel, Merchandising, and Design; Event Management; Hospitality Management; agriculture, business, design education, engineering, liberal arts and sciences or minor areas of study including entrepreneurial studies, design studies, or international studies.

Apparel, Events, and Hospitality Management, otherwise known as AESHM, is composed of three majors:

- Apparel, Merchandising, and Design
- Event Management
- Hospitality Management

Through each of these three programs, students gain skills and knowledge to help them succeed in the real world. In addition to

coursework, they complete an internship that closely relates to their career aspirations.

Graduates of these programs are the managers of your favorite resorts, the designers of your best jeans, and the coordinators of lavish events.

From fine dining to fine apparel, our students, alumni, faculty, and staff have an eye for the original and a taste for quality.

Courses primarily for undergraduates:

AESHM 1110: Professional Development for AESHM

Credits: 1. Contact Hours: Lecture 1.

Introduction to professional experiences within AESHM and CHS Career Services including CyHire. Coursework includes resume development, daily habits for success including stress management, intrapersonal skills with a wellness focus, interpersonal skills and leadership, business etiquette, and professional ethics. (Typically Offered: Fall, Spring)

AESHM 1110L: AESHM Program Orientation and Learning Community

Credits: 1. Contact Hours: Laboratory 2.

Orientation to policies and procedures of department and program. Overview of major and minor options, including entrepreneurship. Exploration of undergraduate research, independent studies, study abroad, and field studies. Coverage of goal setting, curriculum planning, degree audits, and registration. Peer mentor interaction in academic, extracurricular, and service learning arranged component. (Typically Offered: Fall, Spring)

AESHM 1700D: Supervised Work Experience I: Hospitality

Credits: 1. Repeatable, maximum of 2 times.

Supervised work experience with a cooperating firm or organization. Employer/experience for AESHM 4700 or HSPM 4700 should be different from employer/experience used for AESHM 1700 and AESHM 2700. Graduation Restriction: No more than 12 credits total from AESHM 1700, 2700, and 4700 may be applied toward graduation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

AESHM 1700F: Supervised Work Experience I: Event Management

Credits: 1. Repeatable, maximum of 2 times.

Supervised work experience with a cooperating firm or organization. Employer/experience for AESHM 4700 or HSPM 4700 should be different from employer/experience used for AESHM 1700 and AESHM 2700. Graduation Restriction: No more than 12 credits total from AESHM 1700, 2700, and 4700 may be applied toward graduation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

AESHM 1700N: Supervised Work Experience I: Apparel

Credits: 1. Repeatable, maximum of 2 times.

Supervised work experience with a cooperating firm or organization. Employer/experience for AESHM 4700 or HSPM 4700 should be different from employer/experience used for AESHM 1700 and AESHM 2700. Graduation Restriction: No more than 12 credits total from AESHM 1700, 2700, and 4700 may be applied toward graduation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

AESHM 1750D: Financial Applications for Retail and Hospitality Industries: Hospitality Management

Credits: 2. Contact Hours: Lecture 2.

Using an online delivery method, students will learn basic mathematical concepts, calculations and formulas commonly used in the apparel and hospitality industries. Emphasis on problem solving, critical/creative thinking, and mathematical interpretation of calculations and formulas used within the hospitality industries. (Typically Offered: Spring)

AESHM 1750N: Financial Applications for Retail and Hospitality Industries: Retail Merchandising

Credits: 2. Repeatable.

Using an online delivery method, students will learn basic mathematical concepts, calculations and formulas commonly used in the apparel and hospitality industries. Emphasis on problem solving, critical/creative thinking, and mathematical interpretation of calculations and formulas used within the apparel industries. (Typically Offered: Fall, Spring, Summer)

AESHM 1800E: First Year Student Field Study: Hospitality and Event Management

Credits: 1-2. Contact Hours: Lecture 2.5, Laboratory 0.

Repeatable, maximum of 2 times.

Prereq: Instructor Permission for Course

Study of and tours of regional areas of interest to majors in the HSPM and EVENT majors. Trip to regional location under supervision of faculty member. Locations vary. Journal entries and final report/analysis are required. Cost associated with trip. (Typically Offered: Fall, Spring)

AESHM 1800N: First Year Student Field Study: Apparel, Merchandising, and Design

Credits: 1-2. Contact Hours: Lecture 2.

Repeatable, maximum of 2 times.

Prereq: Instructor Permission for Course

Study of and tours of regional areas of interest to AMD majors. Trip to regional location under supervision of faculty member. Locations vary. Journal entries and final report/analysis are required. Cost associated with trip. (Typically Offered: Fall, Spring)

AESHM 2110: Leadership Experiences and Development (LEAD)

Credits: 3. Contact Hours: Lecture 3.

Introduction to leadership behaviors. Development and utilization of leadership behaviors to positively impact school life, community life, and work life. (Typically Offered: Fall, Spring)

AESHM 2220: Creativity on Demand

Credits: 3. Contact Hours: Lecture 3.

Learn to use creativity strategies to solve everyday problems related to personal and professional lives. Application of creative thinking techniques to view things from different perspectives; identify unique opportunities; and generate and evaluate original ideas. Offered even-numbered years. (Typically Offered: Spring)

AESHM 2380: Human Resource Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Principles and practices of human resource management relevant to human science-related organizations. Emphasis on the entry-level manager's role. (Typically Offered: Fall, Spring)

AESHM 2700D: Supervised Work Experience II: Hospitality

Credits: 1-2. Repeatable, maximum of 2 times.

Supervised work experience with a cooperating firm or organization. Employer/experience for AESHM 4700 or HSPM 4700 should be different from employer/experience used for AESHM 1700 and AESHM 2700. Graduation Restriction: No more than 12 credits total from AESHM 1700, 2700, and 4700 may be applied toward graduation. (Typically Offered: Fall, Spring, Summer)

AESHM 2700F: Supervised Work Experience II: Event Management

Credits: 1-2. Repeatable, maximum of 2 times.

Supervised work experience with a cooperating firm or organization. Employer/experience for AESHM 4700 or HSPM 4700 should be different from employer/experience used for AESHM 1700 and AESHM 2700. Graduation Restriction: No more than 12 credits total from AESHM 1700, 2700, and 4700 may be applied toward graduation. (Typically Offered: Fall, Spring, Summer)

AESHM 2700N: Supervised Work Experience II: Apparel

Credits: 1-2. Repeatable, maximum of 2 times.

Supervised work experience with a cooperating firm or organization. Employer/experience for AESHM 4700 or HSPM 4700 should be different from employer/experience used for AESHM 1700 and AESHM 2700. Graduation Restriction: No more than 12 credits total from AESHM 1700, 2700, and 4700 may be applied toward graduation. (Typically Offered: Fall, Spring, Summer)

AESHM 2720: Fashion Show Production and Promotion

Credits: 2-3. Contact Hours: Lecture 3, Laboratory 2.

Prereq: Instructor Permission for Course

Planning and production of fashion show including developing budgets, public relations, advertising, fund-raising, choreography, staging, lighting, and food. Promotion of fashion show and similar events. Permission by application. Graduation Restriction: Maximum of 5 credits can be applied to graduation. (Typically Offered: Fall, Spring)

AESHM 2800: Orientation to U.S. Field Study

Credits: Required. Contact Hours: Lecture 1.

Repeatable, maximum of 2 times.

Orientation to the field study location during the semester preceding the trip. (Typically Offered: Fall, Spring)

AESHM 2810: Orientation to International Field Study

Credits: 1. Contact Hours: Lecture 1.

Repeatable, maximum of 2 times.

Orientation to the field study location during the semester preceding the trip. (Typically Offered: Fall, Spring, Summer)

AESHM 2870: Principles of Management in Human Sciences

Credits: 3. Contact Hours: Lecture 3.

Introduction to management concepts and principles with application to human sciences-related businesses and organizations. Includes service quality management, professionalism, and social responsibility. (Typically Offered: Fall, Spring)

AESHM 3110E: Seminar on Careers and Internships: Event Management and Hospitality Management

Credits: 1. Contact Hours: Lecture 1.

Prereq: AESHM 1110; Sophomore classification

Internship and career planning, professional expectations and responsibilities. Resume development, business letters/professional correspondence, interviewing techniques, and business etiquette. (Typically Offered: Fall, Spring)

AESHM 3110N: Seminar on Careers and Internships: Apparel, Merchandising, and Design

Credits: 1. Contact Hours: Lecture 1.

Prereq: AESHM 1110; Sophomore classification

Internship and career planning, professional expectations and responsibilities. Resume development, cover letters, interviewing techniques, and business etiquette. (Typically Offered: Fall, Spring)

AESHM 3400: Hospitality and Apparel Marketing Strategies

Credits: 3. Contact Hours: Lecture 3.

Application of marketing principles to the hospitality-, events-, and apparel-related industries. Emphasis on the role of marketing in an organization's overall strategic planning. Development and evaluation techniques available to hospitality, events, apparel, and related businesses, including advertising, sales promotion, packaging, and public relations. (Typically Offered: Fall, Spring)

AESHM 3420: Aesthetics of Consumer Experience

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Design principles, aesthetic concepts, and research applied to consumer experiences, with an emphasis on hospitality and retail environments and events. Influence of individual differences and cultural patterns on aesthetic preferences. (Typically Offered: Fall, Spring)

AESHM 3450X: Retail/Hospitality Experiences & Events

Credits: 1-3. Contact Hours: Lecture 3.

Survey course of retail and hospitality events. Production and execution of retail and hospitality events in the Student Innovation Center.

AESHM 3650: Event, Hospitality, and Retail Risk Management

Credits: 3. Contact Hours: Lecture 3.

Overview and management of hazards and risks in the planning, design, operation, and evaluation stages of events, hospitality organizations, and apparel/retail environments. (Typically Offered: Summer)

AESHM 3800D: U.S. Field Study: Hospitality Management

(Dual-listed with AESHM 5800D).

Credits: 1-3. Repeatable, maximum of 3 times.

Study and tours of areas of interest to majors in the Hospitality Management program. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 2800. Permission by application. (Typically Offered: Fall, Spring, Summer)

AESHM 3800F: U.S. Field Study: Event Management

(Dual-listed with AESHM 5800F).

Credits: 1-3. Repeatable, maximum of 3 times.

Study and tours of areas of interest to majors in the majors in the Event Management program. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 2800. Permission by application. (Typically Offered: Fall, Spring, Summer)

AESHM 3800N: U.S. Field Study: Apparel, Merchandising, and Design
(Dual-listed with AESHM 5800N).

Credits: 1-3. Repeatable, maximum of 3 times.

Prereq: AESHM 2800 or concurrent enrollment; permission of instructor

Study and tours of areas of interest to majors in the Apparel, Merchandising, and Design program. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 2800. Permission by application. (Typically Offered: Fall, Spring, Summer)

AESHM 3810D: International Field Study: Hospitality Management
(Dual-listed with AESHM 5810D).

Credits: 1-3. Repeatable.

Study and tours of areas of interest to majors in the Hospitality Management program. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 2810. Permission by application. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

AESHM 3810F: International Field Study: Event Management
(Dual-listed with AESHM 5810F).

Credits: 1-3. Repeatable.

Prereq: AESHM 2810 or concurrent enrollment; Instructor permission

Study and tours of areas of interest to majors in the Event Management major. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 2810. Permission by application. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

AESHM 3810N: International Field Study: Apparel, Merchandising, and Design

(Dual-listed with AESHM 5810N).

Credits: 1-3. Repeatable, maximum of 3 times.

Prereq: AESHM 2810 or concurrent enrollment; Instructor permission

Study and tours of areas of interest to majors in the Apparel, Merchandising, and Design major. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 2810. Permission by application. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

AESHM 3980: Cooperative Education

Credits: Required. Repeatable.

Prereq: Permission of Advisor; Junior classification

Required of all cooperative education students seeking full-time status. Students register for this course prior to commencing each work period. (Typically Offered: Fall, Spring, Summer)

AESHM 4210: Developing Global Leadership: Maximizing Human Potential

Credits: 3. Contact Hours: Lecture 3.

Development of leadership in a global environment. Focus on global concerns that impact on the well-being of individuals, families, and communities. Strategies for working with individuals, families and communities in other countries and cultures. Taking local action on global issues. Participation in a service activity. Meets International Perspectives Requirement. (Typically Offered: Spring)

AESHM 4620X: Black Lives Matter: Fashion, Politics, and Resistance Movements

Credits: 3. Contact Hours: Lecture 3.

Prereq: AMD 1650 or Permission of Instructor

Use historical and cultural methods to examine the history of the Black Lives Matter movement its relationship to past resistance/activist movements and fashion and appearance. Summarize and evaluate literature on Black activism and Black identity. Plan and develop a public exhibition and opening event. Offered even-numbered years. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Spring)

AESHM 4700F: Supervised Professional Internship: Event Management

Credits: 3-6. Repeatable.

Supervised and structured practical industry work experience with a cooperating firm or organization. Employer/experience for AESHM 4700 or HSPM 4700 should be different from employer/experience used for AESHM 1700 and AESHM 2700. This course if offered for a grade. Graduation Restriction: Maximum number of credits given in a semester is 6. No more than 12 credits from AESHM 1700, 2700, and 4700 may be applied toward graduation. (Typically Offered: Fall, Spring, Summer)

AESHM 4700MX: Supervised Professional Internship: Apparel (Out-of-state)

Credits: 3-6. Repeatable, maximum of 12 credits.

Prereq: Department Permission for Course

Supervised work experience with a cooperating firm or organization. Graduation Restrictions: No more than 12 credits from AESHM 1700, 2700, and 4700 may be applied toward graduation. (Typically Offered: Fall, Spring, Summer)

AESHM 4700N: Supervised Professional Internship: Apparel

Credits: 3-6. Repeatable.

Supervised work experience with a cooperating firm or organization. Employer/experience for AESHM 4700 or HSPM 4700 should be different from employer/experience used for AESHM 1700 and AESHM 2700. Graduation Restriction: No more than 12 credits total from AESHM 1700, 2700, and 4700 may be applied toward graduation. (Typically Offered: Fall, Spring, Summer)

AESHM 4720: Fashion Show Management

Credits: 2-3.

Prereq: Instructor Permission for Course

Provide leadership and communicate direction for planning and production of fashion show, including developing budgets, publicity, advertising, fundraising, choreography, staging, lighting, and food.

Graduation Restriction: Maximum of 5 credits can be applied to graduation. (Typically Offered: Fall, Spring)

AESHM 4740: Entrepreneurship in Human Sciences

Credits: 3. Contact Hours: Lecture 3.

Prereq: AMD 2750 or AESHM 2870 or ACCT 2840 or 3 cr in MKT or permission of instructor

Comprehensive approach to entrepreneurship including concepts of innovation, creativity, opportunity assessment, and business planning. Focus on human sciences-related businesses: retail, service, hospitality, event, food-related, family-owned, rural, and community businesses. Interaction with entrepreneurs, market research, feasibility analysis, business proposals, and business/community outreach and consulting. (Typically Offered: Fall, Spring)

AESHM 4790: Data Analytics for Apparel, Events, and Hospitality Management

Credits: 3. Contact Hours: Lecture 3.

Introduction to business analytics concepts and techniques in retail business including fashion, hospitality, and event. Offers opportunities to learn basic hands-on data analytics methods for data summarization, analysis, visualization, and interpretation. (Typically Offered: Fall)

AESHM 4900H: Independent Study: Honors

Credits: 2-4.

Prereq: Permission of Instructor; Membership in the University Honors Program

Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

AESHM 4970: Cooperative Education

Credits: Required. Contact Hours: Lecture 1.

Repeatable.

Prereq: Permission of advisor; Senior or Graduate classification

Required of cooperative education students. Students must register for this course prior to commencing each work period. (Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

AESHM 5010: Introduction to Scholarly Research for Graduate Students

Credits: 1.

Prereq: Graduate Standing or Permission of Instructor

Focus on the basics of developing scholarly research, including definition and purpose of research and the components of research reporting. Emphasis on standards for each section of research reports. Tips for research reporting and processes of research development. An introduction to ethical standards. Required of all new AESHM graduate students. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

AESHM 5020: Research Methods in Apparel, Events, and Hospitality

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate classification

Overview of research methods for qualitative, quantitative, and mixed methods. Topics include philosophical worldviews, the use of theory, and different research approach, design, methodologies, and procedures. (Typically Offered: Summer)

AESHM 5100: Quantitative Research Methods in Apparel, Events, and Hospitality

Credits: 3. Contact Hours: Lecture 3.

Prereq: STAT 5870 or equivalent; Graduate standing in the Department; Permission of Instructor

Overview of quantitative research methods in apparel and hospitality fields. Topics include types of quantitative research design, sampling design, measurement, validity issues, power and precision analysis, methods of data gathering and analysis techniques, and interpretation of statistical results. Use of statistical packages. Development of research plan. Offered odd-numbered years. (Typically Offered: Spring, Summer)

AESHM 5110: Seminar

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 times.

Prereq: 6 graduate credits in AMD, AESHM, or HSPM. Permission of Instructor

Discussion of scholarship and current issues. Topics vary.

AESHM 5120: Qualitative Research Methods in Apparel, Events, and Hospitality

Credits: 3. Contact Hours: Lecture 3.5.

Prereq: Graduate standing

Introduction to and hands-on experiences with a variety of qualitative research methods specific to apparel, events and hospitality research. Students will develop skills at research design, data, collection, analysis, and write-up for qualitative inquiry. Offered even-numbered years. (Typically Offered: Summer)

AESHM 5550: Strategic Management for Service Industries

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Strategic management process as a planning and decision-making framework: integration of human resources, operations, marketing, and financial management concepts. Emphasis on strategic management tools for researchers and partitioners. Offered even-numbered years. (Typically Offered: Spring)

AESHM 5700A: Apparel Merchandising and Design

Credits: 1-3. Repeatable, maximum of 2 times.

Prereq: 6 graduate credits in AMD, AESHM, or HSPM. Permission of Instructor

Supervised experience related to career objective. Proposal must be approved semester before placement. (Typically Offered: Fall, Spring, Summer)

AESHM 5700B: Hospitality Management

Credits: 1-3. Repeatable, maximum of 2 times.

Prereq: 6 graduate credits in AMD, AESHM, or HSPM. Permission of Instructor

Supervised experience related to career objective. Proposal must be approved semester before placement. (Typically Offered: Fall, Spring, Summer)

AESHM 5740: Entrepreneurship in Human Sciences

Credits: 3. Contact Hours: Lecture 3.

Prereq: AMD 2750 or AESHM 2870 or ACCT 2840 or 3 cr in MKT or permission of instructor

Comprehensive approach to entrepreneurship including concepts of innovation, creativity, opportunity assessment, and business planning. Focus on human sciences-related businesses: retail, service, hospitality, event, food-related, family-owned, rural, and community businesses. Interaction with entrepreneurs, market research, feasibility analysis, business proposals, and business/community outreach and consulting. (Typically Offered: Fall, Spring)

AESHM 5790: Data Analytics for Apparel, Event, and Hospitality Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: STAT 5870 or equivalent; (AESHM 5100 and HDFS 5030) or instructor permission

Business analytics is a process of transforming data into meaningful insights and actionable results in the context of decision making and problem solving. Review of the data-related challenges apparel, event, and hospitality organizations confront and the importance of data analytics in making critical management decisions. Basic analytic techniques including data management, analysis, interpretation, and visualization and analyze case studies that successfully deployed these techniques. Typically Offered: Fall (even-numbered years), Summer (odd-numbered years).

AESHM 5800D: U.S. Field Study: Hospitality Management

(Dual-listed with AESHM 3800D).

Credits: 1-3. Repeatable, maximum of 3 times.

Prereq: AESHM 2800 or concurrent enrollment; permission of instructor

Study and tours of areas of interest to majors in the Hospitality Management program. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 2800. Permission by application. (Typically Offered: Fall, Spring, Summer)

AESHM 5800F: U.S. Field Study: Event Management

(Dual-listed with AESHM 3800F).

Credits: 1-3. Repeatable, maximum of 3 times.

Prereq: AESHM 2800 or concurrent enrollment; permission of instructor

Study and tours of areas of interest to majors in the majors in the Event Management program. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 2800. Permission by application. (Typically Offered: Fall, Spring, Summer)

AESHM 5800N: U.S. Field Study: Apparel, Merchandising, and Design

(Dual-listed with AESHM 3800N).

Credits: 1-3. Repeatable, maximum of 3 times.

Prereq: AESHM 2800 or concurrent enrollment; permission of instructor

Study and tours of areas of interest to majors in the Apparel, Merchandising, and Design program. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 2800. Permission by application. (Typically Offered: Fall, Spring, Summer)

AESHM 5810D: International Field Study: Hospitality Management
(Dual-listed with AESHM 3810D).

Credits: 1-3. Repeatable.

Prereq: AESHM 2810 or concurrent enrollment; Instructor permission

Study and tours of areas of interest to majors in the Hospitality Management program. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 2810. Permission by application. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

AESHM 5810F: International Field Study: Event Management
(Dual-listed with AESHM 3810F).

Credits: 1-3. Repeatable.

Prereq: AESHM 2810 or concurrent enrollment; Instructor permission

Study and tours of areas of interest to majors in the Event Management major. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 2810. Permission by application. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

AESHM 5810N: International Field Study: Apparel, Merchandising, and Design

(Dual-listed with AESHM 3810N).

Credits: 1-3. Repeatable, maximum of 3 times.

Prereq: AESHM 2810 or concurrent enrollment; Instructor permission

Study and tours of areas of interest to majors in the Apparel, Merchandising, and Design major. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 2810. Permission by application. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

Courses for graduate students:

AESHM 6110: Seminar

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: 6 graduate credits in AMD, AESHM, or HSPM. Permission of Instructor

Scholarship and current issues. Topics vary.

AESHM 6700A: Teaching Practicum: Apparel Merchandising and Design

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Supervised experience in the university classroom. Proposal must be approved semester before placement. (Typically Offered: Fall, Spring, Summer)

AESHM 6700B: Teaching Practicum: Hospitality Management

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Supervised experience in the university classroom. Proposal must be approved semester before placement. (Typically Offered: Fall, Spring, Summer)

AESHM 6700C: Teaching Practicum: Event Management

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

This practicum is designed to provide event management graduate students (the graduate instructor) with experience in instructional planning, management, and systematic delivery of designed instruction for event undergraduate courses. Proposal must be approved semester before placement. (Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

AMD 5040: Innovative Textiles

(Dual-listed with AMD 4040).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Instructor Permission for Course

Theories and principles of textile science. Textile product serviceability. Effect of fiber structure on properties and performance. New developments in textiles. Previous coursework in textile science and chemistry recommended.

AMD 5050: Quality Assurance of Textiles and Apparel

(Dual-listed with AMD 3050).

Credits: 3.

Prereq: Instructor Permission for Course

Principles of product and materials evaluation and quality assurance. Developing specifications and using standard practices for evaluating materials, product characteristics, performance, and quality. Previous coursework in natural science and statistics recommended. (Typically Offered: Fall)

AMD 5100: Foundation of Scholarship in Apparel, Merchandising, and Design

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Overview of scholarship in apparel, merchandising, and design with emphasis on current and future directions. Fundamentals of writing literature reviews. Examination of ethical issues in scholarship and academic life. Introduction to creativity, sustainability, and entrepreneurship. (Typically Offered: Fall)

AMD 5210: Digital Technologies in Textile and Apparel

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Digital technologies in textile and apparel design. Theories and practices connected to technology in apparel fields. Technologies explored in this class may include digital textile design and printing, 3D body scanning, avatar development for digital fitting or other advanced technologies used in the textile and apparel industries. Previous coursework in research methods recommended. Offered odd-numbered years. (Typically Offered: Fall)

AMD 5250: Experimental Patternmaking

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or enrollment in AMD 5100

Research, analyze, and apply experimental patternmaking techniques to original garments suitable for entry into a juried competition/exhibitions. Compare, contrast, and organize a framework of research patternmaking principles through content analysis or other appropriate research techniques. Documentation of learning and design process. Previous coursework in apparel construction and patternmaking recommended. Offered odd-numbered years. (Typically Offered: Spring)

AMD 5390: Digital Textile Design and Theory

Credits: 3. Contact Hours: Studio 6.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Focus on artisanal textile, apparel, or surface and structural design techniques. Design processes for specialty fabrics and markets. Topics vary by term. Offered even-numbered years. (Typically Offered: Spring)

AMD 5450: Consumer Experience and Retail Branding

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Examination of hedonic nature of consumer experience and its application to experiential design and branding of retail/hospitality establishments. Emphasis on consumer behavior, environmental psychology, and marketing literature. Previous coursework in psychology, consumer behavior, or marketing recommended. Offered even-numbered years. (Typically Offered: Spring)

AMD 5540: Dress History Research Methods

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Using a variety of sources and methods of analysis, students will develop their ability to read and interpret primary and secondary sources and to understand the methodology underpinnings and process of constructing dress history. Anticipated Semesters Offered: Spring - Alternate offered odd-numbered years. (Typically Offered: Spring)

AMD 5580: Queer Fashions: History, Culture, and the Industry

(Dual-listed with AMD 4580/ WGS 4580). (Cross-listed with WGS 5580).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Focus on analyzing the dressed and undressed body of individuals in the queer and trans communities in various cultural contexts with a focus on material culture. Examine concepts related to gender and sexuality and the changing definitions and representations of individuals who identify in the queer and trans communities focusing on appearance, fashion, and the body. Historic and current representations of fashion, styles, and appearances will be analyzed and discussed. Attention to how sexuality and gender intersect with and shape other identities including race, ability, body size, and class. Examine the complex structures, systems, and ideologies that uphold discrimination and unequitable distribution of power and resources as related to the course material. Attention will mostly be given to North American perspectives. We will use material culture to explore how objects related to fashioning the body reveal lived experiences about the owners and consumers. Offered even-numbered years. (Typically Offered: Spring)

AMD 5620X: Fashion Studies, Culture, Industry, and Social Justice

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Analysis of fashion and cultural practices of historically marginalized communities with a focus on power, privilege, and social justice. Heightened attention towards the 20th and 21st centuries. Examination of the way the global fashion industry intersects with and is related to the communities and their dress practices under study. Emphasis on ethnographic research methods. Offered even-numbered years. (Typically Offered: Fall)

AMD 5650: Sustainability: Theory and Practical Application

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Overview of current sustainability theory, research, and methodology. Emphasis on the evaluation and discussion of current sustainability literature and sustainable practice of apparel, textiles, and related products and services through people, processes, and the environment. Development and presentation of original scholarly and creative design work under various sustainability frameworks. Previous knowledge in apparel industry and product development recommended. Offered even-numbered years. (Typically Offered: Fall)

AMD 5670: Consumer Behavior and Apparel

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Application of concepts and theories from the social sciences to the study of consumer behavior. Experience in conducting research; manuscript writing. Previous coursework in consumer behavior and statistics recommended. Offered odd-numbered years. (Typically Offered: Fall)

AMD 5720: Sourcing and Global Issues

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Evaluation of textile and apparel industries in global markets considering ethical, economic, political, social, and professional implications. Sourcing strategies in a global environment. Corporate and consumer social responsibility and sustainability. Experience in conducting research using secondary data. Previous coursework in merchandising, marketing, or economics recommended. Offered odd-numbered years. Meets International Perspectives Requirement. (Typically Offered: Spring)

AMD 5760: Industry Applications in Merchandising and Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: Instructor Permission for Course

Using the case study method, students apply merchandising theory, principles, and practices to industry scenarios. Emphasis on problem solving, creative thinking, data analysis, and data interpretation involved in business operations. Focus on the development of leadership skills while functioning in small and large groups. (Typically Offered: Spring)

AMD 5770: E-Commerce for Apparel and Hospitality Companies

Credits: 3. Contact Hours: Lecture 3.

Prereq: Instructor Permission for Course

Analysis of technology and consumer trends, industry practices, and marketing strategies for e-commerce including big data, data mining, and social media. Evaluation and development of apparel or hospitality company websites. Theory application to the development of multi-channel business strategies. Previous coursework in marketing recommended. Offered even-numbered years. (Typically Offered: Fall)

AMD 5780: Social Network Analysis

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to social network related theories, practices and analyses. Visualize and analyze social structures, formed from social relationships, interactions, communications, and social media activities. Explore methods for social network data collection and data management, including application on big data. Practical guidelines on conducting S research in social science contexts, including applying S with big data. Previous coursework in statistics recommended. Offered odd-numbered years. (Typically Offered: Spring)

AMD 5900A: Special Topics: Textile Science

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Individually designed AMD-related projects that reflect the special interests of the student.

AMD 5900B: Special Topics: Historical, Cultural, and Museum Studies of Dress and Textiles

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Individually designed AMD-related projects that reflect the special interests of the student.

AMD 5900C: Special Topics: Textile and Apparel Design

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Individually designed AMD-related projects that reflect the special interests of the student.

AMD 5900E: Special Topics: Merchandising, Aesthetics, and Entrepreneurship

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Individually designed AMD-related projects that reflect the special interests of the student.

AMD 5900F: Special Topics: Sociological, Psychological, and Consumer Behavioral Aspects of Dress

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Individually designed AMD-related projects that reflect the special interests of the student.

AMD 5900J: Special Topics: Product Development, Innovation, and Sourcing

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Individually designed AMD-related projects that reflect the special interests of the student. (Typically Offered: Fall, Spring, Summer)

AMD 5900S: Special Topics: Production and Quality Assurance

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Individually designed AMD-related projects that reflect the special interests of the student. (Typically Offered: Fall, Spring, Summer)

AMD 5900W: Special Topics: Fashion Show, Fashion Public Relations and Marketing

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Individually designed AMD-related projects that reflect the special interests of the student. (Typically Offered: Fall, Spring, Summer)

AMD 5950: Senior Design Studio

(Dual-listed with AMD 4950).

Credits: 3. Contact Hours: Studio 6.

Prereq: Graduate Standing or Permission of Instructor

Creation of an apparel line from target market research to prototypes through the use of manual techniques and CAD technologies. The line is to be included in a professional portfolio and pieces submitted to a juried exhibition. Previous coursework in apparel construction and design recommended. (Typically Offered: Fall)

AMD 5990: Creative Component

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Creative Component.

Courses for graduate students:

AMD 6110: Seminar

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Discussion of scholarship and current issues. Topics vary.

AMD 6250: Design Theory and Process

Credits: 4. Contact Hours: Lecture 2, Laboratory 4.

Analysis and application of design theory and creative processes, including strategies for solving aesthetic, functional, and/or technology-focused design problems. Creation and dissemination of design scholarship. Offered even-numbered years. (Typically Offered: Spring, Summer)

AMD 6650: Critical Social Science Theories in Fashion Studies

Credits: 3. Contact Hours: Lecture 3.

Analysis of cultural and social science theories, concepts, frameworks, and epistemologies applicable to how fashion products, management, and media are produced, distributed, consumed, regulated, and represented. Emphasis on qualitative research, theoretical interpretation, and theory development while centering justice and decolonizing theories. Example theories examined include Black feminist thought, critical race theory, feminist queer crip, tribalcrit, symbolic interaction, and semiotics. Collection, analysis, and interpretation of qualitative data. Offered odd-numbered years. (Typically Offered: Spring)

AMD 6760: Merchandising Theory and Research Applications

Credits: 3. Contact Hours: Lecture 3.

Prereq: Instructor Permission for Course

Review of current merchandising theory, research, and methodology. Emphasis on the evaluation and discussion of current and seminal merchandising literature, understanding research processes, interpretation of findings, assessing implications of research for future directions in merchandising, and the development and presentation of original scholarly work. Previous coursework in statistics recommended. Offered even-numbered years. (Typically Offered: Fall)

AMD 6900: Advanced Topics

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Advanced Topics.

AMD 6990: Research

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Courses primarily for undergraduates:

EVENT 1710: Introduction to Event Management

Credits: 3. Contact Hours: Lecture 3.

Overview of the event management industries. Techniques and procedures required for designing and implementing successful events. (Typically Offered: Fall, Spring, Summer)

EVENT 2030: Event Management Sophomore Mentorship

Credits: 2. Contact Hours: Lecture 1.

Prereq: Sophomore classification; AESHM 1110; EVENT 1710; by application only

Event Management sophomore students will be paired with a professional mentor in the event industry. Students will meet in the class and individually with their professional mentor throughout the spring semester. Students will be assessed on their experience through reflection, presentation, and mentor evaluation. (Typically Offered: Fall, Spring, Summer)

EVENT 2120: Digital Production in Event Management

Credits: 3.

Applications of skills in Adobe Suite and other software technologies. Introduction to design elements used within the event management industry with a focus on digital publishing of marketing and promotional materials, wayfinding, and other stationery items. Face-to-face lecture and laboratory work. (Typically Offered: Fall, Spring)

EVENT 2770: Digital Promotion in the Service Industry

Credits: 3. Contact Hours: Lecture 3.

Service industry management digital channels and platforms, including media planning, search advertising, social media, and mobile. Students will be introduced to the trending social media management platforms as well as digital marketing management topics of influencer marketing, digital media planning, and content marketing. (Typically Offered: Spring, Summer)

EVENT 2780: Sustainability Essentials for Service-Related Businesses

Credits: 3. Contact Hours: Lecture 3.

This course introduces with the knowledge and skills needed to navigate sustainability challenges in service business. Through engaging modules, students will explore global sustainability trends and effective business marketing strategies. By the end of the course, students will be empowered to identify and implement sustainable practices in a services business context. (Typically Offered: Spring, Spring)

EVENT 2900: Independent Study

Credits: 1-2. Repeatable, maximum of 4 credits.

Prereq: Freshman or Sophomore classification, permission of instructor

Independent study on topics of special interest to the student, facilitated by approved faculty member. Graduation Restriction: No more than 9 credits of EVENT 2900 and EVENT 4900 may be applied towards graduation requirements. (Typically Offered: Fall, Spring, Summer)

EVENT 3280: Incentive Meeting Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: EVENT 1710

Overview of the incentive meeting industry. Focus on incentive meeting planning, destination selection, program development, risk management, cultural aspects of destination, incentive meeting execution, and incentive meeting evaluation. (Typically Offered: Spring)

EVENT 3330: Entertainment Venue Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: EVENT 1710

Organization and management of various types of entertainment venues including clubs, theaters, auditoriums, and arenas. (Typically Offered: Fall)

EVENT 3430X: Virtual and Hybrid Events

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: EVENT 1710; Event Management major or minor

Application of event management leadership, communication, strategies, and production to analyze and execute virtual and hybrid events.

EVENT 3670: Event Sales

Credits: 3. Contact Hours: Lecture 3.

Prereq: EVENT 1710

This course provides an overview of sales marketing management in the event industry and highlights the role of the professional event sales manager in the marketing process. As an event professional, students will identify best sales practices to develop their personal selling style, to build on their strengths, and to create a referral business that delivers results. Principles covered include evaluation of characteristics and skills necessary for success in sales; strategic planning; sales leadership; analyzing customers and markets; designing and developing the sales force; recognize the importance of relationship building; process management; and measurement, analysis, and knowledge management. (Typically Offered: Fall, Spring)

EVENT 3710: Conference and Meeting Planning

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or concurrent enrollment in EVENT 1710; Sophomore classification

Application of event management principles to conference and meeting planning. Providing a comprehensive introduction to the key planning elements of the global conference, convention and meetings. (Typically Offered: Fall, Spring)

EVENT 3730: Wedding Planning and Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: EVENT 1710

Overview of wedding event industry. Focus on wedding planning processes and implementation, design, and business planning and development. (Typically Offered: Fall, Spring)

EVENT 3790: Nonprofit Fundraising Event Planning

Credits: 3. Contact Hours: Lecture 3.

Prereq: EVENT 1710

Provides a comprehensive understanding of the principles underlying event fundraising. Students will be provided with the necessary knowledge and skills to conceptualize and implement a fundraising plan, either for their own venture, or for a not-for-profit organization. Through practical exercise, students will have the opportunity to put their fundraising concepts and techniques into practice, gaining valuable insights into the challenges and opportunities of the funding process. (Typically Offered: Fall)

EVENT 3830: Sports Event Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: EVENT 1710

A comprehensive overview of sports and recreation competitions, events, and facilities. Best practices in sports event management, sports organizations, and franchises across the industry. In depth look at athlete and guest services, game day operations, marketing, sponsorship, and post-competition. (Typically Offered: Spring)

EVENT 3930: Event Management Workshop

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: EVENT Junior or Senior classification; Permission of Instructor

Topics vary each time offered. Graduation Restriction: Maximum of 6 EVENT 3930 credits can be applied to graduation. (Typically Offered: Fall, Spring, Summer)

EVENT 4230: International Sports and Entertainment Event Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: EVENT 1710

A comprehensive understanding of the strategies, procedures and nuances of planning and executing multinational and multicultural Sports and Entertainment Events that are held outside the U.S. or have large draw from an international audience. Meets International Perspectives Requirement. (Typically Offered: Spring)

EVENT 4710: Event Production

Credits: 1-3. Contact Hours: Lecture 3.

Prereq: EVENT 1710; credit or enrollment in EVENT 3710; Junior classification

Advanced application of event management-provides students with hands-on special event planning experience, an understanding of how events are managed, and confidence in the research, planning, coordinating, marketing, management, financial management, way-finding and evaluation of special events. Event management production, design elements, technical production, stakeholder management, logistics, operations, event marketing and promotion, merchandise, risk management, fundraising, sponsorship, and event assessment. (Typically Offered: Fall, Spring)

EVENT 4820: Sport Event Marketing

Credits: 3. Contact Hours: Lecture 3.

Prereq: EVENT 1710

Sports Marketing is a specialized marketing course that is designed to prepare students to develop skills necessary to address marketing issues specific to the sports industry. This course will analyze the field of sports in terms of the practices, applications, and strategies of mainstream marketing. The subject includes Sponsorship, Endorsements, Licensing, Segmentation of the Sports Market, Promotional Strategy for the Marketing of Sports Products, and Emerging Issues in Sports Marketing. In addition, this class touches on the unique opportunities and challenges associated with marketing in the entertainment industry as an aggregate. To provide students with practical experience addressing sports and entertainment marketing issues, the class is organized around four projects. This course will explore the strategies necessary for success in marketing sports events, products, and services. The course will build knowledge, skills, and a practical understanding of the nature, contexts, and dynamics of sports marketing and critically explore the product, price, promotion, and placement within the sports marketing context. This course emphasizes the exploration of the essentials of effective sports marketing. Topics include the application of marketing principles in the sports arena, licensing issues, sponsorships and endorsements, stadium and arena marketing, broadcasting and media considerations, public policy and sports, and the unique marketing challenges for sport-specific products (football, basketball, baseball, motorsports, etc.) Prerequisites: EVENT 1710. (Typically Offered: Fall)

EVENT 4850: Advanced Event Production: Special Event

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Advanced application event management. Provide leadership and direction for production of a special event including vendor sourcing, contracts, stakeholder relations, logistics, budget management, publicity, operations, choreography, staging, lighting, sponsorship, and food. (Typically Offered: Fall, Spring)

EVENT 4860: Advanced Event Production

Credits: 3. Repeatable, maximum of 6 credits.

Prereq: EVENT 3710; EVENT 4850; Event Management major

Advanced application event management. Provide leadership and direction for production of an event including vendor and stakeholder relations, budget management, publicity, advertising, choreography, staging, lighting, and food. Graduation Restriction: Maximum of 6 credits may be applied toward graduation. (Typically Offered: Fall)

EVENT 4900B: Independent Study: Conferences

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Independent study. (Typically Offered: Fall, Spring, Summer)

EVENT 4900C: Independent Study: Special Events

Credits: 1-30. Repeatable.

Prereq: Program approval

Independent study. (Typically Offered: Fall, Spring, Summer)

EVENT 4900D: Independent Study: Event Management

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Independent study. (Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

EVENT 5310: Event Business Research Essentials

(Dual-listed with EVENT 4310).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Instructor Permission for Course

The effective execution of an event necessitates the application of suitable tools and techniques to achieve the event's intended business objectives. This course equips students with the knowledge and skills to cater to the escalating requirement for a structured methodology for conducting event business research and integrating the findings into the strategic decision-making process. Students will be exposed to a comprehensive curriculum that covers research design, measurement, sampling, data collection, processing, analysis, and interpretation, thereby preparing them to navigate the multifaceted challenges of the event industry with poise and proficiency. (Typically Offered: Fall)

EVENT 5610: Advanced Topics in Event Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Advanced meeting and event planning topics including event strategy, event risk and security management, event financial management, event design, event project management, and event tourism strategy. Offered odd-numbered years. (Typically Offered: Spring)

EVENT 5770: Advanced Social Media Strategy

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Project-based course that includes analyzing relevant literature in social media and developing, implementing, and assessing an integrated social media marketing strategy in the service business marketing plan. Perspective on digital/social/mobile marketing to appreciate its true value to consumers, to managers, and to other corporate stakeholders. (Typically Offered: Fall)

EVENT 5780: Advanced Event Sustainability Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

This course emphasizes the significance of sustainability in service businesses, with a focus on integrating social, economic, and environmental factors. It examines the impact of sustainability on stakeholders, including consumers and employees, while ensuring business profitability." Offered even-numbered years. (Typically Offered: Fall)

EVENT 5900: Special Topics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Instructor Permission for Course

Topics in event management. (Typically Offered: Fall, Spring)

EVENT 5990: Creative Component

Credits: 3. Contact Hours: Lecture 3.

Prereq: Instructor Permission for Course

Creative component as arranged with instructor. (Typically Offered: Fall, Spring, Summer)

Courses for graduate students:

EVENT 6340: Theory and Research Seminar in Event Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: Permission of Instructor; Permission of Advisor

Analysis and application of theories and research methodologies in event management and is designed to strengthen students' analytical and critical perspectives to evaluate event management research. Multidisciplinary approach to the areas of sports events, festivals and fairs, conventions and trade shows, mega events, and event tourism. Offered even-numbered years. (Typically Offered: Spring)

Courses primarily for undergraduates:

HSPM 1010: Introduction to the Hospitality Industry

Credits: 3. Contact Hours: Lecture 3.

Introduction to the foodservice, lodging, and tourism components of the hospitality industry. Background information, current issues, and future challenges in various segments of the industry. (Typically Offered: Fall, Spring)

HSPM 1330: Food Safety Certification

Credits: 1. Contact Hours: Lecture 1.

Introduction to safety and sanitation principles in foodservice operations. Characteristics of food, supplies, and equipment as related to quality, sanitation, and safety are discussed. Application of sanitation principles in restaurants are covered as well. Students must pass a National Sanitation Certification Examination to receive credit. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

HSPM 2010: Casino Management I

Credits: 3. Contact Hours: Lecture 3.

An overview of the casino gaming industry. Emphasis will be placed on examination of the history and development of gaming, casino operations, casino games, marketing of the core gaming products, and social and economic impacts of the gaming industry. (Typically Offered: Fall)

HSPM 2250: Introduction to Food Service Operations

Credits: 3. Contact Hours: Lecture 3.

Introduction to food service operations within the hospitality and event industry. Management concepts, distinct features, sustainability, current issues, and trends. (Typically Offered: Spring)

HSPM 2300: Introduction to Hospitality Performance Analysis

Credits: 3. Contact Hours: Lecture 3.

Introduction to Uniform Systems of Accounts for hospitality industry, profitability, income statements, budgeting, managing cash, accounts receivable and payable, costs control, pricing, and evaluation related to restaurant, lodging, and club industry. Preparation for a hospitality accounting certification exam. (Typically Offered: Fall, Spring)

HSPM 2330: Hospitality Sanitation and Safety

Credits: 3. Contact Hours: Lecture 3.

Sanitation and safety principles in hospitality operations. Issues impacting consumers and operators. (Typically Offered: Fall, Spring)

HSPM 2480: Introduction to Senior Living Management

Credits: 3. Contact Hours: Lecture 3.

Survey course provides a comprehensive overview of the history, current issues, and future trends of the senior living industry. Basics about major aspects of senior living management. (Typically Offered: Fall)

HSPM 2600: Global Tourism Management

Credits: 3. Contact Hours: Lecture 3.

Overview of the global tourism industry: hospitality and related services, destination/ attractions, tourist behaviors, and destination marketing. Introduction to destination mix, socio-economic and cultural impacts of tourism, destination organizations, tourist motivations, destination image, marketing, promotions, tourism distribution system, and the future of tourism. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

HSPM 2800: Non-Alcoholic Beverages and Cafe Operations

Credits: 3. Contact Hours: Lecture 3.

Advanced knowledge, preparation, and service of non-alcoholic beverages applied for cafe operations. (Typically Offered: Fall, Spring)

HSPM 2890: Contemporary Club Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: HSPM 1010

Organization and management of private clubs including city, country, and other recreational and social clubs. Field trip may be required. (Typically Offered: Spring)

HSPM 2900: Independent Study

Credits: 1-2. Repeatable, maximum of 4 credits.

Prereq: Freshman or Sophomore Classification. Permission of instructor, advisor, and department chair.

Independent study on topics of special interest to the student, facilitated by approved faculty member. Graduation Restriction: Maximum of 9 credits combined of HSPM 2900 and HSPM 4900 can be applied to graduation. (Typically Offered: Fall, Spring, Summer)

HSPM 3010: Hospitality Revenue Management

Credits: 3. Contact Hours: Lecture 3.

An overview of the revenue management in the lodging and food service industry will be provided. Emphasis will be placed on the application of analytical and forecasting techniques to formulate and implement pricing strategies in responses to daily operation complexities. (Typically Offered: Fall)

HSPM 3150: Hospitality Law

Credits: 3. Contact Hours: Lecture 3.

Laws relating to ownership and operation of hospitality organizations. The duties and rights of both hospitality business operators and customers. Legal implications of various managerial decisions. (Typically Offered: Spring)

HSPM 3200: Attractions and Amusement Park Administration

Credits: 3. Contact Hours: Lecture 3.

Prereq: HSPM 1010 or permission of instructor

Examination of current issues in the attractions and amusement park industry. Emphasis will be placed on development and design along with the functional departments of modern amusement parks and themed attractions. (Typically Offered: Spring)

HSPM 3330: Hospitality Operations Cost Controls

Credits: 3. Contact Hours: Lecture 3.

Introduction to revenue and cost systems in the hospitality industry. Application of principles related to procurement, production, and inventory controls. (Typically Offered: Fall)

HSPM 3520: Lodging Operations Management I

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or concurrent enrollment in HSPM 1010

Introduction to functional department activities and current issues of lodging organizations with emphasis on front office operations and guest services including reservation activities, forecasting, and auditing exercises. (Typically Offered: Fall)

HSPM 3580: Economics for Senior Living Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: HSPM 2480

Overview of supply and demand, product/service development, consumption, and financials of the senior living industry from a management perspective. (Typically Offered: Fall)

HSPM 3800: Food Production Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: HSPM 1330 or 2 cr MICRO; FSHN 1010, FSHN 1110 or FSHN 2140; FSHN 1150 or FSHN 2150; at least junior classification; enrollment in HSPM 3800L

Principles of and procedures used in food production management including menu planning, costing, work methods, food production systems, quality control, and service. (Typically Offered: Fall, Spring)

HSPM 3800L: Food Production Management Experience

Credits: 3.

Prereq: HSPM 1330 or 2 cr MICRO; FSHN 1110 or FSHN 1010 or FSHN 2140; FSHN 1150 or FSHN 2150; at least junior classification; enrollment in HSPM 3800

Application of food production and service management principles and procedures in the program's foodservice operation. Field trip. (Typically Offered: Fall, Spring)

HSPM 3830: Wine and Spirits in Hospitality Management

Credits: 2. Contact Hours: Lecture 2.

Prereq: Must Be 21 Years or Older on First Day of Class

Introduction to history and methods of production for a variety of wines and spirits. Beverage tasting and sensory analysis; product knowledge; service techniques; sales; and alcohol service related to the hospitality industry. Field trip. Must be age 21 or older by first day of class. . (Typically Offered: Fall, Spring)

HSPM 3830L: Wine, Spirits, and Mixology Laboratory in Hospitality Management

Credits: 2. Contact Hours: Lecture 1, Laboratory 2.

Prereq: Must Be 21 Years or Older on First Day of Class

The application of the management principles and procedures related to the sale and service of alcohol, specialty beverages, and cocktails served in the beverage and hospitality industry. Beverage tasting and sensory analysis of products commonly served in the beverage industry. Field trip. Must be age 21 or older by first day of class. . (Typically Offered: Fall, Spring)

HSPM 3850: Beer and Brewed Beverages in Hospitality Management

Credits: 1. Contact Hours: Lecture 2.

Prereq: Must Be 21 Years or Older on First Day of Class

Introduction to history and methods of production for a variety of beer, cider, perry, mead, sake and other brewed alcoholic beverages. Beverage tasting and sensory analysis; product knowledge; and service techniques related to the beverage and hospitality industry. Field trip. 8-week course. Must be age 21 or older by first day of class. . (Typically Offered: Fall, Spring)

HSPM 3910: Foodservice Systems Management I

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or concurrent enrollment in HSPM 3800 and HSPM 3800L

Principles and techniques related to basic management, leadership, and human resource management of foodservices in health care and other on-site foodservice settings. Food safety and sanitation for on-site foodservice operations. Graduation Restriction: Credit for either HSPM 3910 or AESHM 2870 and AESHM 4380 may count toward graduation. Not accepted for credit toward a major in Hospitality Management. (Typically Offered: Fall)

HSPM 3920: Foodservice Systems Management II

Credits: 3. Contact Hours: Lecture 3.

Prereq: HSPM 3910

Introduction to cost control in foodservice operations: procedures for controlling food and labor variable costs. Application of principles related to food product selection, specification, purchase, and storage in health care and other onsite operations. Interpretation and application of financial records. Graduation Restriction: Credit for either HSPM 3920 or HSPM 2330 and HSPM 3330 may count toward graduation. Not accepted for credit toward a major in Hospitality Management. (Typically Offered: Spring)

HSPM 3930AX: Workshop: Confectionary Art

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Repeatable.

Intensive 2-to-8-week workshop exploration. Topics vary each time offered. Graduation Restriction: Maximum of 6 credits of HSPM 393 can be applied toward graduation.

HSPM 3930B: Hospitality Management Industry Workshop: Baking and Pastry Art

Credits: 3. Repeatable.

Introduces students with practical experience working in a realistic bakeshop situation to restaurant kitchens and bakeries. Students will become familiar with producing a variety of baked goods as well as setting up "Mise En Place", different baking techniques, and dessert plating techniques for the dining room and banquet situations. Focus on weights, measurements, formulas, general baking classifications, handling, and storage of ingredients, safety and handling, production of yeast raised dough products, cakes, cookies, batters, bread, biscuits, muffins, pies, and special dessert preparation. Introduction to various ingredients and how they affect the finished product by giving a tender crumbed and a well-developed crust. The essential basic functions of ingredients and the techniques of scaling, pan preparation, and sifting. (Typically Offered: Fall, Spring, Summer)

HSPM 3930M: Hospitality Management Industry Workshop: Molecular Gastronomy

Credits: 3. Repeatable.

Introduction to molecular gastronomy as a type of modern and innovative cuisine through both sweet and savory culinary applications. Develop and apply basic and advanced culinary skills. Basic principles of chemistry, biology, and physics and how they can be used in combination with culinary arts techniques to create unique culinary experiences. (Typically Offered: Fall, Spring, Summer)

HSPM 4200: Fairs, Festivals, and Events Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: HSPM 3200

Examine current issues within fairs and festivals. Emphasis placed on the evolution of exhibitions to modern day fairs and festivals, along with the processes necessary for operating fairs and festivals. (Typically Offered: Fall)

HSPM 4330: Hospitality Financial Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: ACCT 2840; ECON 1010; HSPM 3330; credit or concurrent enrollment in STAT 1010 or STAT 1040

Fundamental concepts and issues in hospitality finance and investment. Application of financial statement analysis, accounting ratio analysis, and financial instruments in management decision-making. (Typically Offered: Spring)

HSPM 4370: Hospitality Technology Applications

Credits: 3. Contact Hours: Lecture 3.

Prereq: HSPM 1010

Introduction to hospitality technology. Emphasis will be placed on basic computer software and hardware components, property managements, point-of-sales systems; customer relationship management, selecting and purchasing computer systems, electronic distribution systems, and communication networks. (Typically Offered: Fall)

HSPM 4390: Advanced Hospitality Human Resource Management

Credits: 3. Contact Hours: Lecture 3.

Emphasis on development of management personnel in hospitality organizations. Case studies. (Typically Offered: Fall)

HSPM 4520: Lodging Operations Management II

Credits: 3. Contact Hours: Lecture 3.

Prereq: HSPM 3520

Development of business plan and evaluation of business performance in a simulated environment. Operational decision making practices by applying concepts of management, operations, marketing, and finance for a computer-mediated environment. (Typically Offered: Spring)

HSPM 4550: Strategic Management in Hospitality

Credits: 3. Contact Hours: Lecture 3.

Prereq: AESHM 2380 and AESHM 3400; credit or concurrent enrollment in HSPM 4330

Introduction to strategic management principles and practices with an application of human resources, operations, marketing, and financial management concepts. Case studies. (Typically Offered: Spring)

HSPM 4700: Supervised Professional Internship

Credits: 3. Repeatable.

Supervised work experience with a cooperating firm or organization, documentation of experience, and completion of an internship project. Coursework includes weekly self-reflection and topics related to current issues and career advancement. Employer/experience should be different than employer/experience used for AESHM 1700 and AESHM 2700. Graduation Restriction: No more than 12 credits from AESHM 1700, AESHM 2700, or HSPM 4700 may be applied toward graduation. (Typically Offered: Fall, Spring, Summer)

HSPM 4870: Fine Dining Management

(Dual-listed with HSPM 5870).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: HSPM 3800, HSPM 3800L, and HSPM 1330, or ServSafe® Certification

Exploration of the historical and cultural development of the world food table. Creative experiences with U.S. regional and international foods. Application of management and financial principles in food preparation and service in fine dining settings. Meets International Perspectives Requirement. (Typically Offered: Fall)

HSPM 4900B: Independent Study: Hospitality Management

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Independent Study in Hospitality Management. (Typically Offered: Fall, Spring, Summer)

HSPM 4900D: Independent Study: Lodging Operations

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

HSPM 4900E: Independent Study: Foodservice Operations

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

HSPM 4900H: Independent Study: Honors

Credits: 1-30. Repeatable.

Prereq: Permission of Instructor; Membership in the University Honors Program

(Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

HSPM 5050: Hospitality Management Scholarship and Applications

Credits: 1-3. Contact Hours: Laboratory 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Focus on teaching and research scholarship involving the hospitality industry. (Typically Offered: Fall, Summer)

HSPM 5060: Research Seminar in Hospitality Management

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Focus on current research in hospitality industry. Discuss research designs and methods commonly used in hospitality management research; Introduce research proposal development procedures. (Typically Offered: Spring)

HSPM 5070X: Teaching, Career Planning & Professional Development

Credits: 1. Contact Hours: Lecture 1.

Prereq: Graduate Standing or Permission of Instructor

Seminar course focused on developing teaching skill, planning career, and practicing professionalism for graduate students in hospitality and tourism management. Introduces and discusses a number of topics regarding the high-impact instructional methods and teaching techniques needs for the future hospitality educators at the college level. Discussion of career planning and professional development for graduate students encompasses the activities and resources that can help students sharpen a skill set to secure their future career as a hospitality educator in the higher education. (Typically Offered: Fall)

HSPM 5330: Financial Decision Making in Hospitality Organizations

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Concepts of financial management applied to strategic decision making. Offered odd-numbered years. (Typically Offered: Spring)

HSPM 5380: Human Resources Development in Hospitality Organizations

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Theories of human resources management. Practices and principles related to development of management personnel. Offered odd-numbered years. (Typically Offered: Fall)

HSPM 5400: Strategic Marketing

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Application of marketing principles in developing effective marketing strategies for hospitality, apparel, and retail organizations. Evaluation of multi-dimensional marketing functions in hospitality organizations. Offered even-numbered years. (Typically Offered: Fall)

HSPM 5550: Strategic Management in Hospitality Organizations

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Strategic management process as a planning and decision-making framework; integration of human resources, operations, marketing, and financial management concepts. Offered even-numbered years. (Typically Offered: Spring)

HSPM 5600: Tourism Management and Tourist Behavior

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Tourism theories and research. Overview of tourism industry, tourism theories, methods, and current issues in destination marketing and management and travel behavior. Evaluation of tourism and destination research. (Typically Offered: Spring)

HSPM 5870: Fine Dining Management

(Dual-listed with HSPM 4870).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Exploration of the historical and cultural development of the world food table. Creative experiences with U.S. regional and international foods. Application of management and financial principles in food preparation and service in fine dining settings. Meets International Perspectives Requirement. (Typically Offered: Fall)

HSPM 5900B: Special Topics: Hospitality Management

Credits: 1-30. Repeatable, maximum of 3 credits.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

HSPM 5900C: Special Topics: Tourism

Credits: 1-30. Repeatable, maximum of 3 credits.

Prereq: Graduate Standing or Permission of Instructor

Special topics in tourism. (Typically Offered: Fall, Spring, Summer)

HSPM 5900D: Special Topics: Lodging Operations

Credits: 1-30. Repeatable, maximum of 3 credits.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

HSPM 5900E: Special Topics: Commercial/Retail Foodservice Operations

Credits: 1-30. Repeatable, maximum of 3 credits.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

HSPM 5900F: Special Topics: Onsite Foodservice Operations

Credits: 1-30. Repeatable, maximum of 3 credits.

Prereq: Graduate Standing or Permission of Instructor

(Typically Offered: Fall, Spring, Summer)

HSPM 5900G: Special Topics: Event Management

Credits: 1-30. Repeatable, maximum of 6 credits.

Prereq: Graduate Standing or Permission of Instructor

Special Topics in Event Management. Graduation Restriction: Only 6 credits of HSPM 5900G can be applied toward graduation. (Typically Offered: Fall, Spring, Summer)

HSPM 5990: Creative Component

Credits: 1-30.

Prereq: Instructor Permission for Course

Creative component as arranged with instructor. (Typically Offered: Fall, Spring, Summer)

Courses for graduate students:

HSPM 6040: Professional Writing

Credits: 2. Contact Hours: Lecture 2.

Development of professional written communication with emphasis on abstracts, proposals, and manuscripts. (Typically Offered: Spring, Summer)

HSPM 6080: Administrative Problems

Credits: 1-4. Contact Hours: Lecture 4.

Repeatable, maximum of 4 credits.

Advanced administrative problems; case studies in foodservice and lodging organizations. (Typically Offered: Fall, Spring, Summer)

HSPM 6330: Advanced Hospitality Financial Management

Credits: 3. Contact Hours: Lecture 3.

Theories and research in financial management with emphasis on financial performance and financing decisions. (Typically Offered: Fall, Summer)

HSPM 6380: Advanced Human Resources Management in Hospitality Organizations

Credits: 3. Contact Hours: Lecture 3.

Research in human resources management with an emphasis on organization or unit administration. (Typically Offered: Fall, Summer)

HSPM 6400: Seminar on Marketing Thoughts

Credits: 3. Contact Hours: Lecture 3.

Conceptual and theoretical development of marketing strategies. Analytical and critical review of marketing research and industry practices. (Typically Offered: Fall, Summer)

HSPM 6520: Advanced Lodging Operations

Credits: 3. Contact Hours: Lecture 3.

Analysis and applications of concepts and theories of operations research for lodging operations. (Typically Offered: Spring, Summer)

HSPM 6600: Research Seminar in Tourism Management

Credits: 3. Contact Hours: Lecture 3.

Advanced graduate course on tourism and destination theories and research. Analysis and application of theories, research findings, and research methods in tourism and destination management. Offered odd-numbered years. (Typically Offered: Spring)

HSPM 6800: Analysis of Research in Foodservice Operations

Credits: 3. Contact Hours: Lecture 3.

Analysis and application of theories, research, and research methods in foodservice operations. Offered even-numbered years. (Typically Offered: Spring)

HSPM 6900B: Advanced Topics: Hospitality Management

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable, maximum of 30 credits.

Prereq: Instructor Permission for Course

Advanced study of current topics in hospitality management. (Typically

Offered: Fall, Spring, Summer)

HSPM 6900C: Advanced Topics: Tourism

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable, maximum of 30 credits.

Prereq: Instructor Permission for Course

Advanced study of current topics in hospitality management. (Typically

Offered: Fall, Spring, Summer)

HSPM 6900D: Advanced Topics: Lodging Operations

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable, maximum of 30 credits.

Prereq: Instructor Permission for Course

Advanced study of current topics in hospitality management. (Typically

Offered: Fall, Spring, Summer)

HSPM 6900E: Advanced Topics: Commercial/Retail Foodservice Operations

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable, maximum of 30 credits.

Advanced study of current topics in hospitality management. (Typically

Offered: Fall, Spring, Summer)

HSPM 6900F: Advanced Topics: Onsite Foodservice Operations

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable, maximum of 30 credits.

Advanced study of current topics in hospitality management. (Typically

Offered: Fall, Spring, Summer)

HSPM 6900G: Advanced Topics: Event Management

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable, maximum of 30 credits.

Advanced study of current topics in event management and hospitality management. (Typically Offered: Fall, Spring, Summer)

HSPM 6990: Research

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Research. (Typically Offered: Fall, Spring, Summer)

Athletic Training

This major prepares students for a career as an athletic trainer in a variety of settings such as high school, college and professional settings. There are additional settings in sports medicine clinics, hospitals, military, industry, and in performing arts. The accredited program will prepare students for the Board of Certification exam upon graduation. Admission

to the athletic training program is competitive and based on available departmental resources. Admission procedures and technical standards can be found at <http://www.kin.hs.iastate.edu/programs/athletic-training/#program-information-and-requirements>.

Iowa State University's Athletic Training Program has transitioned to a Professional Master's degree program. Undergraduate students will be enrolled in the 3+2 athletic training program with a 3-year Pre-Athletic Training undergraduate curriculum and a 2-year Master of Athletic Training program in the Department of Kinesiology. Students with a B.S. or B.A. degree may apply directly to the master's program with completion of prerequisite coursework, program requirements, and observation hours. For more information, please contact the program director, Dr. Mary Meier, at mary@iastate.edu.

Mission

Athletic training is the art and science of the prevention, recognition, care, and rehabilitation of athletic injuries. It includes the organization and administration of athletic training education programs, as well as the education and counseling physically active individuals and athletes. The Iowa State University athletic training program provides high quality education striving to instill intellectual curiosity, evidence-based knowledge, and clinical skills essential for individual development. The athletic training program enrolls academically qualified students who represent diverse socio-economic levels, ethnic heritage and who provide a gender balance. The program faculty and clinical preceptors strive to prepare athletic training students to be productive and responsible citizens of the world and to foster affective, caring individuals to promote the profession of athletic training.

The Athletic Training faculty and clinical preceptors continually update educational curriculum to keep athletic training students current with field knowledge and to ensure the best possible undergraduate and graduate education in both the didactic and clinical settings.

Goals

1. We prepare athletic training students for the BOC Certification Exam.
2. We produce high quality athletic trainers prepared for employment in educational, clinical, and professional settings.
3. We promote professional and ethical conduct at all times.
4. We provide athletic training students equal opportunity to develop their skills both in the classroom and in the clinical settings.
5. We continually update the curricular offerings to provide the athletic training student current evidence-based knowledge in the profession.
6. We provide high quality instruction in the classroom and clinical experiences.
7. We assist the athletic training student in gaining employment.

8. We promote the concept of establishing professional contacts by attending professional and educational meetings.
9. We foster an appreciation of athletic training as a component of sports medicine.
10. We foster the affective, caring side of athletic training.

Student Learning Objectives

1. Athletic training graduates will use effective communication skills.
2. Athletic training graduates will demonstrate competence in athletic training skills and knowledge.
3. Athletic training graduates will possess ethical, caring, professional attributes and behaviors as a health care professional.
4. Athletic training graduates will demonstrate effective critical thinking and problem-solving skills ensuring them of being an effective athletic trainer.
5. Athletic training graduates will demonstrate the ability to apply clinical skills and make evidence-based decisions to optimize patient outcomes.

UNDERGRADUATE STUDY

The Department of Kinesiology offers a Bachelor of Science degree in Kinesiology & Health. The B.S. in Athletic Training degree is only offered upon completion of the 3+2 B.S./M.A.TR. Athletic Training program. The undergraduate curriculum major/option is comprised of three components: general education, required departmental courses and the component courses. The intent of the general education component is to promote intellectual and personal growth and to prepare students for success in the basic, advanced and major/option components. Required courses provide an introduction to the field and fundamental principles of physical activity, fitness, health and disease, and component courses fulfill prerequisite requirements of the graduate program.

B.S./M.A.TR. degree in Athletic Training

Certified Athletic Trainers are allied medical health care professionals who specialize in risk reduction, wellness, health literacy, assessment, evaluation, diagnosis, critical incident management, and therapeutic intervention of injuries. To gain certification as an athletic trainer, candidates must graduate from a CAATE accredited athletic training education program and successfully pass the Board of Certification (BOC) examination. In addition, most states have licensure requirements to practice athletic training. The ISU Athletic Training undergraduate education program has been CAATE accredited since 2001 and has transitioned to a Professional Master's program. The Athletic Training program at Iowa State University includes various athletic training clinical rotations including high school settings, physical therapy and university settings, physician offices, surgical and emergency department observations, and immersive clinical opportunities in orthopedic and non-orthopedic settings.

Curriculum in Athletic Training

This major prepares students for a career as an athletic trainer in high school, college, professional sports, and within additional settings, including sports medicine clinics, hospitals, the military, industry, and the performing arts. Additional settings include sports medicine clinics, hospitals, military, industry, and with the performing arts. The 3+2 program prepares students for the Board of Certification exam upon graduation from the master's program. Admission to the Athletic Training Master's degree program is competitive. Admission requirements for the Professional Master's in Athletic Training program can be found at <http://www.kin.hs.iastate.edu/graduate-programs/athletic-training/> (<http://www.kin.hs.iastate.edu/programs/athletic-training/#program-information-and-requirements>).

Curriculum in Athletic Training Communication Proficiency

In order to meet graduation requirements, all students must pass ENGL 1500 and pass ENGL 2500, with a grade no lower C. Students not meeting this condition must earn a C or better in an advanced writing course:

ENGL 3020	Business Communication	3
or ENGL 3140	Technical Communication	
LIB 1600	Introduction to College Level Research	1
SPCM 2120	Fundamentals of Public Speaking	3

U.S. Cultures and Communities and International Perspectives

In order to meet graduation requirements, all students must complete 3 cr. of course work in U.S. Cultures and Communities and 3 cr. in International Perspectives. See university approved list.

General Education

Physical and Life Sciences:

BIOL 2550	Fundamentals of Human Anatomy	3
BIOL 2550L	Fundamentals of Human Anatomy Laboratory	1
BIOL 2560	Fundamentals of Human Physiology	3
BIOL 2560L	Fundamentals of Human Physiology Laboratory	1

Additional major-specific requirements are:

CHEM 1630	College Chemistry	4
or CHEM 1770	General Chemistry I	
CHEM 1630L	Laboratory in College Chemistry	1
or CHEM 1770L	Laboratory in General Chemistry I	
FSHN 1670	Introductory Human Nutrition and Health	3

PHYS 1310	General Physics I	4-5
& 1310L	and General Physics I Laboratory	
or PHYS 1150	Physics for the Life Sciences	

Mathematics and Statistics:

From the following: 3-4

MATH 1400	College Algebra
or MATH 14	Preparation for Calculus
or MATH 14	Applied Trigonometry
or MATH 16	Calculus I

From the following: 3-4

STAT 1010	Principles of Statistics
or STAT 104	Introduction to Statistics

Social Sciences: 9 cr. min required

PSYCH 1010	Introduction to Psychology	3
or PSYCH 2300	Developmental Psychology	
SOC 1340	Introduction to Sociology	3

Humanities: 6 cr. min required

Choose from department approved list.

Communications:

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
LIB 1600	Introduction to College Level Research	1
SPCM 2120	Fundamentals of Public Speaking	3
One of the following		3
ENGL 3020	Business Communication	
or ENGL 314	Technical Communication	
or SPCM 312	Business and Professional Speaking	

Program requirements:

The following courses are required in all majors and options:

HS 1100	Personal and Consumer Health	3
HS 3500	Human Diseases (*)	3
KIN 2520	Introduction to the Discipline of Kinesiology	1
KIN 2530	Orientation and Learning Community in Kinesiology and Health	1
KIN 2580	Principles of Physical Fitness and Conditioning	2
KIN 3580	Exercise Physiology (*)	3
KIN 3590	Exercise Physiology Lab	1
KIN 3730	Biomechanics and Motor Control Laboratory	1

* A grade of C- or better is required.

Courses for Athletic Training Major

Option Requirements:

ATR 2190	Anatomy Clinical Practicum	1
ATR 2200	Basic Athletic Training	2
ATR 2210	Pre-Athletic Training Clinical Practicum	1
ATR 2230	Preseason Clinical Experience Practicum	1
KIN 3550	Biomechanics (*)	3
KIN 3650	Sport Psychology (*)	3
or KIN 3660	Exercise Psychology	
KIN 4800	Functional Anatomy	3
Electives		3

* A grade of C- or better is required.

Athletic Training B.S./Masters (B.S./M.A.T.R.) Degree

Sample Five-Year Plan

First Year

Fall	Credits	Spring	Credits
ATR 2180	0.5	ATR 2180	0.5
BIOL 2550*	3	BIOL 2110	3
		or 2120	
BIOL 2550L*	1	BIOL 2110L	1
		or 2120L	
ENGL 1500	3	BIOL 2560**	3
HS 1100	3	BIOL 2560L**	1
KIN 2520	1	FSHN 1670	3
KIN 2530	1	SOC 1340	3
LIB 1600	1	STAT 1010	3-4
		or 1040	
PSYCH 1010	3		
	16.5		17.5-18.5

Second Year

Fall	Credits	Spring	Credits
ATR 2200*	2	ATR 2170**	1
ATR 2210*	1	ATR 2190	1
CHEM 1630	4	KIN 2580	2
or 1770			
CHEM 1630L	1	MATH 1400,	3-4
or 1770L		1430, 1450,	
		or 1650	
ENGL 2500	3	PHYS 1150	4-5
		or 1310 and	
		1310L	

Humanities/ US Cultures and Communities (formerly U.S. Diversity)	3 SPCM 2120	3
PSYCH Choice	3 Humanities/ International Perspectives	3
		17

Third Year		17-19	
Fall	Credits	Spring	Credits
ATR 2230*	1 ATR 3280**	1 ATR 5010	1
ATR 2280*	2 ENGL 3020, 3140, or SPCM 3120	3 ATR 5020	3
ATR 2290*	1 HS 3500	3 ATR 5090	1
FSHN 3670	1 KIN 3720	3 ATR 5200	1
KIN 3550	3 KIN 3730	1 BMS 4480	4
KIN 3580	3 KIN 4800	3	
KIN 3590	1 PSYCH 4600	3	
KIN 3650 or 3660	3		
Apply for admission to the AT/MATR program in December. Acceptance into the program is required before spring of the third year.			
		15	10

Fourth Year		17	
Fall	Credits	Spring	Credits
ATR 5050*	3 ATR 5130**	3 ATR 5150	2
ATR 5100*	3 ATR 5220**	1 ATR 5230	1

ATR 5190*	3 ATR 5290**	3 ATR 5390	2
ATR 5210*	1 ATR 5450**	3 ATR 5600	3
		10	8

Fifth Year

Fall	Credits	Spring	Credits
ATR 5500	2 ATR 5240**	1	
ATR 5590*	4 ATR 5690**	5	
ATR 5700*	3 ATR 5750**	3	
HS 5640	3		
		12	9

Optional experiences: ATR 5490A/KIN 3810A and ATR 5490B/KIN 3810B Athletic Training Clinical Education Study Abroad (2 credits).

* Fall Only Course

** Spring Only Course

Planned course offerings may change, and students need to check the online Schedule of Classes each term to confirm course offerings: <https://classes.iastate.edu/>.

Humanities, Social Science, International Perspectives, and U.S.

Cultures and Communities courses: <https://kin.hs.iastate.edu/current-students/academics/resources-and-registration/>

This sequence is only an example.

Students who have already completed, or will complete, a B.A. or B.S. degree from an accredited institution and who have completed necessary prerequisite course work and other admission requirements can apply for the Master's in Athletic Training program. More information on the admissions requirements and application can be found here: <https://kin.hs.iastate.edu/graduate-students/graduate-program/masters-in-athletic-training/admissions-requirements-application/>.

Athletics

Administered by the Department of Kinesiology.

Courses primarily for undergraduates:

ATH 1010B: Intercollegiate Athletics: Basketball (men)

Credits: 1. Contact Hours: Laboratory 15.

Repeatable, maximum of 4 credits.

Prereq: Athletic Team Coach Permission for Course

Limited to a maximum of 4. Graduation Restriction: Credit for a sport section of ATH 1010 may not be applied toward graduation if credit is also received for KIN 1660 or any skill technique course in the same sport. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

ATH 1010C: Intercollegiate Athletics: Basketball (women)

Credits: 1. Contact Hours: Laboratory 15.

Repeatable, maximum of 4 credits.

Prereq: Athletic Team Coach Permission for Course

Limited to a maximum of 4. Graduation Restriction: Credit for a sport section of ATH 1010 may not be applied toward graduation if credit is also received for KIN 1660 or any skill technique course in the same sport. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

ATH 1010D: Intercollegiate Athletics: Cross Country (men)

Credits: 1. Contact Hours: Laboratory 15.

Repeatable, maximum of 4 credits.

Prereq: Athletic Team Coach Permission for Course

Limited to a maximum of 4. Graduation Restriction: Credit for a sport section of ATH 1010 may not be applied toward graduation if credit is also received for KIN 1660 or any skill technique course in the same sport. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

ATH 1010E: Intercollegiate Athletics: Cross Country (women)

Credits: 1. Contact Hours: Laboratory 13.

Repeatable, maximum of 4 credits.

Prereq: Athletic Team Coach Permission for Course

Limited to a maximum of 4. Graduation Restriction: Credit for a sport section of ATH 1010 may not be applied toward graduation if credit is also received for KIN 1660 or any skill technique course in the same sport. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

ATH 1010F: Intercollegiate Athletics: Football (men)

Credits: 1. Contact Hours: Laboratory 15.

Repeatable, maximum of 4 credits.

Prereq: Athletic Team Coach Permission for Course

Limited to a maximum of 4. Graduation Restriction: Credit for a sport section of ATH 1010 may not be applied toward graduation if credit is also received for KIN 1660 or any skill technique course in the same sport. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

ATH 1010G: Intercollegiate Athletics: Golf (men)

Credits: 1. Contact Hours: Laboratory 15.

Repeatable, maximum of 4 credits.

Prereq: Athletic Team Coach Permission for Course

Limited to a maximum of 4. Graduation Restriction: Credit for a sport section of ATH 1010 may not be applied toward graduation if credit is also received for KIN 1660 or any skill technique course in the same sport. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

ATH 1010J: Intercollegiate Athletics: Gymnastics (women)

Credits: 1. Contact Hours: Laboratory 13.

Repeatable, maximum of 4 credits.

Prereq: Athletic Team Coach Permission for Course

Limited to a maximum of 4. Graduation Restriction: Credit for a sport section of ATH 1010 may not be applied toward graduation if credit is also received for KIN 1660 or any skill technique course in the same sport. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

ATH 1010K: Intercollegiate Athletics: Softball (women)

Credits: 1. Contact Hours: Laboratory 13.

Repeatable, maximum of 4 credits.

Prereq: Athletic Team Coach Permission for Course

Limited to a maximum of 4. Graduation Restriction: Credit for a sport section of ATH 1010 may not be applied toward graduation if credit is also received for KIN 1660 or any skill technique course in the same sport. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

ATH 1010M: Intercollegiate Athletics: Swimming/Diving (women)

Credits: 1. Contact Hours: Laboratory 13.

Repeatable, maximum of 4 credits.

Prereq: Athletic Team Coach Permission for Course

Limited to a maximum of 4. Graduation Restriction: Credit for a sport section of ATH 1010 may not be applied toward graduation if credit is also received for KIN 1660 or any skill technique course in the same sport. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

ATH 1010O: Intercollegiate Athletics: Tennis (women)

Credits: 1. Contact Hours: Laboratory 15.

Repeatable, maximum of 4 credits.

Prereq: Athletic Team Coach Permission for Course

Limited to a maximum of 4. Graduation Restriction: Credit for a sport section of ATH 1010 may not be applied toward graduation if credit is also received for KIN 1660 or any skill technique course in the same sport. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

ATH 1010P: Intercollegiate Athletics: Track and Field (men)

Credits: 1. Contact Hours: Laboratory 15.

Repeatable, maximum of 4 credits.

Prereq: Athletic Team Coach Permission for Course

Limited to a maximum of 4. Graduation Restriction: Credit for a sport section of ATH 1010 may not be applied toward graduation if credit is also received for KIN 1660 or any skill technique course in the same sport. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

ATH 1010Q: Intercollegiate Athletics: Track and Field (women)

Credits: 1. Contact Hours: Laboratory 13.

Repeatable, maximum of 4 credits.

Prereq: Athletic Team Coach Permission for Course

Limited to a maximum of 4. Graduation Restriction: Credit for a sport section of ATH 1010 may not be applied toward graduation if credit is also received for KIN 1660 or any skill technique course in the same sport. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

ATH 1010R: Intercollegiate Athletics: Volleyball (women)

Credits: 1. Contact Hours: Laboratory 13.

Repeatable, maximum of 4 credits.

Prereq: Athletic Team Coach Permission for Course

Limited to a maximum of 4. Graduation Restriction: Credit for a sport section of ATH 1010 may not be applied toward graduation if credit is also received for KIN 1660 or any skill technique course in the same sport. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

ATH 1010S: Intercollegiate Athletics: Wrestling (men)

Credits: 1. Contact Hours: Laboratory 15.

Repeatable, maximum of 4 credits.

Prereq: Athletic Team Coach Permission for Course

Limited to a maximum of 4. Graduation Restriction: Credit for a sport section of ATH 1010 may not be applied toward graduation if credit is also received for KIN 1660 or any skill technique course in the same sport. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

ATH 1010T: Intercollegiate Athletics: Golf (women)

Credits: 1. Contact Hours: Laboratory 13.

Repeatable, maximum of 4 credits.

Prereq: Athletic Team Coach Permission for Course

Limited to a maximum of 4. Graduation Restriction: Credit for a sport section of ATH 1010 may not be applied toward graduation if credit is also received for KIN 1660 or any skill technique course in the same sport. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

ATH 1010U: Intercollegiate Athletics: Soccer (women)

Credits: 1. Contact Hours: Laboratory 13.

Repeatable, maximum of 4 credits.

Prereq: Athletic Team Coach Permission for Course

Limited to a maximum of 4. Graduation Restriction: Credit for a sport section of ATH 1010 may not be applied toward graduation if credit is also received for KIN 1660 or any skill technique course in the same sport. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

Culinary Food Science (HHSCI)

The Culinary Food Science degree is an interdisciplinary program that combines the principles of food science and culinary skills development. As a graduate, you'll combine food product development skills and entrepreneurial talents with scientific knowledge, to create new innovative food products and recipes.

The Culinary Food Science major is an approved Culinology® program through the Research Chefs Association.

The department also offers a culinary food science minor.

Student Learning Outcomes

Upon graduation, students should be able to:

- Communicate effectively in their field of study using written, oral, visual and/or electronic forms.
- Demonstrate proficiency in ethical data collection and interpretation, literature review and citation, critical thinking and problem solving.
- Participate effectively in a group or team.
- Integrate creativity, innovation, or entrepreneurship in ways that produce value.
- Explain how human activities impact the natural environment and how societies are affected.
- Meet program specific learning outcomes for the Culinary Food Science major.

Degree Requirements

Administered by the Department of Food Science and Human Nutrition

Total Degree Requirement: 120 cr.

Students must fulfill International Perspectives and U.S. Cultures and Communities requirements by selecting coursework from approved lists. These courses may also be used to fulfill other area requirements. Only 65 cr. from a two-year institution may apply to the degree which may include up to 16 technical cr.; 9 P-NP cr. of electives; 2.00 minimum GPA.

International Perspectives: 3 cr.
U.S. Cultures and Communities: 3 cr.
Communications and Library: 10 cr.

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
LIB 1600	Introduction to College Level Research	1
SPCM 2120	Fundamentals of Public Speaking	3
Total Credits		10

Humanities and Social Sciences: 9-15 cr.

FSHN 2200	American Food and Culture	3
ECON 1010	Principles of Microeconomics	3

If a Culinary Food Science student in the College of Health and Human Sciences, select:

Additional Humanities course

Additional Humanities or Social Science course

Ethics: 3 cr. (Included as part of the Humanities and Social sciences requirement)

FSHN 3420 World Food Issues: Past and Present 3

Mathematical Sciences: 6-8 cr.

Select at least 3 credits from: 3-4

MATH 1400 College Algebra

MATH 1430 Preparation for Calculus

MATH 1600 Survey of Calculus

MATH 1650 Calculus I

Select at least 3 credits from: 3-4

STAT 1010 Principles of Statistics

STAT 1040 Introduction to Statistics

Total Credits 6-8

Physical Sciences: 9 cr.

CHEM 1630 College Chemistry 4
or CHEM 1770 General Chemistry I

CHEM 1630L Laboratory in College Chemistry 1
or CHEM 1770L Laboratory in General Chemistry I

CHEM 2310 Elementary Organic Chemistry 3

CHEM 2310L Laboratory in Elementary Organic Chemistry 1

Total Credits 9

Biological Sciences: 10-11 cr.

BBMB 3010 Survey of Biochemistry 3

BIOL 2120 Principles of Biology II 3

BIOL 2120L Principles of Biology Laboratory II 1

MICRO 2010 Introduction to Microbiology 2-3
or MICRO 3020 Biology of Microorganisms

MICRO 2010L Introductory Microbiology Laboratory 1
or MICRO 3020L Microbiology Laboratory

Total Credits 10-11

Animal Science Coursework: 6 cr.

ANS 2700 Foods of Animal Origin 2

ANS 2700L Foods of Animal Origin Laboratory 1

ANS 4600 Science and Technology of Value Added Meat Products 3

Total Credits 6

Food Science and Human Nutrition: 42 cr.

FSHN 1010 Food and the Consumer 3

FSHN 1040 Introduction to Professional Skills in Culinary Science 2

FSHN 1100 Professional and Educational Preparation 1

FSHN 1670 Introductory Human Nutrition and Health 3

FSHN 2030 Contemporary Issues in Food Science and Human Nutrition 1

FSHN 2140 Scientific Study of Food 3

FSHN 2150 Advanced Food Preparation Laboratory 2

FSHN 3050 Food Quality Management and Control 2

FSHN 2070 Processing of Foods: Basic Principles and Applications 3

FSHN 3110 Food Chemistry 3

FSHN 3110L Food Chemistry Laboratory 1

FSHN 3140 Professional Development for Culinary Food Science and Food Science Majors 1

FSHN 4030 Food Laws and Regulations 2

FSHN 4060 Sensory Evaluation of Food 3

FSHN 4070 Microbiological Safety of Foods of Animal Origins 3

FSHN 4110 Food Ingredient Interactions and Formulations 2

FSHN 4120 Food Product Development 3

FSHN 4200 Food Microbiology 3

Take one of the following courses for 2 credits: 2

FSHN 4910B Supervised Work Experience: Food Science
or FSHN 491 Supervised Work Experience: Culinary Science

Total Credits 43

Hospitality Management: 12 cr.

HSPM 1330 Food Safety Certification 1

HSPM 3800 Food Production Management 3

HSPM 3800L Food Production Management Experience 3

HSPM 3830 Wine and Spirits in Hospitality Management 2
or FSHN 5090 Sensory Evaluation of Wines

HSPM 4870 Fine Dining Management 3

Total Credits 12

Electives 1-13 cr. Select from any university coursework to earn at least 120 total credits.

Go to FSHN courses.

Culinary Food Science, B.S.

First Year					
Fall	Credits	Spring	Credits		
FSHN 1100		1 FSHN 1040	2		
CHEM 1630 or 1770		4 FSHN 1670	3		
CHEM 1630L or 1770L		1 FSHN 2070	3		
FSHN 1010		3 BIOL 2120	3		
MATH 1400, 1430, 1600, or 1650		3-4 BIOL 2120L	1		
ENGL 1500		3 ECON 1010	3		
LIB 1600		1			
16-17			15		
Second Year					
Fall	Credits	Spring	Credits		
CHEM 2310		3 FSHN 2140	3		
CHEM 2310L		1 FSHN 2150	2		
ENGL 2500		3 BBMB 3010	3		
FSHN 2030		1 MICRO 2010 or 3020	2-3		
FSHN 2200		3 MICRO 2010L or 3020L	1		
HSPM 1330		1 STAT 1040 or 1010	3-4		
SPCM 2120		3			
15			14-16		
Third Year					
Fall	Credits	Spring	Credits	Summer	Credits
ANS 2700		2 FSHN 3050		2 FSHN 4910B or 4910D	2
ANS 2700L		1 FSHN 4030			2
FSHN 3110		3 HSPM 3800			3
FSHN 3110L		1 HSPM 3800L			3
FSHN 3140		1 Humanities or social science (CHHS) or elective (CALS)			3
FSHN 4110		2 Elective *			3
FSHN 4200		3			

Electives *		1-3		
14-16		16		2
Fourth Year				
Fall	Credits	Spring	Credits	
FSHN 4060		3 ANS 4600	3	
FSHN 4070		3 FSHN 3420	3	
FSHN 4910B or 4910D (if not yet completed)		2 FSHN 4120	3	
HSPM 3830 (if not taking FSHN 5090 Spring)		2 Humanities (CHHS) or Elective (CALS)	3	
HSPM 4870		3 Elective *	3	
U.S. Cultures and Communities		3		
16		15		

* Choose elective courses to total equal to or greater than 120 credits. Planned course offerings may change and students need to check the online Schedule of Classes each term to confirm course offerings: <https://classes.iastate.edu> (<https://classes.iastate.edu/>). This sequence is only an example. The number of credits taken each semester should be based on the individual student's situation. Factors that may affect credit hours per semester include student ability, employment, health, activities, and grade point consideration.

More information on the Culinary Food Science minor can be found here: www.catalog.iastate.edu/collegeofagricultureandlifesciences/foodscienceandhumannutrition/#undergraduateminortext.

Dance

Administered by the Department of Kinesiology.

Coursework in dance provides opportunities for students to develop an understanding and appreciation of dance as part of a liberal education. Those interested in teaching dance and physical education in the public schools may major in Kinesiology and Health (Teacher Licensure option) and minor in Dance.

A Performing Arts major with a Dance emphasis is available through the College of Liberal Arts and Sciences. For further information see: Performing Arts.

Diet and Exercise (HHSCI)

OVERVIEW

Diet and Exercise, B.S./M.S.

Administered by the Department of Food Science and Human Nutrition and Department of Kinesiology.

This is an accelerated program with concurrent enrollment in the undergraduate and graduate degree programs. Courses included have been approved as meeting the academic requirements of the Didactic Program in Dietetics (DPD) in preparation for admission to accredited dietetics internship programs; the DPD is accredited by the Accreditation Council for Education in Nutrition and Dietetics, the accrediting agency of the Academy of Nutrition and Dietetics. There is a \$30 fee for the verification statement of completion of the accredited dietetics program. Additionally, courses are included to meet the American College of Sports Medicine (ACSM) requirements for certification at the level of Certified Exercise Physiologist.

The Diet and Exercise program of study is not offered as an additional major, it is only offered as a full degree program. Students pursuing the Diet and Exercise degree program are allowed to pursue additional majors in other eligible programs of study if desired.

Student Learning Outcomes

Upon graduation, students should be able to:

- Communicate effectively in their field of study using written, oral, visual and/or electronic forms.
- Demonstrate proficiency in ethical data collection and interpretation, literature review and citation, critical thinking and problem solving.
- Participate effectively in a group or team.
- Integrate creativity, innovation, or entrepreneurship in ways that produce value.
- Explain how human activities impact the natural environment and how societies are affected.
- Meet program specific learning outcomes for the Diet & Exercise major.

Degree Requirements

Total Degree Requirements: 120 cr. for bachelor's degree and 36-40 cr. for master's degree

International Perspectives: 3 cr.

U.S. Cultures and Communities: 3 cr.

Students must fulfill International Perspectives and U.S. Cultures and Communities requirements by selecting coursework from approved lists. These courses may also be used to fulfill other area requirements.

Communications and Library: 10 cr.

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
LIB 1600	Introduction to College Level Research	1
SPCM 2120	Fundamentals of Public Speaking	3
Total Credits		10

Social Sciences: 6 cr.

PSYCH 1010	Introduction to Psychology	3
KIN 3660	Exercise Psychology	3
Total Credits		6

Mathematical Sciences: 6-8 cr.

Select at least 3 credits from:		3-4
MATH 1400	College Algebra	
MATH 1430	Preparation for Calculus	
MATH 1600	Survey of Calculus	
MATH 1650	Calculus I	
Select at least 3 credits from:		3-4
STAT 1010	Principles of Statistics	
STAT 1040	Introduction to Statistics	
STAT 2260	Introduction to Business Statistics I	
Total Credits		6-8

Physical Sciences: 13 cr.

Select from:		5
CHEM 1630	College Chemistry	
& 1630L	and Laboratory in College Chemistry	
or CHEM 1710	General Chemistry I	
& 1770L	and Laboratory in General Chemistry I	
CHEM 2310	Elementary Organic Chemistry	3
CHEM 2310L	Laboratory in Elementary Organic Chemistry	1
PHYS 1150	Physics for the Life Sciences	4
or PHYS 1310	General Physics I	
Total Credits		13

Biological Sciences: 13 cr.

BBMB 3010	Survey of Biochemistry	3
BIOL 2550	Fundamentals of Human Anatomy	3
BIOL 2550L	Fundamentals of Human Anatomy Laboratory	1
BIOL 2560	Fundamentals of Human Physiology	3
BIOL 2560L	Fundamentals of Human Physiology Laboratory	1
MICRO 2010	Introduction to Microbiology	2
Total Credits		13

Diet and Exercise undergraduate courses to be completed or in progress when applying for admission to the program: 21-23 cr.

Select from: 1-2

FSHN 1100	Professional and Educational Preparation	
or KIN 2520	Introduction to the Discipline of Kinesiology and Orientation and Learning Community in	
& KIN 2530	Kinesiology and Health	
FSHN 1670	Introductory Human Nutrition and Health	3
FSHN 2140	Scientific Study of Food	3
FSHN 2150	Advanced Food Preparation Laboratory	1-2
or FSHN 1150	Food Preparation Laboratory	
FSHN 2650	Metabolism, Nutrition and Health	3
FSHN 3400	Foundations of Dietetic Practice	2
FSHN 3600	Advanced Nutrition and the Regulation of Metabolism in Health and Disease	3
HS 1100	Personal and Consumer Health	3
KIN 2580	Principles of Physical Fitness and Conditioning	2

Total Credits 21-23**Acceptance into the B.S./M.S. PROGRAM is required BEFORE spring semester of the THIRD year.****Humanities and Ethics: 6-9 cr.**

Select 6 credits from approved Humanities list 6

Select 3 credits from approved Ethics list 3

Note: If ethics course is on the humanities list, it can meet both requirements.

Diet and Exercise remaining undergraduate courses to complete the bachelor's degree requirements: 42 cr.

HS 3800	Worksite Health Promotion	3
or HS 3500	Human Diseases	
ATR 2200	Basic Athletic Training	2
or HS 1050	First Aid and Emergency Care	
KIN 2590	Leadership Techniques for Fitness Programs	3
KIN 3450	Management of Health-Fitness Programs and Facilities	3
or FSHN 3920	Food and Nutrition Services Management	
KIN 3580	Exercise Physiology	3
KIN 3590	Exercise Physiology Lab	1

Select two from: 6

KIN 3550	Biomechanics	
KIN 3600	Sociology of Physical Activity and Health	
KIN 3720	Motor Control and Learning Across the Lifespan	
KIN 4580	Principles of Fitness Assessment and Exercise Prescription	
KIN 4800	Functional Anatomy	

KIN 4620	Medical Aspects of Exercise	3
FSHN 3610	Nutrition and Health Assessment	2
FSHN 3670	Medical Terminology for Health Professionals	1
FSHN 4300	U.S. Health Systems and Policy	2
FSHN 4660	Nutrition Counseling and Education Methods	3
HSPM 1330	Food Safety Certification	1
HSPM 3800	Food Production Management	3
HSPM 3800L	Food Production Management Experience	3
NUTRS 5630	Community Nutrition and Health *	3

Total Credits 42**Diet and Exercise graduate courses to complete the master's degree requirements: 36-40 cr.**

FSHN 5900C	Special Topics: Teaching **	1
FSHN 6810	Seminar **	1
FSHN 6820	Research Presentation and Discussion **	
NUTRS 5100	Advanced Nutrition and Metabolism in Health and Disease: Macronutrients	2
NUTRS 5110	Advanced Nutrition and Metabolism in Health and Disease: Micronutrients	2
NUTRS 5610	Medical Nutrition and Disease I	4
NUTRS 5630	Community Nutrition and Health *	3
NUTRS 5640	Medical Nutrition and Disease II *	4
KIN 5010	Research Methods in Physical Activity	3
KIN 5050	Research Laboratory Techniques in Exercise Physiology	3
KIN 5500	Advanced Physiology of Exercise I	3
or KIN 5510	Advanced Physiology of Exercise II	
STAT 5101	Statistical Methods for Data Analysis	4

Select 3-6 additional credits (FSHN students select 3 credits, KIN students select 6 credits) from: 3-6

KIN 5500	Advanced Physiology of Exercise I	
KIN 5510	Advanced Physiology of Exercise II	
KIN 5670	Exercise and Health: Behavior Change	
KIN 5700	Physical Activity Assessment for Health Related Research	
KIN 5730X	Impact of Physical Activity on Healthy Aging	

* Course counts toward both bachelor's and master's degrees.

** Requirement for students in the FSHN Department.

Go to FSHN courses.

Go to KIN courses.

Diet and Exercise, B.S./M.S.

First Year

Fall	Credits	Spring	Credits
FSHN 1100 or KIN 2520 <i>and</i> KIN 2530	1-2	FSHN 1670	3
CHEM 1630 or 1770	4	ENGL 2500	3
CHEM 1630L or 1770L	1	HS 1100	3
ENGL 1500	3	KIN 2580	2
LIB 1600	1	STAT 1010, 1040, or 2260	3-4
MATH 1400, 1430, 1600, or 1650	3-4		
PSYCH 1010	3		
16-18		14-15	

Second Year

Fall	Credits	Spring	Credits	Summer	Credits
BIOL 2550	3	FSHN 2650	3	SPCM 2120	3
BIOL 2550L	1	BIOL 2560	3		
KIN 3660	3	BIOL 2560L	1		
CHEM 2310	3	BBMB 3010	3		
CHEM 2310L	1	FSHN 2140	3		
KIN 2590	3	FSHN 1150 or 2150	1-2		
HSPM 1330	1	MICRO 2010	2		
15		16-17		3	

Third Year

Fall	Credits	Spring	Credits	Summer	Credits
FSHN 3400	2	Acceptance into the program required before spring of the third year		KIN 5990, FSHN 5990, KIN 6990, or NUTRS 6990	1-3
FSHN 3600	3	FSHN 3610	2	STAT 5101	4
KIN 3580	3	FSHN 3670	1		
KIN 3590	1	HSPM 3800	3		
ATR 2200 or HS 1050	2	HSPM 3800L	3		
PHYS 1150 or 1310	4	Select two courses from:	6-7		
Apply for admission to the BS/MS program by Oct. 1		KIN 3550, 3600, 3720, 4580, or 4800			
15		15-16		5-7	

Fourth Year

Fall	Credits	Spring	Credits	Summer	Credits
KIN 5050	3	KIN 5010	3	KIN 5990, FSHN 5990, KIN 6990, or NUTRS 6990	1-3
NUTRS 5610	4	KIN 5510	3		
NUTRS 5630 (Time conflict with NUTRS 5010 next fall)	3	NUTRS 5640	4		
FSHN 4300	2	FSHN 6820 (FSHN Dept)	0		

FSHN 6820 (FSHN Dept)	0 KIN 4620	3	
KIN 5500, 5510, 5670, 5700, or 5730X	3		
	15	13	1-3

Fifth Year

Fall	Credits	Spring	Credits
NUTRS 5100	2	NUTRS 5110	2
FSHN 6820 (FSHN Dept)	0	FSHN 6810 (FSHN Dept)	1
FSHN 5900C	1	KIN 3450 or FSHN 3920	3
Additional: KIN 5500, KIN 5510, KIN 5670, KIN 5700, KIN 5730X	3	KIN 6990, NUTRS 6990, KIN 5990, or FSHN 5990	2
HS 3500 or 3800	3	FSHN 4660	3
Humanities/ Ethics course	3	Humanities/ International Perspectives	3
	12	14	

Planned course offerings may change, and students need to check the online Schedule of Classes each term to confirm course offerings: <http://classes.iastate.edu/>. This sequence is only an example.

Dietetics (HHSCI)

Dietitians are nutrition experts who strive for optimal health and nutrition of individuals and the population. The curriculum for the dietetics program as well as the diet and exercise program meet the academic requirements of the Didactic Program in Dietetics and prepares students for a career in the field of dietetics. The program is accredited by the Accreditation Council for Education in Nutrition and Dietetics, the accrediting agency for the Academy of Nutrition and Dietetics.

Student Learning Outcomes

Upon graduation, students should be able to:

- Communicate effectively in their field of study using written, oral, visual and/or electronic forms.
- Demonstrate proficiency in ethical data collection and interpretation, literature review and citation, critical thinking and problem solving.
- Participate effectively in a group or team.
- Integrate creativity, innovation, or entrepreneurship in ways that produce value.
- Explain how human activities impact the natural environment and how societies are affected.
- Meet program specific learning outcomes for the Dietetics major.

Administered by the Department of Food Science and Human Nutrition

The dietetics undergraduate curriculum meets the academic requirements as the Didactic Program in Dietetics and is accredited by the Accreditation Council for Education in Nutrition and Dietetics, the accrediting agency of the Academy of Nutrition and Dietetics. Graduates of the program are eligible to apply to ACEND®-accredited graduate programs, or complete a graduate degree and an accredited dietetic internship, to be eligible to take the exam to become a Registered Dietitian Nutritionist. There is a \$30 fee for the verification statement of completion of the accredited dietetics program.

Total Degree Requirement: 120 cr.

Students must fulfill International Perspectives and U.S. Cultures and Communities requirements by selecting coursework from approved lists. These courses may also be used to fulfill other area requirements. Only 65 cr. from a two-year institution may apply to the degree which may include up to 16 technical cr.; 9 P-NP cr. of electives; 2.00 minimum GPA.

International Perspectives: 3 cr.

U.S. Cultures and Communities: 3 cr.

Communications and Library: 10 cr.

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
LIB 1600	Introduction to College Level Research	1
SPCM 2120	Fundamentals of Public Speaking	3
Total Credits		10

Humanities and Social Sciences: 6-12 cr.

Select Humanities course from approved list	3
PSYCH 1010 Introduction to Psychology	3
If CHHS student, select:	6
Additional Humanities course	
Additional Humanities or Social Science course	

Ethics: 3 cr.

FSHN 3420	World Food Issues: Past and Present	3

Mathematical Sciences: 6-8 cr.

Select at least 3 credits from: 3-4

MATH 1400	College Algebra	
MATH 1430	Preparation for Calculus	
MATH 1600	Survey of Calculus	
MATH 1650	Calculus I	
Select at least 3 credits from:		3-4
STAT 1010	Principles of Statistics	
STAT 1040	Introduction to Statistics	

Total Credits 6-8**Physical Sciences: 9 cr.**

Select from: 5

CHEM 1630 & 1630L	College Chemistry and Laboratory in College Chemistry or CHEM 1770 General Chemistry I and Laboratory in General Chemistry I & 1770L	
CHEM 2310	Elementary Organic Chemistry	3
CHEM 2310L	Laboratory in Elementary Organic Chemistry	1

Total Credits 9**Biological Sciences: 17-18 cr.**

BBMB 3010	Survey of Biochemistry	3
BIOL 2120	Principles of Biology II	3
BIOL 2120L	Principles of Biology Laboratory II	1
BIOL 2550	Fundamentals of Human Anatomy	3
BIOL 2550L	Fundamentals of Human Anatomy Laboratory	1
Select at least 3 credits from:		3-4

BIOL 2560 & 2560L	Fundamentals of Human Physiology and Fundamentals of Human Physiology Laboratory	
BIOL 3350	Principles of Human and Other Animal Physiology	
MICRO 2010	Introduction to Microbiology	2
MICRO 2010L	Introductory Microbiology Laboratory	1

Total Credits 17-18**Food Science and Human Nutrition: 44-45 cr.**

FSHN 1100	Professional and Educational Preparation	1
FSHN 1670	Introductory Human Nutrition and Health	3
FSHN 2140	Scientific Study of Food	3
FSHN 2150 or FSHN 1150	Advanced Food Preparation Laboratory Food Preparation Laboratory	1-2
FSHN 2420	The US Food System	3
FSHN 2650	Metabolism, Nutrition and Health	3
FSHN 3400	Foundations of Dietetic Practice	2

FSHN 3600	Advanced Nutrition and the Regulation of Metabolism in Health and Disease	3
FSHN 3610	Nutrition and Health Assessment	2
FSHN 3620	Nutrition and Health Throughout the Lifecycle	3
FSHN 3670	Medical Terminology for Health Professionals	1
FSHN 4110	Food Ingredient Interactions and Formulations	2
FSHN 4300	U.S. Health Systems and Policy	2
FSHN 4450	Strategies for Personal Food Waste Reduction	1
FSHN 4610	Medical Nutrition and Disease I	4
FSHN 4630	Community Nutrition and Health	3
FSHN 4640	Medical Nutrition and Disease II	4
FSHN 4660	Nutrition Counseling and Education Methods	3

Total Credits 44-45**Management: 10 cr.**

HSPM 1330	Food Safety Certification	1
HSPM 3800	Food Production Management	3
HSPM 3800L	Food Production Management Experience	3
FSHN 3920	Food and Nutrition Services Management	3

Total Credits 10**Electives: 0-15 cr. Select from any university coursework to earn at least 120 total credits.**

Go to FSHN courses.

Dietetics, B.S.**First Year**

Fall	Credits Spring	Credits
FSHN 1100	1 FSHN 1670	3
CHEM 1630 or 1770	4 BIOL 2120	3
CHEM 1630L or 1770L	1 BIOL 2120L	1
MATH 1400, 1430, 1600, or 1650	3-4 HSPM 1330	1
ENGL 1500	3 PSYCH 1010	3
LIB 1600	1 Humanities/Social Sci. (CHHS) or Elective (CALS) course	3
Humanities	3	

16-17 **14****Second Year**

Fall	Credits Spring	Credits
CHEM 2310	3 FSHN 2650	3
CHEM 2310L	1 FSHN 2420	3
BIOL 2550	3 BIOL 2560 and 2560L, or BIOL 3350	3-4

BIOL 2550L	1 BBMB 3010	3
ENGL 2500	3 MICRO 2010	2
STAT 1010 or 1040	3-4 MICRO 2010L	1

14-1515-16

Third Year

Fall	Credits Spring	Credits
FSHN 3400	2 FSHN 3610	2
FSHN 3600	3 FSHN 3620	3
FSHN 2140	3 FSHN 3670	1
FSHN 2150 or 1150	1-2 HSPM 3800	3
SPCM 2120	3 HSPM 3800L	3
FSHN 3420	3 Humanities course (CHHS) or Elective* (CALS)	3

15-1615

Fourth Year

Fall	Credits Spring	Credits
FSHN 4610	4 FSHN 4640	4
FSHN 4630	3 FSHN 4450	1
FSHN 4110	2 FSHN 4300	2
FSHN 4660	3 FSHN 3920	3
U.S. Cultures and Communities	3 Electives *	6

1516

Footnotes

* Choose elective courses to total equal to or greater than 120 credits. This sequence is only an example, and the number of credits taken each semester should be based on the individual student's situation. Factors that may affect credit hours per semester include student ability, employment, health, activities, and grade point consideration.

More information on minors offered through Food Science and Human Nutrition can be found here: <http://catalog.iastate.edu/collegeofagricultureandlifesciences/foodscienceandhumannutrition/#undergraduateminortext>.

The Department of Food Science and Human Nutrition offers a Master of Professional Practice in Dietetics (M.P.P.D). More information on the program can be found here: <http://catalog.iastate.edu/collegeofhumansciences/professionalpracticeindietetics/>.

Digital Health Overview

The Department of Kinesiology offers a 12-24 month, online, 30-credit professional master's degree in Digital Health. The overall academic goal is to prepare students to use information and communications technologies in health professions to manage illnesses and health risks, enhance the efficiency of treatment delivery, make interventions more personalized and precise, and promote health and wellness. Students will be taught digital health knowledge and skills, including the use of wearable devices, mobile health, telehealth, and health information technology. They will learn to incorporate digital technologies into the delivery of exercise and health interventions, analyze individual and population-level data to develop efficient solutions for target populations, and integrate innovative technologies to target multiple layers of influence to empower patients and populations in the self-management of their health and the health of their families. This is a coursework-only program of study.

Elevate your career with the cutting-edge online master of digital health – a program designed to empower you with expertise in information and communications technologies within the health professions, health systems, and industry. Guided by distinguished faculty, the comprehensive curriculum explores wearable devices, mobile health, telehealth, and health information technology.

Whether you are seeking job promotion, a career change, or to advance your knowledge for immediate application in your current role, the program is catered to working professionals and is offered fully online to provide flexibility.

This online master's degree can be completed in just one year, offering the flexibility to balance coursework with your professional commitments. Designed for working professionals, you can progress at your own pace.

For more information, visit https://www.grad-college.iastate.edu/programs/digital_health (https://www.grad-college.iastate.edu/programs/digital_health/)

Early Childcare Education and Programming Curriculum in Early Childcare Education and Programming

The **Early Childcare Education and Programming (ECP)** curriculum is designed to prepare graduates to work in a variety of early care and education programs that serve young children and their families. Some of the programs are childcare centers and homes, infant/toddler and preschool programs, Head Start programs, and before and after-school

programs for children ages birth to eight. The curriculum is 100% online and flexible by nature to accommodate working adults.

The ECP curriculum is designed to provide content for the final two years of a student's program; the content is focused specifically on topics directly relevant to the major. This is an online program offered through a collaboration of universities called IDEA: and Online Higher Education Alliance. The program within IDEA is known as Early Care and Education for a Mobile Society. For more information see <https://www.idea.edu/program/early-care-and-education-in-a-mobile-society> (<https://www.idea.edu/program/early-care-and-education-in-a-mobile-society/>)

Students will complete a total of 120 credits for the major, 48 of which are specific to the ECP curriculum. These 48 credit hours are comprised of 12 core courses and 2 practicum courses. The final practicum will be a 6-credit capstone experience. Students must complete 30 credits of college work, a lifespan development course, and have a 2.5 GPA to be admitted to ECP. If students prefer to be admitted to ISU before being admitted to the ECP major, they can enroll as Pre ECP (PECP) students until they are eligible for the ECP major. Once admitted as an ECP major, full time students can complete the program in 27 months.

This degree does not lead to teacher licensure. Students interested in a license to teach in public schools can refer to the Early Childhood Education - Unified (ECE) program.

For more information about the ECP program at Iowa State, see <https://online.hs.iastate.edu/early-childcare-programming> (<https://online.hs.iastate.edu/early-childcare-programming/>).

Student Learning Outcomes

Upon successful completion of the ECP bachelor's degree program, students will be able to:

- Use their understanding of young children's characteristics and needs, and of multiple interacting influences on children's development and learning, to create environments that are healthy, respectful, supportive, and challenging for each child.
- Understand how successful early childhood education depends upon partnerships with children's families and communities and value the importance and complex characteristics of children's families and communities.
- Use child observation, documentation, and other forms of assessment, in partnership with families and other professionals, to positively influence the development of every child.
- Use their knowledge of academic disciplines to design, implement, and evaluate experiences that promote positive development and learning for every young child.

- Identify and conduct themselves as a member of the early childhood profession, using ethical guidelines and other professional standards related to early childhood practice.
- Demonstrate, through sequential practicum experiences and clinical practice, the knowledge, skills, and professional dispositions necessary to promote the development and learning of young children across the entire developmental period of early childhood.

Administered by the Department of Human Development and Family Studies. Leading to the degree Bachelor of Science.

Total credits required: 120

Human Development and Family Studies Core: 3 credits

HDFS 1020	Human Development	3

Early Childcare Education and Programming Professional Core: 48 credits

Pre-practicum I

ECP 2010	Child Development - Ages Birth to 3	3
ECP 2020	Child Development - Ages 4 to 8	3
ECP 3050	Professional Development	3

Pre-practicum II

ECP 4120	Development of Curriculum for Children Ages Birth to 3 *	3
ECP 4130	Development of Curriculum for Children Ages 4 to 8 *	3
ECP 4240	Assessing Young Children and Their Environments to Enhance Development *	3
ECP 4250	Understanding and Adapting for Developmental Differences *	3
ECP 4400	Practicum II - Curriculum Development and Implementation	3

Professional Development

ECP 3060	Health, Safety, and Nutrition	3
ECP 3070	Child Guidance and Classroom Environments	3
ECP 3220	Diversity in the Lives of Young Children and Families	3
ECP 3230	Working with Families	3
ECP 3240	Technology and Young Children	3
ECP 4420	Administration and Supervision in Early Childhood Settings	3
ECP 4600	Practicum III - Capstone Experience	6

Total Credits 48

*** Must be completed prior to enrollment in Practicum II (ECP 4400)**

Electives: 31-32 credits

Communications and Library: 13 credits

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
LIB 1600	Introduction to College Level Research	1
One of the following:		3
SPCM 2120	Fundamentals of Public Speaking	
COMST 2110	Interpersonal Communication	
COMST 2180	Communication and Conflict Management	
One of the following:		3
ENGL 3020	Business Communication	
ENGL 3090	Proposal and Report Writing	
ENGL 3140	Technical Communication	
Total Credits		13

Natural Sciences and Mathematical Disciplines: 9-10 credits

One of the following:		3-4
STAT 1010	Principles of Statistics	
MATH 1040	Introduction to Probability	
MATH 1050	Introduction to Mathematical Ideas	
MATH 1400	College Algebra	
MATH 1500	Discrete Mathematics for Business and Social Sciences	
MATH 1650	Calculus I	
Select from Biological or Physical Sciences courses		6
Total Credits		9-10

Social Sciences: 9 credits

Select from Approved General Education options.

Humanities: 6 credits

Select from Approved General Education options.

Total credits: 120 credits

Early Childhood Education - Unified

The degree in early childhood education – unified (ECE) is Administered by the Department of Human Development and Family Studies.

The ECE curriculum prepares graduates to teach young children (birth through age 8/third grade) and work with their families. Students meet performance outcomes through coursework and a variety of practicum experiences with infants/toddlers, preschoolers, and primary school age children (K-3) with varying abilities and needs.

Graduates can be recommended for licensure to the Iowa Board of Educational Examiners. The curriculum meets requirements for candidates to seek a teaching endorsement in PK-3 Inclusive Settings, (1001) and PK-K Early Childhood Special Education (262), which permit individuals to teach general and special education for children from birth through third grade.

Student Learning Outcomes

Graduates of the Early Childhood Education program will meet the following learning objectives, as defined by the InTASC standards for teacher preparation.

Standard 1: Learner Development

The student understands how learners grow and develop, recognizing that patterns of learning and development vary individually within and across the cognitive, linguistic, social, emotional, and physical areas, and designs and implements developmentally appropriate and challenging learning experiences.

Standard 2: Learning Differences

The student uses understanding of individual differences and diverse cultures and communities to ensure inclusive learning environments that enable each learner to meet high standards.

Standard 3: Learning Environments

The student works with others to create environments that support individual and collaborative learning, and that encourage positive social interaction, active engagement in learning, and self-motivation.

Standard 4: Content Knowledge

The student understands the central concepts, tools of inquiry, and structures of the discipline(s) he or she teaches and creates learning experiences that make the discipline accessible and meaningful for learners to assure mastery of the content.

Standard 5: Application of Content

The student understands how to connect concepts and use differing perspectives to engage learners in critical thinking, creativity, and collaborative problem solving related to authentic local and global issues.

Standard 6: Assessment

The student understands and uses multiple methods of assessment to engage learners in their own growth, to monitor learner progress, and to guide the teacher's and learner's decision making.

Standard 7: Planning for Instruction

The student plans instruction that supports every student in meeting rigorous learning goals by drawing upon knowledge of content areas, curriculum, cross-disciplinary skills, and pedagogy, as well as knowledge of learners and the community context.

Standard 8: Instructional Strategies

The student understands and uses a variety of instructional strategies to encourage learners to develop deep understanding of content areas and

their connections, and to build skills to apply knowledge in meaningful ways.

Standard 8A: Technology

The student integrates current and emerging technology in instruction to encourage student creativity, problem solving, collaboration, and digital literacy. Teachers practice and advocate safe, legal, and responsible use of information and technology.

Standard 9: Professional Learning and Ethical Practice

The student engages in ongoing professional learning and uses evidence to continually evaluate his/her practice, particularly the effects of his/her choices and actions on others (learners, families, other professionals, and the community), and adapts practice to meet the needs of each learner.

Standard 10: Leadership and Collaboration

The student seeks appropriate leadership roles and opportunities to take responsibility for student learning, to collaborate with learners, families, colleagues, other school professionals, and community members to ensure learner growth, and to advance the profession.

Curriculum in Early Childhood Education – Unified Degree Requirements

122 total credits required

Professional Education core: 15 credits

EDUC 2010	Educational Technologies in the PK-6 Classroom **	3
EDUC 2050	Social Foundations of Education in the United States: Early Childhood and Elementary Education	3
EDUC 3320	Educational Psychology of Early Childhood and Elementary Education **	3
EDUC 4050	Teaching and Learning in a Pluralistic Society: Early Childhood and Elementary	3
SPED 2500	Education of the Exceptional Learner **	3
Total Credits		15

**Must receive a "C" or above

Preprimary Inclusive: 24 credits

HDFS 2400	Children's Literature **	3
HDFS 3400	Infant-Toddler Curriculum and Assessment **	4
HDFS 3420	Social-Emotional Development and Guidance **	3
HDFS 3430	Preschool Curriculum and Assessment **	4
HDFS 3450	Inclusive Teaching and Interaction Strategies **	3
HDFS 4550	Curriculum and Interventions: Ages 3 through 6 Years **	4
HDFS 4560	Family Partnerships in Early Childhood **	3
Total Credits		24

**Must receive a "C" or above

Primary Inclusive: 20 credits

EDUC 2450	Landscape of Teaching **	3
EDUC 3770	Foundations of Literacy	4
EDUC 4330	Teaching Social Studies in the Primary Grades **	2
EDUC 4380	Teaching Mathematics in the Primary Grades **	2
EDUC 4390	Teaching Science in the Primary Grades **	2
EDUC 4680F	Pre-Student Teaching Experience III: Primary Grades Inclusive, Literacy **	1
EDUC 4680G	Pre-Student Teaching Experience III: Primary Grades Inclusive, Mathematics **	1
EDUC 4680I	Pre-Student Teaching Experience III: Primary Grades Inclusive, Science **	1
SPED 4050	Assessment and Instructional Methods in Inclusive Primary Settings (K-3) **	4
SPED 4580	Pre-Student Teaching Experience III: Mild/Moderate Disabilities in Primary Grades (K-3) **	1
Total Credits		21

**Must receive a "C" or above

Student Teaching **: 16.5 credits

EDUC 4160A	Supervised Student Teaching - Elementary: Primary grades (K-3)	8
HDFS 4170	Supervised Student Teaching: Early Childhood Special Education	8
HDFS 4180	Reflective Supervision	0.5
Total Credits		16.5

**Must receive a "C" or above

Orientation: 3 credits

HDFS 1100	Freshman Learning Community Orientation	1
or HDFS 1110	New Transfer Student Seminar	
HDFS 2080	Foundations of Early Childhood Professions	2
Total Credits		3

Human Development and Family Studies: 4 credits

HDFS 2240	Child Development **	3
HDFS 2240L	Child Development Practicum	1
Total Credits		4

Communications and Library: 10 credits

ENGL 1500	Critical Thinking and Communication **	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition **	3
LIB 1600	Introduction to College Level Research	1

Communication course from approved general education options list	3
Total Credits	10

**Must receive a "C" or above

Biological Sciences, Physical Sciences, Mathematics and Health: 14 credits

MATH 1950	Mathematics for Elementary Education I *	3
MATH 1960	Mathematics for Elementary Education II *	3
HS 1050	First Aid and Emergency Care	2
Biological Sciences course from approved general education options list		3
Physical Sciences course from approved general education options list		3
Total Credits		14

*Must receive a "C-" or above

Social Sciences: 9 credits

HDFS 1020	Human Development	3
One of the following:		3
HIST 2210	Survey of United States History I	
HIST 2220	Survey of United States History II	
POLS 1110	Introduction to American Government	
Social Sciences course from approved ECE list		3
Total Credits		9

Humanities: 6 credits

Humanities courses from approved ECE list	6
Total Credits	6

Electives: Credits left to get to 122 total credits Total Credits: 122

U.S. Cultures and Communities and International Perspectives Requirement: Students in early childhood education – unified fulfill the U.S. Cultures and Communities and International Perspectives Requirements by choosing three credits of coursework from university-approved Humanities or Social Sciences included on the approved general education options list.

The courses listed in this section are approved general education course options for this major.

Communication Skills: 3 credits

COMST 2100	Communication and U.S. Diversity	3
COMST 2110	Interpersonal Communication	3

COMST 2140	Professional Communication	3
COMST 2180	Communication and Conflict Management	3
SPCM 2120	Fundamentals of Public Speaking	3

Natural Sciences and Mathematics: 6 credits. Coursework designed to facilitate students' understanding of the structure and behavior of the natural world, appreciate mathematics as a valuable tool of the sciences, and an intrinsically important way of thinking.

Biological Sciences: 3 credits

ANTHR 2020	Human Origins	3
BIOL 1010	Introductory Biology	3
BIOL 1550	Human Biology	3
BIOL 1730	Environmental Biology	3
BIOL 2110	Principles of Biology I	3
BIOL 2550	Fundamentals of Human Anatomy	3

Physical Sciences: 3 credits

ASTRO 1200	The Sky and the Solar System	3
ASTRO 1500	Stars, Galaxies, and Cosmology	3
CHEM 1600	Chemistry in Modern Society	3
CHEM 1630	College Chemistry ((4 credits))	4
GEOL 1000	How the Earth Works	3
GEOL 1010	Environmental Geology: Earth in Crisis	3
MTEOR 2060	Introduction to Weather and Climate	3
PHYS 1010	Physics for the Nonscientist	3
PHYS 1020L	Physical Sciences for Elementary Education	3

Social Sciences: 9 credits. Coursework designed to help students develop an understanding of the principal methods of studying human behavior and an understanding of the structure and functioning of institutions.

AESHM 4210	Developing Global Leadership: Maximizing Human Potential	3
AFAM 3300	Ethnic and Race Relations	3
AMIN 3100	Contemporary Topics in American Indian Studies	3
AMIN 3150	Archaeology of North America	3
AMIN 3220	Peoples and Cultures of Native North America	3
Anthropology (ANTHR) - except 2020		
Economics (ECON)		
FSHN 3420	World Food Issues: Past and Present	3
HDFS 2390	Consumer Issues	3
HDFS 2490	Family Studies	3
HDFS 2760	Human Sexuality	3
HDFS 3210	Happiness Across the Lifespan	3

HDFS 3670	Family Stress, Abuse, and Resilience	3
HDFS 3770	Aging and the Family	3
HDFS 3950	Children, Families, and Public Policy	3
INTST 2350	Introduction to International Studies	3
LING 2190	Introduction to Linguistics	3
LING 4710	Language and Reading Development in Children	3
Political Science (POLS)		
Psychology (PSYCH) - except 1310, 3320/3330		
Sociology (SOC), including Criminal Justice (C J)		
WGS 2010	Introduction to Women's and Gender Studies	3
WGS 2030	Introduction to Lesbian Communities	3
WGS 3010	International Perspectives on Women and Gender	3
ENVS 3200	Ecofeminism	3
WGS 3270	Gender and Sexualities in Society	3
WGS 3280	Sociology of Masculinities and Manhood	3
WGS 3460	Psychology of Women	3
AFAM 3500	Women of Color in the U.S	3
WGS 3850	Women in Politics	3
FDM 1650	Fashion, Appearance, and Diversity in U.S. Society	3
FDM 3620	Cultural Perspectives of Global Dress	3
FDM 4670	Consumer Studies in Apparel and Fashion Products	3

Humanities: 6 credits. Coursework designed to assist students to develop an understanding of human cultural heritage and history, and an appreciation of reasoning and the aesthetic value of human creativity.

AESHM 3420	Aesthetics of Consumer Experience	3
AFAM 2010	Introduction to African American Studies	3
AFAM 3340	Africana Religions	3
AFAM 3470	African American Literature	3
AFAM 3530	History of African Americans I	3
AFAM 3540	History of African Americans II	3
AMIN 2100	Introduction to American Indian Studies	3
AMIN 2400	Introduction to American Indian Literature	3
AMIN 3460	American Indian Literature	3
ANTHR 2300	Globalization and the Human Condition	3
ANTHR 3400	Magic, Witchcraft, and Religion	3
ARCH 2210	Histories and Theories of Architecture to 1750	3
ARCH 4200	Topics in American Architecture	3
Art History (ART H)		
Classical Studies (CL ST)		
DANCE 2700	Dance Appreciation	3
DANCE 3600	History and Philosophy of Dance	3

History (HIST) except 2210 or 2220		
HSPM 2600	Global Tourism Management	3
Literature (ENGL) except 2050		
MUSIC 1020	Introduction to Music Listening	3
MUSIC 3020	Masterpieces of Music and Art in Western Culture	3
MUSIC 3040	History of American Rock 'n' Roll	3
MUSIC 3830	History of Music I	3
MUSIC 3840	History of Music II	3
Philosophy (PHIL)		
Religious Studies (RELIG)		
THTRE 1060	Introduction to the Performing Arts	3
THTRE 1100	Theatre and Society	3
THTRE 4650	Theatre History: Ancient to 19th Century	3
THTRE 4660	Theatre History: 19th Century to Present	3
USLS 2110	Introduction to U.S. Latino/a Studies	3
WGS 2010	Introduction to Women's and Gender Studies	3
WGS 3360	Religion, Sex and Gender	3
WGS 3380	Feminist Philosophy	3
WGS 3450	Women's Literature	3
WGS 3700	Studies in English Translation	
WGS 3740	Sex, Gender, and Culture in the Ancient Mediterranean World	3
WGS 3860	History of Women in America	3
World Languages and Cultures (ARABC, CHIN, FRNCH, GER, GREEK, RUS, SPAN)		
FDM 3540	Fashion History I: Prehistoric to Mid-19th Century	3
FDM 3560	Fashion History II: Mid-19th Century to the Present	3

Early Childhood Education - Unified, B.S.

Freshman

Fall	Credits Spring	Credits
HDFS 1020	3 Humanities Option *	3
HDFS 1100 or 1110	1 HDFS 2080	2
LIB 1600	1 Select one of the following:	3
EDUC 2050	3 HIST 2210	
ENGL 1500	3 HIST 2220	
Social Science Option *	3 POLS 1110	
	MATH 1950	3
	SPED 2500	3
	14	14

Sophomore

Fall	Credits Spring	Credits
HDFS 2400	3 EDUC 2450	3

HDFS 3420	3 EDUC 3320	3
MATH 1960	3 HDFS 2240	3
ENGL 2500	3 HDFS 2240L	1
EDUC 2010	3 Biological Sciences Option*	3
Physical Sciences Option*	3 Communication Option*	3
	Apply to Educator Preparation program	
	18	16

Junior

Fall	Credits Spring	Credits
EDUC 3770 ^B	4 EDUC 4390 ^B	2
EDUC 4380 ^B	2 EDUC 4680I ^B	1
EDUC 4680F ^B	1 SPED 4050 ^B	4
EDUC 4680G ^B	1 SPED 4580 ^B	1
EDUC 4330	2 EDUC 4050	3
HDFS 3400	4 HDFS 3430	4
	HDFS 3450	3
	14	18

Senior

Fall	Credits Spring	Credits
HDFS 4550	4 EDUC 4160A ^B	8
HDFS 4560	3 HDFS 4170	8
HS 1050	2 HDFS 4180	.5
Humanities course	3	
Electives, if needed to equal	.5	
122 total credits		
Apply to graduate		
Apply to student teaching		
	12.5	16.5

This sheet provides a guide to the sequence of HDFS and EDUC courses; courses adhere to a prescribed sequence of semesters. Your academic advisor will help you develop an individual long-range plan.

B Block of courses listed together in the semester must be taken concurrently as sequenced

* See approved general education options list of courses for courses in Biological Sciences, Humanities, Physical Sciences and Social Sciences

ISU requires a 3 credit U.S. Cultures and Communities course (satisfied by HDFS 2400) and a 3 credit international perspective course (usually met through a University approved humanities or social science options from the approved general education options list).

Education Secondary

Secondary Major in Education

A secondary major in Education at Iowa State University prepares candidates to teach at the middle school and high school levels. K-12/Secondary Educator Preparation Programs eligible to pursue the secondary major in Education are:

- English Education
- History/Social Sciences Education - History
- History/Social Sciences Education - Political Science
- Mathematics Education
- Science Education – Biology
- Science Education – Chemistry
- Science Education – Earth Science
- Science Education – Physics
- World Languages and Cultures Education – French
- World Languages and Cultures Education – German
- World Languages and Cultures Education – Spanish

Additional Endorsements and Minors

Candidates pursuing the secondary major in Education have the opportunity to pursue additional endorsements and minors:

- K-12 Coaching Endorsement
- K-12 English as a Second Language Endorsement
- 5-12 Reading Endorsement
- Additional Science Endorsements
 - 5-12 Basic Science
- Additional Social Sciences Endorsements
 - 5-12 American Government
 - 5-12 Anthropology
 - 5-12 Economics
 - 5-12 Psychology
 - 5-12 Sociology
- Learning Technologies Minor
(See <https://education.iastate.edu/find-your-major/learning-technologies-minor/>)

Specific program requirements can be found within each department that houses the endorsement. Information on K-12 Coaching, K-12 English as a Second Language, 5-12 Reading, and K-12 Speech and Theatre can be found at: <https://iastate.app.box.com/s/m4tr3ogr9ouwmiubz5dhv9catryr2jqf>. (<https://iastate.app.box.com/s/m4tr3ogr9ouwmiubz5dhv9catryr2jqf/>)

Student Learning Outcomes

Upon graduation, students should be able to:

The Learner and Learning

Standard #1: Learner Development.

Understand how learners grow and develop, recognizing that patterns of learning and development vary individually within and across the cognitive, linguistic, social, emotional, and physical areas, and designs and implements developmentally appropriate and challenging learning experiences.

Standard #2: Learning Differences.

Use understanding of individual differences and diverse cultures and communities to ensure inclusive learning environments that enable each learner to meet high standards.

Standard #3: Learning Environments.

Work with others to create environments that support individual and collaborative learning, and that encourage positive social interaction, active engagement in learning, and self-motivation.

Content

Standard #4: Content Knowledge.

Understand the central concepts, tools of inquiry, and structures of the discipline(s) he or she teaches and creates learning experiences that make the discipline accessible and meaningful for learners to assure mastery of the content.

Standard #5: Application of Content.

Understand how to connect concepts and use differing perspectives to engage learners in critical thinking, creativity, and collaborative problem solving related to authentic local and global issues.

Instructional Practices

Standard #6: Assessment.

Understand and use multiple methods of assessment to engage learners in their own growth, to monitor learner progress, and to guide the teacher's and learner's decision making.

Standard #7: Planning for Instruction.

Plan instruction that supports every student in meeting rigorous learning goals by drawing upon knowledge of content areas, curriculum, cross-disciplinary skills, and pedagogy, as well as knowledge of learners and the community context.

Standard #8: Instructional Strategies.

Understand and use a variety of instructional strategies to encourage learners to develop deep understanding of content areas and their connections, and to build skills to apply knowledge in meaningful ways.

Standard #8A: Technology.

Integrate current and emerging technology in instruction to encourage student creativity, problem solving, collaboration, and digital literacy.

Teachers practice and advocate safe, legal, and responsible use of information and technology.

Professional Responsibility

Standard #9: Professional Learning and Ethical Practice.

Engage in ongoing professional learning and uses evidence to continually evaluate his/her practice, particularly the effects of his/her choices and actions on others (learners, families, other professionals, and the community), and adapts practice to meet the needs of each learner.

Standard #10: Leadership and Collaboration.

Seek appropriate leadership roles and opportunities to take responsibility for student learning, to collaborate with learners, families, colleagues, other school professionals, and community members to ensure learner growth, and to advance the profession.

Curriculum in Secondary Major in Education

Educator Preparation Program Admission Requirements

In addition to being admitted to Iowa State University and departmental programs/majors, educator preparation candidates must be admitted to the Educator Preparation Program prior to beginning advanced coursework.

Educator Preparation Program Admission Requirements are provided in Educator Preparation Policy.

- Decision Point 1 - Admission to the Educator Preparation Program (<https://iastate.box.com/s/f2xplqjfa805a9imk8wyr7dem9vjabz4/>)
- Decision Point 1 - Early Admission to the Educator Preparation Program for Transfer Students (<https://iastate.box.com/s/saysyv1to63q0bzwvtwzwtsp3s5kxl2/>)

In order to be eligible to student teaching (EDUC 4170), candidates must have completed all degree program requirements and content specific coursework.

- Decision Point 2 - Requirements (<https://iastate.box.com/s/rl301lpd66te2lq53gzsebgza3q9jn1c/>) (<https://iastate.box.com/s/rl301lpd66te2lq53gzsebgza3q9jn1c/>) Students Must Meet Prior to Student Teaching (<https://iastate.box.com/s/rl301lpd66te2lq53gzsebgza3q9jn1c/>)

In order to be recommended for licensure, candidates must have completed all degree program requirements and be considered an educator preparation program completer.

- Decision Point 3 - Recommendation for Licensure (<https://iastate.box.com/s/lxzk584p9y4e4zgck631cwns111qjq0/>)

All Educator Preparation Program candidates must complete the professional core coursework (information found under each program) and required pedagogy and field experience coursework for their program. In addition, all prospective teachers are required to meet general education requirements as a part of their preparation. They must complete studies in the following general education groups. General education courses may be found in many departments. Credits listed are minimum requirements. Specific departments and/or colleges may require specific coursework to meet these requirements or additional credits. Credits used to satisfy these general education requirements typically satisfy department and college general education requirements.

Educator Preparation General Education Requirements

Natural Sciences	6
Mathematics or Statistics	3
Social Sciences	9
Humanities	6
Communication Skills Must include ENGL 1500 and 2500 or an equivalent	9
Library Skills LIB 1600	1
HDFS 1020 or PSYCH 2300	3
One course in American history or government	
One course that develops interpersonal or group presentation skills	

NOTE: Specific majors will provide approved options to meet these requirements.

Secondary major in Education Requirements for English, Social Sciences, Mathematics, World Languages, and Science Education Candidates
Educator Preparation Field Experiences:

EDUC 2800L	Pre-Student Teaching Experience I: Secondary Education	0.5
EDUC 3800A	Pre-Student Teaching Experience II: Core Experience	2
EDUC 4170	Student Teaching	16
EDUC 4800	Pre-Student Teaching Experience III	2

Educator Preparation Professional Core Coursework:

EDUC 2020	Educational Technologies in the 7-12 Classroom	3
EDUC 2040	Social Foundations of Education in the United States: Secondary	3

EDUC 2190	Orientation to Teacher Education: English, FCS, History, Math, Science and World Language Majors	1
PSYCH 3330	Educational Psychology	3
EDUC 3950	Teaching Disciplinary Literacy	3
EDUC 4060	Teaching and Learning in a Pluralistic Society: Secondary	3
SPED 4010	Teaching Secondary Students with Exceptionalities in General Education	3

Please check departmental information IN REGARD TO specific content and methods coursework.
Education Studies

A degree in Education Studies, administered by the School of Education, prepares undergraduate students for professions within the field of education, but outside of K-12 classroom teaching. This non-licensure degree seeks to equip educators across the education landscape with the ability to design, implement, and assess educational programming that advances teaching and learning for all.

As part of this proposed degree program, students would take classes that meet ISU general education and college-level requirements along with SOE foundational education courses for the first two years to provide a grounding in education theory and practice. In the final two years, students in this new degree program would then pursue a parallel track that would include coursework focused on one of three emphasis areas (Teaching, Learning & Leadership, Innovation, Technology, & Society, or STEM) before participating in a semester-long internship related to their career goals.

The following emphasis areas in this degree are intended to be multidisciplinary and flexible in nature to reflect current trends and issues in education in order to prepare students for a broad and ever-changing education landscape.

- **Teaching, Learning, and Leadership** – this emphasis area is for students who are interested in teaching and learning across a range of educational settings, contexts, and learners. Students in this emphasis area can pursue a variety of careers related to education including international education, informal or community-based education such as museum or library educators, support for K-12 classrooms, or educational programming, policy, or consulting.
- **Innovation, Technology, and Society** - this emphasis area is for students who are interested in the intersection of innovation, design, educational technology, and the impact on society. This concentration would build upon expertise of education technology faculty within the SOE and with collaborations across campus to explore current technology-based innovations and learning technologies in educational settings, such as game-based learning, computer science, artificial intelligence, and human computer

interaction for educators. Students in this emphasis area could pursue careers in instructional design, technology-based learning, educational or technology firms, online learning, educational consulting, or educational entrepreneurship.

- **Science, Technology, Engineering, and Mathematics (STEM)** - this emphasis area is for students who are interested in learning and teaching as it relates to Science, Technology, Engineering and Mathematics (STEM) contexts and environments. This concentration seeks to equip educators across STEM fields with the ability to design, implement, and assess research-based educational programs that advance the goals of STEM education for all involved. Students in this emphasis area could pursue careers in museums, science or nature centers, out of school STEM programs and camps, curriculum development and testing, educational programming for STEM-related industries, such as business or healthcare.

Student Learning Outcomes

Students pursuing the education studies degree program would engage with the following objectives to build a well-rounded foundation that would allow them to make meaningful contributions to the field of education.

1. Study various educational systems, including their structures, policies, and practices.
2. Build foundational knowledge and understanding of educational theory, research, and practice to better understand how people learn and how to facilitate effective learning experiences.
3. Learn to design and implement engaging and effective educational materials and programming including innovative technology-based learning.
4. Participate in a program of study that aligns with career aspirations and interests that includes a semester-long internship experience.

Degree requirements

To receive a Bachelor of Science degree in education studies, a student must complete a minimum of 120 credits.

- International Perspective: 3 credits
- U.S. Cultures and Communities: 3 credits

Communication/Library: 10 credits

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
LIB 1600	Introduction to College Level Research	1
Approved Communications Course		3
Total Credits		10

Humanities and Social Sciences: 15 credits

PSYCH 2300	Developmental Psychology	3
Approved Social Science Courses (2 Courses)		6
Approved Humanities Courses (2 Courses)		6
Total Credits		15

Mathematics and Sciences: 15 credits

Approved Mathematics Courses (2 Courses)		6
Approved Science Courses (3 Courses)		9
Total Credits		15

Education Studies Core: 29 credits

Choose from one of the following:		3
EDUC 2010	Educational Technologies in the PK-6 Classroom	
EDUC 2020	Educational Technologies in the 7-12 Classroom	
Choose from one of the following:		3
EDUC 2040	Social Foundations of Education in the United States: Secondary	
EDUC 2050	Social Foundations of Education in the United States: Early Childhood and Elementary Education	
Choose from one of the following:		3
SPED 2500	Education of the Exceptional Learner	
SPED 4010	Teaching Secondary Students with Exceptionalities in General Education	
SPED 2100X	Disability in a Diverse Society	
EDUC 3320	Educational Psychology of Early Childhood and Elementary Education	3
Choose from one of the following:		3
EDUC 2450	Landscape of Teaching	
EDUC 4260	Principles of Secondary Education	
EDUC 3550X	Teaching Multilingual Learners	3
EDUC 3690X	Dilemmas in Education	3
Choose from one of the following:		3
EDUC 4050	Teaching and Learning in a Pluralistic Society: Early Childhood and Elementary	
EDUC 4060	Teaching and Learning in a Pluralistic Society: Secondary	
Choose from one of the following:		3
EDUC 3950	Teaching Disciplinary Literacy	
EDUC 4590	Critical Approaches to Teaching Children's and Adolescent Literature	
Approved Learning Community Course		1

Approved Initial Field Experience Course	1
Total Credits	29

Emphasis Area Electives: 36 credits

- Teaching, Learning, and Leadership
- Technology, Design, and Innovation
- Science, Technology, Engineering, and Mathematics (STEM)

Internship: 15 credits

Four Year Plan

Freshman

Fall	Credits Spring	Credits
Freshman Learning Community	1 Level 1 Field Experience (EDUC 2800)	1
ENGL 1500	3 Education of the Exceptional Learner (SPED 2100/2500/4010)	3
LIB 1600	1 Humanities Option	3
Social Foundations of Education (EDUC 2040/2050)	3 Math Option	3
Social Science	3 Science Option	3
Science Option	3 Social Science Option	3
	14	16

Sophomore

Fall	Credits Spring	Credits
Intro to Educational Technologies (EDUC 2010/2020)	3 Landscapes of Teaching (EDUC 2450/4260)	3
ENGL 2500	3 Educational Psychology (EDUC 3320/3330)	3
Math Option	3 CHS Communications Option	3
Science Option	3 Humanities Option	3
Social Science Option	3 Emphasis Area Elective	3
	15	15

Junior

Fall	Credits Spring	Credits
EDUC 3690X	3 Introduction to Social Justice (EDUC 4050/4060)	3
Emphasis Area Elective	3 Emphasis Area Elective	3
Emphasis Area Elective	3 Emphasis Area Elective	3
Emphasis Area Elective	3 Emphasis Area Elective	3

Emphasis Area Elective	3 Emphasis Area Elective	3
	15	15

Senior

Fall	Credits Spring	Credits
Literature and Learning (EDUC 3950/4590)	3 Semester Long Internship	15
EDUC 3550X	3	
Emphasis Area Elective	3	
Emphasis Area Elective	3	
Emphasis Area Elective	3	
	15	15

Total Credits: 120

** In year 3, students have completed ISU & CHS gen ed requirements and SOE core courses

They would choose one of three Education Studies emphasis areas:

1. Teaching, Learning, and Leadership
2. Technology, Design, and Innovation
3. Science, Technology, Engineering, and Mathematics (STEM)

See table for emphasis area elective options.

Emphasis Area Options: Teaching, Learning, and Leadership

EDUC 3020	Principles and Practices of Learning with Technology	3
EDUC 3700	Toying with Technology	3
EDUC 3770	Foundations of Literacy	4
EDUC 3780	Methods for Teaching Literacy in the Elementary Classroom	4
EDUC 4070	Online Education in Pre-K-12 Classrooms: Hybrid, Virtual, and Blended Approaches	3
EDUC 4200	Bilingualism & The Education of Latinx Youth	3
EDUC 4220	Teaching and Learning Iowa History	3
EDUC 4430	The Teaching of Social Studies	3
EDUC 4480	Teaching Children Mathematics	3
EDUC 4490	The Teaching of Science	3
EDUC 4520	Assessment for Literacy and Learning	3
EDUC 4540	Emerging Topics in Educational Technologies	1
EDUC 4560	Integrating Technology into Literacy	3
EDUC 4880	Supervised Tutoring in Reading	3
EDUC 4750	International Travel Study in Education	1-6
AESHM 2110	Leadership Experiences and Development (LEAD)	3

COMST 2100	Communication and U.S. Diversity	3
COMST 2110	Interpersonal Communication	3
COMST 2140	Professional Communication	3
COMST 2180	Communication and Conflict Management	3
HDFS 1020	Human Development	3
HDFS 2230	Child Development and Health	3
HDFS 2260	Development and Guidance in Middle Childhood	3
HDFS 2270	Middle Childhood and Adolescence	3
HDFS 2490	Family Studies	3
HDFS 2760	Human Sexuality	3
HDFS 2490	Family Studies	3
PSYCH 2300	Developmental Psychology	3
PSYCH 3130	Learning and Memory	3
PSYCH 3350	Child and Adolescent Psychopathology	3
PSYCH 3500	Human Factors in Technology	3
PR 2200	Principles of Public Relations	3
POLS 2350	Introduction to Ethics and Politics	3
POLS 3330	Democracy in America	3
POLS 4800	Ethics and Public Policy	3
POLS 3350	Science, Technology, and Public Policy	3
LDST 1220	Leading with Purpose	1
LDST 3220	Leadership in a Diverse Society	3
LDST 3330	Women, Gender, and Leadership	3
LLS 1120	Foundations of Learning and Productive Team Membership	2
LLS 1140	Developing Responsible Learners and Effective Leaders	2
LLS 2120	Habits of Mind and Decision-Making in Leadership	2
SOC 4640	Strategies for Community Engagement	3

Emphasis Area Options: Technology, Design, and Innovation

EDUC 3020	Principles and Practices of Learning with Technology	3
EDUC 3700	Toying with Technology	3
EDUC 4070	Online Education in Pre-K-12 Classrooms: Hybrid, Virtual, and Blended Approaches	3
EDUC 4540	Emerging Topics in Educational Technologies	1
EDUC 4560	Integrating Technology into Literacy	3
COMS 1030	Computer Literacy and Applications	4
COMS 1040	Brief Introduction to Computer Programming for Non-Majors	2
COMS 1050A	Short Course in Computer Programming: Perl	2

COMS 1050B	Short Course in Computer Programming: MATLAB	2
COMS 1060	Introduction to Web Programming	3
COMS 1070	Windows Application Programming	3
COMS 2070	Fundamentals of Computer Programming	3
COMS 4720	Principles of Artificial Intelligence	3
COMST 3300	Communication in a Digital World	3
CPRE 2300	Cyber Security Fundamentals	3
DES 1500	Introduction to Innovation and Design	3
DES 2300	Design Thinking	3
DS 2010	Introduction to Data Science	3
DSNS 2320	Digital Design Communications	3
ECON 3830X	Economics of Innovation	3
ENGL 2220	Artificial Intelligence and Writing	3
ENTSP 3100	Entrepreneurship and Innovation	3
JLMC 4740	Communication Technology and Social Change	3
PHIL 3430	Philosophy of Technology	3
PSYCH 3500	Human Factors in Technology	3
PSYCH 3860	Media Psychology	3
POLS 3350	Science, Technology, and Public Policy	3

Emphasis Area Options: Science, Technology, Engineering and Mathematics (STEM)

EDUC 3020	Principles and Practices of Learning with Technology	3
EDUC 3700	Toying with Technology	3
EDUC 4070	Online Education in Pre-K-12 Classrooms: Hybrid, Virtual, and Blended Approaches	3
EDUC 4430	The Teaching of Social Studies	3
EDUC 4480	Teaching Children Mathematics	3
EDUC 4490	The Teaching of Science	3
EDUC 4540	Emerging Topics in Educational Technologies	1
EDUC 4560	Integrating Technology into Literacy	3
AECL/BIOL/ENSCI 3120: Ecology		3
BIOL/ENVS/ENSCI 2010: Introduction to Environmental Issues		3
ENGL 2220	Artificial Intelligence and Writing	3
ENGL 3120	Communicating Science and Public Engagement	3
IALL 3100	Science Teaching Methods	1-3
IALL 3140	Nature Based, Early Childhood Teaching Methods Using 'The Project Approach'	3-4
JLMC 2600	Media Controversies in Science and Technology	3
JLMC 3470	Science Communication	3
NREM 3800	Field Ecology Research and Teaching	3

PHIL 3430	Philosophy of Technology	3
PSYCH 3500	Human Factors in Technology	3
POLS 3350	Science, Technology, and Public Policy	3

Additional emphasis area electives may be included towards the requirement following consultation with their academic advisor.

Elementary Education

A degree in elementary education at Iowa State prepares you to teach all subjects at the elementary school level (grades K-6). Program completers can be recommended for licensure to the Iowa Board of Education Examiners.

In addition to pursuing a degree in Elementary Education, candidates are required to pursue an endorsement in at least one additional area. Candidates will be prepared to teach students in grades kindergarten through eighth grade in this area of specialization. Endorsements in the following areas are available for elementary education majors:

- K-8 English/Language Arts & Reading
- K-12 English as a Second Language (ESL)
- K-8 Health
- K-8 Mathematics
- K-8 Science
- K-8 Social studies
- K-8 Special education (Instructional Strategist I: Mild/Moderate Disabilities K-8)

In addition, candidates can choose to pursue endorsements in K-8 Reading, K-12 Coaching, and 5-8 Algebra for HS Credit.

Additional information about endorsements can be found at: <https://www.education.iastate.edu/find-majors/elementary-education/>. (<https://www.education.iastate.edu/find-majors/elementary-education/>)

Student Learning Outcomes

Upon graduation, students should be able to:

The Learner and Learning

Standard #1: Learner Development.

Understand how learners grow and develop, recognizing that patterns of learning and development vary individually within and across the cognitive, linguistic, social, emotional, and physical areas, and designs and implements developmentally appropriate and challenging learning experiences.

Standard #2: Learning Differences.

Use understanding of individual differences and diverse cultures and communities to ensure inclusive learning environments that enable each learner to meet high standards.

Standard #3: Learning Environments.

Work with others to create environments that support individual and collaborative learning, and that encourage positive social interaction, active engagement in learning, and self-motivation.

Content

Standard #4: Content Knowledge.

Understand the central concepts, tools of inquiry, and structures of the discipline(s) he or she teaches and creates learning experiences that make the discipline accessible and meaningful for learners to assure mastery of the content.

Standard #5: Application of Content.

Understand how to connect concepts and use differing perspectives to engage learners in critical thinking, creativity, and collaborative problem solving related to authentic local and global issues.

Instructional Practices

Standard #6: Assessment.

Understand and use multiple methods of assessment to engage learners in their own growth, to monitor learner progress, and to guide the teacher's and learner's decision making.

Standard #7: Planning for Instruction.

Plan instruction that supports every student in meeting rigorous learning goals by drawing upon knowledge of content areas, curriculum, cross-disciplinary skills, and pedagogy, as well as knowledge of learners and the community context.

Standard #8: Instructional Strategies.

Understand and use a variety of instructional strategies to encourage learners to develop deep understanding of content areas and their connections, and to build skills to apply knowledge in meaningful ways.

Standard #8A: Technology.

Integrate current and emerging technology in instruction to encourage student creativity, problem solving, collaboration, and digital literacy.

Teachers practice and advocate safe, legal, and responsible use of information and technology.

Professional Responsibility

Standard #9: Professional Learning and Ethical Practice.

Engage in ongoing professional learning and uses evidence to continually evaluate his/her practice, particularly the effects of his/her choices

and actions on others (learners, families, other professionals, and the community), and adapts practice to meet the needs of each learner.

Standard #10: Leadership and Collaboration.

Seek appropriate leadership roles and opportunities to take responsibility for student learning, to collaborate with learners, families, colleagues, other school professionals, and community members to ensure learner growth, and to advance the profession.

Curriculum in Elementary Education

Educator Preparation Program Admission Requirements

In addition to being admitted to Iowa State University and departmental programs/majors, educator preparation candidates must be admitted to the Educator Preparation Program prior to beginning advanced coursework.

Educator Preparation Program Admission Requirements are provided in Educator Preparation Policy.

- Decision Point 1 - Admission to the Educator Preparation Program (<https://iastate.box.com/s/n8eewbs3fznazf8alerv0qbf216fno7e/>)
- Decision Point 1 - Early Admission to the Educator Preparation Program for Transfer Students (<https://iastate.box.com/s/r3ap8wej7m3bmd0cehixe12epxtekxax/>)

Degree Requirements

120 total credits minimum required

Communications and Library: 10 credits

ENGL 1500	Critical Thinking and Communication **	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition **	3
LIB 1600	Introduction to College Level Research	1
Communication course from approved Elementary Education list *		3
Total Credits		10

*Must receive a "C-" or above

**Must receive a "C" or above

Social Sciences: 9 credits

PSYCH or SOC Option from approved Elementary Education list *	3
Social Sciences course from approved Elementary Education list *	3
Social Sciences course from approved Elementary Education list *	3
Total Credits	9

*Must receive a "C-" or above

Humanities: 6 credits

HIST 2210	Survey of United States History I *	3
or HIST 2220	Survey of United States History II	
Humanities courses from approved Elementary Education list *		3

*Must receive a "C-" or above

Mathematics: 9 credits

MATH 1950	Mathematics for Elementary Education I *	3
MATH 1960	Mathematics for Elementary Education II *	3
Math Option from approved Elementary Education list *		3
Total Credits		9

*Must receive a "C-" or above

Biological Sciences, Physical Sciences, Earth/Space Sciences: 9 credits

Biological Sciences course from approved Elementary Education list *		3
Physical Sciences course from approved Elementary Education list *		3
Earth/Space Sciences course from approved Elementary Education list *		3
Total Credits		9

*Must receive a "C-" or above

Orientation and Initial Field Experience: 2 credits

EDUC 2160	Learning Community Orientation to Teacher Education	1
or EDUC 3150	Transfer Orientation	
EDUC 2800N	Pre-Student Teaching Experience I: Elementary Education	1
or EDUC 2800T	Pre-Student Teaching Experience I: Tutoring	
Total Credits		2

Professional Education Core: 21 credits

EDUC 2010	Educational Technologies in the PK-6 Classroom **	3
EDUC 2050	Social Foundations of Education in the United States: Early Childhood and Elementary Education **	3
SPED 2500	Education of the Exceptional Learner **	3
EDUC 2450	Landscape of Teaching **	3
HDFS 1020	Human Development **	3
or PSYCH 2300 Developmental Psychology		
EDUC 3320	Educational Psychology of Early Childhood and Elementary Education **	3
HDFS 2400	Children's Literature **	3
Total Credits		21

**Must receive a "C" or above

Block I: Teaching Children Literacy, Mathematics, and Social Studies: 12 Credits

EDUC 3770	Foundations of Literacy **	4
EDUC 4480	Teaching Children Mathematics **	3
EDUC 4430	The Teaching of Social Studies	3
EDUC 4680A	Pre-Student Teaching Experience III: Primary Grades, Reading and Language Arts	1
EDUC 4680C	Pre-Student Teaching Experience III: Primary Grades, Mathematics	1
Total Credits		12

**Must receive a "C" or above

Block II: Literacy and Science: 12 credits

EDUC 3780	Methods for Teaching Literacy in the Elementary Classroom **	4
EDUC 4050	Teaching and Learning in a Pluralistic Society: Early Childhood and Elementary	3
EDUC 4490	The Teaching of Science **	3
EDUC 4680B	Pre-Student Teaching Experience III: Intermediate Grades, Reading and Language Arts	1
EDUC 4680D	Pre-Student Teaching Experience III: Intermediate Grades, Science	1
Total Credits		12

**Must receive a "C" or above

Related Methods: 7 credits

KIN 2840	Elementary and Pre-school Movement Education **	3
or HS 2750	Health Education in the Elementary School	
MUSIC 2650	Music in Elementary Education **	2
ARTED 2090	Methods of Teaching in and Through Art **	2
Total Credits		7

**Must receive a "C" or above

Primary Endorsement Area: Credits Vary

Minimum grade of a "C" required for all EDUC, HDFS, and SPED courses and all content-specific pedagogy/methods courses. Minimum grade of "C-" required for all other courses in endorsement areas.

Primary Endorsement Options:

- K-8 English/Language Arts & Reading
- K-12 English as a Second Language (ESL)
- K-8 Health
- K-8 Mathematics

- K-8 Science
- K-8 Social studies
- K-8 Special education (Instructional Strategist I: Mild/Moderate Disabilities K-8).

Additional information about endorsements can be found at <https://www.education.iastate.edu/find-majors/elementary-education/>.

Student Teaching: 16 credits

EDUC 4160A	Supervised Student Teaching - Elementary: Primary grades (K-3) **	8
EDUC 4160B	Supervised Student Teaching - Elementary: Intermediate grades (3-6) **	8
Total Credits		16

**Must receive a "C" or above

Total Credits: 122 minimum credits (credits will vary depending on endorsement option)

U.S. Cultures and Communities and International Perspectives Requirements: Students in elementary education fulfill the U.S. Cultures and Communities and International Perspectives requirements by choosing three credits of coursework from university-approved Humanities or Social Sciences courses included on the Elementary Education approved options sheet.

Additional Endorsement

Candidates can pursue any of the primary endorsement areas listed above and in the following areas:

- K-8 Reading
- K-12 Coaching
- 5-8 Algebra for HS Credit

Information about these endorsements can be found at: <https://iastate.app.box.com/s/m4tr3ogr9ouwmiubz5dhv9catryr2jqf> (<https://iastate.app.box.com/s/m4tr3ogr9ouwmiubz5dhv9catryr2jqf/>).

Contact an Elementary Education academic advisor for additional information.

Educator Preparation Program Completion Requirements:

In order to be recommended for licensure, candidates must have completed all degree program requirements and be considered an Educator Preparation Program Completer. Access the policy: Decision Point 3 - Recommendation for Licensure (<https://iastate.box.com/s/tvfae96b3b1y87wbyfna2oonhmfoba7g/>)

Elementary Education, B.S.

First Year

Fall	Credits Spring	Credits
EDUC 2050	3 EDUC 2800N	1
EDUC 2160	1 SPED 2500	3
PSYCH 2300 or HDFS 1020	3 MATH 1950	3
ENGL 1500	3 HIST 2210 or 2220	3
LIB 1600	1 Science Option 1	3
Social Science Option	3 PSYCH or SOC Option	3
	14	16

Second Year

Fall	Credits Spring	Credits
EDUC 2010	3 EDUC 2450	3
HDFS 2400	3 EDUC 3320	3
ENGL 2500	3 Biological Science Option 3	3
MATH 1960	3 Math Option	3
Science Option 2	3 Endorsement Area	3
Apply/Accepted to Educator Preparation Program		
	15	15

Third Year

Fall	Credits Spring	Credits
Block I	Block II	
EDUC 3770	4 EDUC 3780	4
EDUC 4050	3 EDUC 4430	3
EDUC 4480	3 EDUC 4490	3
EDUC 4680A	1 EDUC 4680B	1
EDUC 4680C	1 EDUC 4680D	1
Social Science Option	3 Endorsement Area	3
	15	15

Fourth Year

Fall	Credits Spring	Credits
ARTED 2090	2 Student Teaching:	
KIN 2840 or HS 2750	3 EDUC 4160A	8
MUSIC 2650	2 EDUC 4160B	8
Communications Option	3	
Humanities Option/ Endorsement Area	6	
Apply for Graduation		
	16	16

Total Credits: 122 and above

It is our expectation that students know the requirements of their academic program and develop and follow an academic plan based on their academic catalog and degree audit using their individual academic advisor as a resource in this process.

Event Management

Administered by the Department of Apparel, Events, and Hospitality Management.

The program offers study for the degree of Bachelor of Science with a major in event management. The program prepares undergraduate students for careers in leading event and meeting management businesses. To complete the program, a student combines general education, Event core classes, and a structure of focused courses to form an option in: (a) corporate/business events, (b) virtual events, (c) social events: weddings and nonprofit events, (d) sport events, or (e) innovative event experiences in retail.

Through the major, students gain background and experiences in planning, budgeting, and implementing conferences, meetings, and other special events in the public or private sectors. Course work provides students with a general education plus professional preparation focusing on the concepts and principles involved in meeting and event planning strategy; special event management; stakeholder development; budgets and finance; site selection; contracts, vendors, and negotiations; marketing and promotions; food and beverage management; meeting technology; event evaluation; and hospitality law. Event electives include courses in event sustainability, event digital promotion, incentive meetings, and international conference planning. Supporting courses include foodservice, catering, promotion, brand management, trend analysis, fashion, and resource management.

The program also houses "The Meeting Room: Where Experiences and Technology Innovate," a lab designed to allow Event Management students to have hands-on access to a number of cutting-edge technology tools designed to let students focus on new and event disruptive ideas in events and meeting management. The lab is equipped with virtual reality headsets, event sound and lighting equipment, wireless connectivity to displays for BYOD, and group/collaboration furniture.

Graduates from this program are prepared for careers in event planning (corporate events, celebrations, education, promotions, commemorations, trade shows, weddings, conferences, association events, exhibitions, festivals, philanthropies, entertainment, fundraising, conventions, and sport events) and small business development (entrepreneurship). Graduates demonstrate leadership characteristics and make decisions based on integrating knowledge of financial, human resources, promotion, and event management principles. Students are required to complete an internship in event management prior to graduation. The student experience is enhanced through networking and development

events with our Event Management Executive Advisory Council, meeting/event industry conferences and association meetings, and international experiences designed specifically for event management students.

Leading to the degree Bachelor of Science

Total credits required: 123, including a minimum of 18 credits from the AESHM Department at Iowa State University for the degree.

The curriculum in event management prepares students for careers in leading event and meeting management businesses. Courses are required in general education, and the professional area. Students majoring in Event Management are required to earn C- or better in all AESHM and EVENT courses, and all courses in the EVENT Core.

Communication Proficiency Requirement: Grade of C or better in ENGL 1500 Critical Thinking and Communication, and ENGL 2500 Written, Oral, Visual, and Electronic Composition.

Student Learning Outcomes

Upon graduation, students should be able to:

- 1. *Communication.* Use clear and effective written, oral, verbal and electronic (WOVE) communication techniques to foster inquiry, collaboration, and engagement in apparel and related industries.
- 2. *Self-assessment/self-reflection.* Analyze and evaluate one's own knowledge, abilities, and actions relative to professional standards, seek opportunities to grow professionally, and utilize self-assessment and assessment of others to foster psychological, cognitive, social and emotional well-being.
- 3. *Critical thinking.* Understand fundamental concepts of event management and apply critical thinking to solve problems from personal, scholarly, and professional perspectives.
- 4. *Ethics, Diversity, and Social Responsibility.* Demonstrate leadership and social justice to improve quality of life for global citizens and encourage socially responsible decision-making for consumers and businesses.

Curriculum in Event Management

Administered by the Apparel, Events, and Hospitality Management Department.

Leading to the degree Bachelor of Science.

Total credits required: 123 including a minimum of 18 credits from the AESHM Department at Iowa State University for the degree. The curriculum in event management prepares students for careers in leading event and meeting management businesses. Courses are required in general education, and the professional area. Students majoring in Event Management are required to earn C- or better in all AESHM and EVENT courses, and all courses in the EVENT Core. Communication Proficiency Requirement: Grade of C or better in ENGL 1500 Critical Thinking and

Communication, and ENGL 2500 Written, Oral, Visual, and Electronic Composition.

A minor in event management is available; see requirements under Apparel, Events, and Hospitality Courses and Programs.

Degree Requirements
(13) Communications and Library

ENGL 1500	Critical Thinking and Communication *	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition *	3
ENGL 3020	Business Communication	3
LIB 1600	Introduction to College Level Research	1
Select one (1) course from:		3
COMST 2110	Interpersonal Communication	
COMST 2140	Professional Communication	
SPCM 2120	Fundamentals of Public Speaking	

Total Credits 13

(9-10) Natural Sciences and Mathematical Disciplines

Select one (1) course from:		3
MATH 1040	Introduction to Probability	
MATH 1050	Introduction to Mathematical Ideas	
MATH 1400	College Algebra	
MATH 1430	Preparation for Calculus	
MATH 1500	Discrete Mathematics for Business and Social Sciences	
MATH 1600	Survey of Calculus	
Select one (1) course from:		3-4
STAT 1010	Principles of Statistics	
STAT 1040	Introduction to Statistics	
STAT 2260	Introduction to Business Statistics I	
Select one (1) course from:		3

Dept of ASTRO, BIOL, BBMB, CHEM, COMS, ENT, ENSCI, ENVS, GEN, GEOL, MTEOR, PHYS, FSHN, (1010,1150. or 1670), or FDM 2040

Total Credits 9-10

(9) Social Sciences

ECON 1010	Principles of Microeconomics	3
Select two (2) courses from:		6
ECON 1020	Principles of Macroeconomics	
FDM 1650	Fashion, Appearance, and Diversity in U.S. Society	
HDFS 1020	Human Development	
POLS 1110	Introduction to American Government	
PSYCH 1010	Introduction to Psychology	
PSYCH 2300	Developmental Psychology	
PSYCH 2800	Social Psychology	

SOC 1340	Introduction to Sociology	
Total Credits		9

(6) Humanities

AESHM 3420	Aesthetics of Consumer Experience	3
Select one (1) course from:		3
Dept of AFAM, AMIN, ANTHR, ARTH, CLST, ENGL, HIST, LING, PHIL, RELIG, MUSIC, DANCE, WGS, WLS, DSNS 1830, or INTST 2350		
Total Credits		6

**(8-9Cr) General Electives
(21Cr) EVENT Core Courses**

EVENT 1710	Introduction to Event Management	3
EVENT 2120	Digital Production in Event Management	3
EVENT 2770	Digital Promotion in the Service Industry	3
EVENT 2780	Sustainability Essentials for Service-Related Businesses	3
EVENT 3670	Event Sales	3
EVENT 3710	Conference and Meeting Planning	3
EVENT 4710	Event Production	3
Total Credits		21

(30-33) AESHM Business CORE

AESHM 1110	Professional Development for AESHM	1
AESHM 1110L	AESHM Program Orientation and Learning Community	1
AESHM 2110	Leadership Experiences and Development (LEAD)	3
AESHM 2380	Human Resource Management	3
AESHM 2870	Principles of Management in Human Sciences	3
AESHM 3110E	Seminar on Careers and Internships: Event Management and Hospitality Management	1
AESHM 3400	Hospitality and Apparel Marketing Strategies	3
AESHM 4700F	Supervised Professional Internship: Event Management	3-6
AESHM 4740	Entrepreneurship in Human Sciences	3
ACCT 2840	Financial Accounting	3
HSPM 1010	Introduction to the Hospitality Industry	3
HSPM 3150	Hospitality Law	3
Total Credits		30-33

(11-14) Event Management Elective Courses

EVENT 2030	Event Management Sophomore Mentorship	2
EVENT 3280	Incentive Meeting Management	3
EVENT 3330	Entertainment Venue Management	3
EVENT 4820	Sport Event Marketing	3
EVENT 3730	Wedding Planning and Management	3

EVENT 3790	Nonprofit Fundraising Event Planning	3
EVENT 3830	Sports Event Management	3
EVENT 3930	Event Management Workshop	1-3
EVENT 4230	International Sports and Entertainment Event Management	3
EVENT 4850	Advanced Event Production: Special Event	3
EVENT 4860	Advanced Event Production	3
AESHM 1700F	Supervised Work Experience I: Event Management	1
AESHM 1800E	First Year Student Field Study: Hospitality and Event Management	2
AESHM 2220	Creativity on Demand	3
AESHM 2700F	Supervised Work Experience II: Event Management	2
AESHM 2720	Fashion Show Production and Promotion	2
AESHM 2810	Orientation to International Field Study	1
AESHM 3450X	Retail/Hospitality Experiences & Events	1-3
AESHM 3650	Event, Hospitality, and Retail Risk Management	3
AESHM 3800F	U.S. Field Study: Event Management	1-3
AESHM 3810F	International Field Study: Event Management	1-3
AESHM 4210	Developing Global Leadership: Maximizing Human Potential	3
AESHM 4700F	Supervised Professional Internship: Event Management	3-6
AESHM 4790	Data Analytics for Apparel, Events, and Hospitality Management	3
FDM 2750	Retail Merchandising	3
FDM 3750	Omni-Channel Retailing	3
FDM 3770	Visual Presentation and Promotions	3
HSPM 1330	Food Safety Certification	1
HSPM 2010	Casino Management I	3
HSPM 2600	Global Tourism Management	3
HSPM 2800	Non-Alcoholic Beverages and Cafe Operations	3
HSPM 2890	Contemporary Club Management	3
HSPM 3200	Attractions and Amusement Park Administration	3
HSPM 3800	Food Production Management	3
HSPM 3800L	Food Production Management Experience	3
HSPM 3830	Wine and Spirits in Hospitality Management	2
HSPM 3830L	Wine, Spirits, and Mixology Laboratory in Hospitality Management	2
HSPM 3850	Beer and Brewed Beverages in Hospitality Management	1
HSPM 3930M	Hospitality Management Industry Workshop: Molecular Gastronomy	3

HSPM 3930B	Hospitality Management Industry Workshop: Baking and Pastry Art	3
HSPM 4200	Fairs, Festivals, and Events Management	3
HSPM 4370	Hospitality Technology Applications	3
HSPM 4870	Fine Dining Management	3
AGEDS 2270	Fundamentals of Visual Communication for Agriculture and Life Sciences	3
AGEDS 2630	Communicate with Impact in Agriculture, Natural Resources, and Life Science	3
AGEDS 3110	Presentation and Sales Strategies for Agricultural Audiences	3
AGEDS 3150	Personal, Professional, and Entrepreneurial Leadership in Agriculture	3
ADVRT 2300	Advertising Principles	3
ADVRT 3010	Research and Strategic Planning for Advertising and Public Relations	3
HORT 1310	Floral Design	2
HORT 1320	Wedding and Event Floral Design	2
JLMC 3070	Fundamentals of Digital Video Production	3
JLMC 4060	Media Management	3
KIN 3450	Management of Health-Fitness Programs and Facilities	3
KIN 3650	Sport Psychology	3
KIN 3990	Recreational Sport Management	3
PR 2200	Principles of Public Relations	3
PR 3050	Publicity Methods	3
SCM 3010	Supply Chain Management	3

(30CR) Primary Options:

Select one (1) primary professional option from the following choices:

CORPORATE/BUSINESS EVENTS

EVENT 3280	Incentive Meeting Management	3
EVENT 4860	Advanced Event Production	3
AESHM 4790	Data Analytics for Apparel, Events, and Hospitality Management	3
HSPM 4370	Hospitality Technology Applications	3

(18) Select courses from Event Management Electives

Total Credits **12**

SOCIAL EVENTS: WEDDINGS AND NONPROFIT EVENTS

EVENT 3330	Entertainment Venue Management	3
EVENT 3730	Wedding Planning and Management	3
EVENT 3790	Nonprofit Fundraising Event Planning	3
FDM 3770	Visual Presentation and Promotions	3

(18) Select courses from Event Management Electives

Total Credits **12**

SPORTS EVENTS

EVENT 3330	Entertainment Venue Management	3
EVENT 4820	Sport Event Marketing	3
EVENT 3830	Sports Event Management	3
EVENT 4230	International Sports and Entertainment Event Management	3
EVENT 4850	Advanced Event Production: Special Event	3

(18) Select courses from Event Management Electives

Total Credits **15**

Event Management, B.S.

Freshman

Fall	Credits	Spring	Credits
AESHM 1110	1	AESHM 2870	3
AESHM 1110L	1	ECON 1010	3
ENGL 1500	3	ENGL 2500	3
EVENT 1710	3	Humanities	3
		"Select from" Course	
HSPM 1010	3	LIB 1600	1
Social Science	3	Natural Sciences	3
"Select from" Course		"Select from" Course	
14		16	

Sophomore

Fall	Credits	Spring	Credits
AESHM 2110	3	AESHM 3400	3
AESHM 2380	3	EVENT 2780	3
EVENT 2120	3	Event Management Electives course	3
Math	3	Course #1	3
"Select from" Course		towards "Option"	

Speech/ Communication "Select from" Course	3 Social Science 'Select from' course	3

15 15

Junior

Fall	Credits	Spring	Credits	Summer	Credits
ACCT 2840	3	EVENT 2770	3	AESHM 4700F	3
AESHM 3110E or 3110N	1	Event Management Elective course	3		
AESHM 3420	3	Course #3 towards "Option"	3		
EVENT 4710	3	HSPM 3150	3		
EVENT 3670	3	STAT 1010	4		
Course #2 towards "Option"	3				

16 16 3

Senior

Fall	Credits	Spring	Credits
AESHM 4740	3	"Option" Course #5 or Event Mgmt Elective	3
ENGL 3020	3	Event Management Electives course	3
EVENT 3710	3	Event Management Electives course	3
Course #4 towards "Option"	3	General Elective course	5

Event Management Electives course	3

15 14

Total Credits: 124

Event Management Minor

The AESHM Department offers a minor in Event Management. The minor can be earned by successfully completing the following for a total of 15 credits. The minor must include at least six (6) credits in courses numbered 3000 or above taken at ISU. All course prerequisites must be completed prior to taking the course. All minor courses must be taken for a grade. The Event Management Minor requires students to complete EVENT 1710, EVENT 3710, and EVENT 4710. The remaining 6 credits may be selected from any courses listed below. **Only 12 total credits of EVENT classes can apply to the minor.

9 credits are required:

EVENT 1710	Introduction to Event Management	3
EVENT 3710	Conference and Meeting Planning	3
EVENT 4710	Event Production	3

And 6 credits of the following: (only 1 additional course designated "EVENT" can apply towards your minor)

EVENT 2770	Digital Promotion in the Service Industry	3
EVENT 2780	Sustainability Essentials for Service-Related Businesses	3
EVENT 3280	Incentive Meeting Management	3
EVENT 3330	Entertainment Venue Management	3
EVENT 3730	Wedding Planning and Management	3
EVENT 3790	Nonprofit Fundraising Event Planning	3
EVENT 3830	Sports Event Management	3
AESHM 2870	Principles of Management in Human Sciences	3
AESHM 3400	Hospitality and Apparel Marketing Strategies	3
AESHM 3420	Aesthetics of Consumer Experience	3
AESHM 4720	Fashion Show Management	2-3
AESHM 4740	Entrepreneurship in Human Sciences	3
HSPM 2890	Contemporary Club Management	3
HSPM 3200	Attractions and Amusement Park Administration	3
HSPM 4370	Hospitality Technology Applications	3
PR 2200	Principles of Public Relations	3

Event Management Master's Program

Event Management Core (required)

AESHM 5010	Introduction to Scholarly Research for Graduate Students	1
EVENT 5310	Event Business Research Essentials	3
EVENT 5610	Advanced Topics in Event Management	3
EVENT 5770	Advanced Social Media Strategy	3
EVENT 5780	Advanced Event Sustainability Management	3
EVENT 5990	Creative Component	3
EVENT 6340	Theory and Research Seminar in Event Management	3
Total Credits		19

AESHM Electives

Select three (3) courses from:

AMD 5450	Consumer Experience and Retail Branding	3
AESHM 5740	Entrepreneurship in Human Sciences	3
AESHM 5790	Data Analytics for Apparel, Event, and Hospitality Management	3
AESHM 5800D	U.S. Field Study: Hospitality Management	1-3
	or AESHM 5800E U.S. Field Study: Event Management	
	or AESHM 5800N U.S. Field Study: Apparel, Merchandising, and Design	
AESHM 5810D	International Field Study: Hospitality Management	1-3
	or AESHM 5810E International Field Study: Event Management	
	or AESHM 5810N International Field Study: Apparel, Merchandising, and Design	
AESHM 6700A	Teaching Practicum: Apparel Merchandising and Design	1-3
	or AESHM 6700B Teaching Practicum: Hospitality Management	
	or AESHM 6700C Teaching Practicum: Event Management	
AMD 5450	Consumer Experience and Retail Branding	3
AMD 5650	Sustainability: Theory and Practical Application	3
AMD 5670	Consumer Behavior and Apparel	3
AMD 5770	E-Commerce for Apparel and Hospitality Companies	3
EVENT 5900	Special Topics	3
HSPM 5330	Financial Decision Making in Hospitality Organizations	3
HSPM 5380	Human Resources Development in Hospitality Organizations	3
HSPM 5400	Strategic Marketing	3
HSPM 5550	Strategic Management in Hospitality Organizations	3

Research Methods and Statistics

Select two (2) courses from

AESHM 5020	Research Methods in Apparel, Events, and Hospitality	3
AESHM 5100	Quantitative Research Methods in Apparel, Events, and Hospitality	3
AESHM 5120	Qualitative Research Methods in Apparel, Events, and Hospitality	3
RESEV 5500	Introduction to Educational Research	3
RESEV 5520	Basic Educational Statistics	3
RESEV 5800	Introduction to Qualitative Research Methodology	3
STAT 5101	Statistical Methods for Data Analysis	4

Family and Consumer Sciences Education and Studies

Family and Consumer Sciences Education and Studies

Administered by the Department of Human Development and Family Studies. Leading to a degree bachelor of science.

The curriculum in Family and Consumer Sciences Education and Studies (FCEDS) prepares graduates with a broad understanding of individual and family well-being. Graduates apply knowledge and research in Human Sciences content in global professional settings. They work in an integrative fashion to improve well-being by addressing and acting on complex problems confronting individuals, families, and communities.

FCEDS is an interdisciplinary major where students take coursework in across content areas including Human Development, Early Childhood Education, Interpersonal Relationships, Culinary Arts, Nutrition, Textiles, Interior Design, and Financial Planning. This unique program of study integrates multiples facets of human health and well-being, preparing FCEDS graduates to support individuals, families, and communities in diverse settings to achieve an optimal quality of life.

Student Learning Outcomes

Upon completion of the FCEDS undergraduate program, students will:

Learning Outcome 1: Human Development: The student understands how humans grow and develop, recognizing that patterns of learning and development vary individually within and across the cognitive, linguistic, social, emotional, and physical areas, and designs and implements developmentally appropriate and challenging learning experiences and materials.

Learning Outcome 2: Human Differences: The student uses understanding of individual differences and diverse cultures and

communities to ensure inclusive learning environments that enable each individual to meet high standards.

Learning Outcome 3: Learning Environments: The student works with others to create environments that support individual and collaborative learning, and that encourage positive social interaction, active engagement in learning, and self-motivation.

Learner 4: Content Knowledge: The student understands the central concepts, tools of inquiry, and structures of Family & Consumer Sciences to make the discipline accessible and meaningful for their audience.

Standard 5: Application of Content: The student understands how to connect concepts and use differing perspectives to engage individuals in critical thinking, creativity, and collaborative problem solving related to authentic local and global issues.

Learning Outcome 6: Assessment: The student understands and uses multiple methods of assessment to engage learners in their own growth, to monitor progress and outcomes, and to guide decision making.

Learning Outcome 7: Planning for Instruction: The student plans education that supports every individual in meeting rigorous goals by drawing upon knowledge of content areas, cross-disciplinary skills, and pedagogy/andragogy, as well as knowledge of individual and community context.

Learning Outcome 8: Instructional Strategies: The student understands and uses a variety of strategies to encourage learners to develop deep understanding of content areas and their connections, and to build skills to apply knowledge in meaningful ways. The student integrates current and emerging technology in instruction to encourage creativity, problem solving, collaboration, and digital literacy. Students practice and advocate safe, legal, and responsible use of information and technology.

Learning Outcome 9: Professional Learning and Ethical Practice: The student engages in ongoing professional learning and uses evidence to continually evaluate his/her practice, particularly the effects of his/her choices and actions on others (individuals, families, other professionals, and the community), and adapts practice to meet the needs of each learner.

Learning Outcome 10: Leadership and Collaboration: The student seeks appropriate leadership roles and opportunities to collaborate with learners, families, colleagues, other professionals, and community members to ensure learner growth, and to advance the profession.

Students in FCEDS may choose coursework that leads to becoming a Certified Family Life Educator (CFLE), a program that has been approved by the National Council on Family Relations (NCFR). These courses provide the basic education for students interested in working with families, including adolescents, parents, or adults working to strengthen

relationships. The student takes courses that support the development of knowledge and skills in family life content areas selected by the National Council on Family Relations. The certification is a voluntary credential that requires the individual to complete a degree in an approved program and to have at least two years of work experience in family life education settings (see <http://www.ncfr.org/cfle-certification> (<http://www.ncfr.org/cfle-certification/>)).

Graduates may also choose from one of several nationally recognized professional certifications available from the American Association of Family and Consumer Sciences (AAFCS) Council for Certification. This program measures competencies of FCS professionals using high-quality, rigorous assessments. Certifications that are currently available can be seen at <https://www.aafcs.org>.

Family and Consumer Sciences Education and Studies OPTIONS FOR EMPHASIS

Students choose one of three options: Teacher Licensure, Professional Studies, or Communications.

Graduates of the **Teacher Licensure** option may teach Family and Consumer Sciences in middle, junior high, and senior high schools. Students who enroll in Teacher Licensure must apply and be accepted into the educator preparation program prior to enrolling in advanced courses. This program is approved by the Iowa Department of Education. There is an opportunity to take online & summer courses to allow certified teachers or those enrolled in a teacher intern program to add endorsement 139: 5-12 Family & Consumer Sciences – General"

Graduates of the **Professional Studies** option are prepared to work in a variety of careers including Extension & Outreach, non-profit organizations, and governmental agencies as well as within the private business or entrepreneurial sector.

Graduates of the **Communications** option have the ability to educate consumers in a global and technologically changing society. Students apply the principles of educational presentations, journalism, marketing, and public relations to empower people to critically analyze options and make the best choices for their needs.

General Education Requirements

Communications and Library: 10 credits

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
Select one of the following:		3
HDFS 2700	Family Communications and Relationships	
COMST 2110	Interpersonal Communication	
COMST 2140	Professional Communication	
COMST 2180	Communication and Conflict Management	

SPCM 2120	Fundamentals of Public Speaking	
SPCM 3120	Business and Professional Speaking	
LIB 1600	Introduction to College Level Research	1
Total Credits		10

Natural Sciences and Mathematical Disciplines: 9-10 credits

BIOL 1010	Introductory Biology	3
or BIOL 1550	Human Biology	
MATH or STAT course from approved general education options		3-4
CHEM 1600	Chemistry in Modern Society	3
Total Credits		9-10

Social Sciences: 9 credits

HDFS 1020	Human Development *	3
HDFS 2760	Human Sexuality *	3
Select one of the following: *		3
HDFS 2390	Consumer Issues	
HDFS 3210	Happiness Across the Lifespan	
HDFS 3730	Death as a Part of Living	
HDFS 3770	Aging and the Family	
HDFS 3690	Research Methods in Human Development and Family Studies	
FSHN 3420	World Food Issues: Past and Present	
ECON 1010	Principles of Microeconomics	
Total Credits		9

Minimum grade of C*Humanities: 6 credits**

Select from approved general education options.

FCS Core: 23 credits

HDFS 1100	Freshman Learning Community Orientation	1
or HDFS 1110	New Transfer Student Seminar	
FCEDS 2060	Home Ec to Human Sciences: Legacy and Advocacy. *	2
FCEDS 3060	Teaching Human Sciences *	4
HDFS 2830	Personal Finance *	3
Select one from: *		3
FSHN 1010	Food and the Consumer **	
FSHN 2420	The US Food System	
FSHN 1150	Food Preparation Laboratory *	1
Select one from: *		3
HDFS 2490	Family Studies	
or HDFS 224	Child Development	
FCEDS 3250	Housing & Interior Design for FCS Professionals *	3

HSPM 1010	Introduction to the Hospitality Industry *	3
Total Credits		23

***Minimum grade of C **Teacher Licensure must take the option**

Option 1- Teacher Licensure: 52 Credits

EDUC 2190	Orientation to Teacher Education: English, FCS, History, Math, Science and World Language Majors *	1
EDUC 2020	Educational Technologies in the 7-12 Classroom *	3
EDUC 2040	Social Foundations of Education in the United States: Secondary *	3
EDUC 3330	Educational Psychology *	3
EDUC 4060	Teaching and Learning in a Pluralistic Society: Secondary *	3
FCEDS 4060X	Educational Principles in Family & Consumer Sciences *	3
or EDUC 4260	Principles of Secondary Education	
FCEDS 4130	Curriculum, Lab Management and Assessment for Family and Consumer Sciences *	3
FCEDS 3980	Foundations of Career and Technical Education in Family and Consumer Sciences *	3
SPED 4010	Teaching Secondary Students with Exceptionalities in General Education *	3
HDFS 2270	Middle Childhood and Adolescence *	3
HDFS 2240L	Child Development Practicum *	1
FCEDS 3800V	Pre-Student Teaching Experience in FCS Education	1
FCEDS 4800V	Pre-Student Teaching Experience in FCS Education	2
FCEDS 3350	Textiles & Apparel for FCS Professionals (offered even summers only) *	3
or FDM 1310	Fashion Products and Markets	
FDM 1200	Intro to Assembly Apparel Processes *	1
FCEDS 4170A	Supervised Teaching in Family and Consumer Sciences: Vocational family and consumer sciences. *	8
FCEDS 4170B	FCEDS 4170B: Supervised Teaching in Family and Consumer Sciences *	8
Total Credits		52

***Minimum grade of C**

Option 2- Communications: 45 Credits

AESHM 2870	Principles of Management in Human Sciences	3
Select one of the following:		3
HDFS 2700	Family Communications and Relationships	
ENGL 3020	Business Communication	
COMST 2140	Professional Communication	

COMST 3140	Organizational Communication	
HDFS 2270	Middle Childhood and Adolescence	3
or HDFS 2340	Young Adulthood Through Later Life	
HDFS 3690	Research Methods in Human Development and Family Studies	3
HDFS 3950	Children, Families, and Public Policy	3
HDFS 4200	Advanced Professional Practice	3
HDFS 3860	Human Services Management I	3
HDFS 4860	Human Services Management II	3
PR 2200	Principles of Public Relations	3
PR 3050	Publicity Methods	3
Select one of the following:		3
HDFS 3670	Family Stress, Abuse, and Resilience	
HDFS 3770	Aging and the Family	
HS 1100	Personal and Consumer Health	
Select one of the following:		3
ENGL 3130	Rhetorical Website Design	
ENGL 3140	Technical Communication	
ENGL 3320	Visual Communication of Quantitative Information	
ENGL 4150	Business and Technical Editing	
ENGL 4160	Visual Aspects of Business and Technical Communication	
Select one of the following:		3
DSNS 2320	Digital Design Communications	
JLMC 4620	Media Ethics, Freedom, Responsibility	
JLMC 4760	World Communication Systems	
JLMC 4770	Diversity and the Media	
FCEDS 4910A	Supervised Experiences in a Professional Setting: Communications	6

Total Credits 45

Option 3- Professional Studies: 45 credits

AESHM 4740	Entrepreneurship in Human Sciences	3
or ENTSP 3100	Entrepreneurship and Innovation	
HDFS 2270	Middle Childhood and Adolescence	3
or HDFS 2340	Young Adulthood Through Later Life	
HDFS 3690	Research Methods in Human Development and Family Studies	3
HDFS 3670	Family Stress, Abuse, and Resilience	3
HDFS 3770	Aging and the Family	3
HDFS 3950	Children, Families, and Public Policy	3
HDFS 4200	Advanced Professional Practice	3
HDFS 3860	Human Services Management I	3

HDFS 4860	Human Services Management II (minimum of 6 credits)	3
Select one of the following:		3
HDFS 2390	Consumer Issues	
HDFS 3830	Fundamentals of Financial Planning	
HDFS 3410	Income Tax Planning	
HDFS 3840	Insurance Planning	
HDFS 3780	Retirement Planning and Employee Benefits	
Select one of the following:		3
AESHM 3420	Aesthetics of Consumer Experience	
PHIL 3400	Aesthetics: Art, Beauty, and Everyday Life	
FDM 3620	Cultural Perspectives of Global Dress	
Select two from the following:		6
HDFS 2700	Family Communications and Relationships	
COMST 2140	Professional Communication	
COMST 3140	Organizational Communication	
PR 2200	Principles of Public Relations	
PR 3050	Publicity Methods	
ENGL 3020	Business Communication	
ENGL 3140	Technical Communication	
FCEDS 4910B	Supervised Experiences in a Professional Setting: Professional Studies	6

Total Credits 45

University Electives: 13-21 credits

Total Credits: 123 credits

The courses listed in this section are approved general education course options for this major.

Natural Sciences and Mathematics: 9-10 credits. Coursework designed to facilitate students' understanding of the structure and behavior of the natural world and appreciate mathematics as a valuable tool of the sciences and an intrinsically important way of thinking.

Licensure

Select 3-4 credits from:	
MATH 1040	Introduction to Probability
MATH 1050	Introduction to Mathematical Ideas
MATH 1400	College Algebra
MATH 1500	Discrete Mathematics for Business and Social Sciences
MATH 1650	Calculus I
MATH 1950	Mathematics for Elementary Education I
STAT 1010	Principles of Statistics
Communications	

Select 3-4 credits from:

STAT 1010	Principles of Statistics
STAT 1040	Introduction to Statistics

Professional Studies

Select 3-4 credits from:

MATH 1040	Introduction to Probability
MATH 1050	Introduction to Mathematical Ideas
MATH 1400	College Algebra
MATH 1500	Discrete Mathematics for Business and Social Sciences
MATH 1650	Calculus I
MATH 1950	Mathematics for Elementary Education I
STAT 1010	Principles of Statistics

Humanities: 6 credits. Coursework designed to assist students to develop an understanding of human cultural heritage and history, and an appreciation of reasoning and the aesthetic value of human creativity.

Note: Courses meeting International Perspectives requirements are marked with an *. Additional courses may be found in departments listed with a double **.

AESHM 3420	Aesthetics of Consumer Experience	3
AFAM 2010	Introduction to African American Studies	3
AFAM 3340	Africana Religions	3
AFAM 3470	African American Literature	3
AFAM 3530	History of African Americans I	3
AFAM 3540	History of African Americans II	3
FDM 3540	Fashion History I: Prehistoric to Mid-19th Century	3
FDM 3560	Fashion History II: Mid-19th Century to the Present	3
AMIN 2100	Introduction to American Indian Studies	3
AMIN 2400	Introduction to American Indian Literature	3
AMIN 3460	American Indian Literature	3
ARCH 2210	Histories and Theories of Architecture to 1750 *	3
ARCH 4200	Topics in American Architecture	3
Art History (ARTH) **		
American Sign Language (ASL)		
Classical Studies (CLST) **		
DANCE 2700	Dance Appreciation	3
DANCE 3600	History and Philosophy of Dance	3
ENGL 2010	Introduction to Literature	3
ENGL 2250	Survey of British Literature to 1800	3
ENGL 2260	Survey of British Literature since 1800	3
ENGL 2270	Survey of American Literature to 1865	3
ENGL 2280	Survey of American Literature since 1865	3

ENGL 2400	Introduction to American Indian Literature	3
HDFS 2400	Children's Literature	3
History (HIST) **		
HSPM 2600	Global Tourism Management *	3
MUSIC 1020	Introduction to Music Listening *	3
MUSIC 3020	Masterpieces of Music and Art in Western Culture	3
MUSIC 3040	History of American Rock 'n' Roll	3
MUSIC 3830	History of Music I *	3
MUSIC 3840	History of Music II *	3
Philosophy (PHIL)		
Religious Studies (RELIG) **		
THTRE 1060	Introduction to the Performing Arts	3
THTRE 1100	Theatre and Society	3
WGS 2010	Introduction to Women's and Gender Studies	3
WGS 3360	Religion, Sex and Gender	3
WGS 3380	Feminist Philosophy	3
WGS 3450	Women's Literature	3
WGS 3700F	Studies in English Translation: French Topics on Women and Gender Studies *	3
	or WGS 3700G Studies in English Translation: German Topics on Women or Feminism	
	or WGS 3700R Studies in English Translation: Russian Topics on Women or Feminism	
	or WGS 3700S Studies in English Translation: Hispanic Topics on Women or Feminism	
WGS 3740	Sex, Gender, and Culture in the Ancient Mediterranean World *	3
WGS 3850	Women in Politics	3
WGS 3860	History of Women in America	3
World Languages and Cultures (ARABC, CHIN, FRNCH, GER, GREEK, RUS, SPAN) **		

Family and Consumer Sciences Education and Studies, B.S.-teacher licensure option

Freshman

Fall	Credits Spring	Credits
HDFS 1100 or 1110	1 HDFS 2760	3
HDFS 1020	3 HDFS 2830	3
ENGL 1500	3 FCEDS 2060	2
EDUC 2040	3 MATH or STAT Course from approved FCEDS list	3
RELIG 2050 (Humanities course)	AESHM 4210, FSHN 3420, PSYCH 1010, or SOC 1340	3
FCEDS 2060	2 EDUC 2190	1

LIB 1600	1	
	13	15

Sophomore

Fall	Credits Spring	Credits
FCEDS 3060	4 CHEM 1600	3
EDUC 2020	3 HDFS 2240 or 2490	3
BIOL 1010 or 1550	3 HDFS 2240L	1
COMST 2110, 2140, 2180, SPCM 2120, or SPCM 3120	3 FSHN 1150	1
ENGL 2500	3 FSHN 1010 or 2420	3
	Apply to Educator Preparation program	
	FCEDS 3980	3
	16	14

Junior

Fall	Credits Spring	Credits
PSYCH 3330	3 FCEDS 3980	3
Humanities	3 FDM 1200	1
Communications from list	3 SPED 4010	3
FDM 1310	3 FCEDS 4800V	2
FCEDS 3250	3 Elective	5-6
FCEDS 3800V	1-2	
	16-17	14-15

Senior

Fall	Credits Spring	Credits
Elective	6-7 FCEDS 4170A	8
EDUC 4060	3 FCEDS 4170B	8
EDUC 4260	3 PRAXIS II in content & pedagogy to be taken prior to license approval	
	12-13	16

U.S. Cultures and Communities and International Perspectives

Requirement: Students in Family and Consumer Sciences Education fulfill the U.S. Cultures and Communities by taking HDFS 2760 and the International Perspectives Requirement by taking FSHN 3420.

Note: This sequence is only an example. The number of credits taken each semester should be based on the individual student's situation. Factors that may affect credit hours per semester include student ability, employment, health, activities, and grade point consideration.

Family and Consumer Sciences Education and Studies, B.S.-communications option**Freshman**

Fall	Credits Spring	Credits
HDFS 1100 or 1110	1 CHEM 1600 or 1630	3-4
ENGL 1500	3 CHEM 1630L (if taking CHEM 1630)	
Humanities	3 FCEDS 2060	2
HDFS 1020	3 Humanities	3
LIB 1600	1 HDFS 2830 or 2390	3
HSPM 1010	3 HDFS 2760	3
	14	14-15

Sophomore

Fall	Credits Spring	Credits
FCEDS 3060	4 PR 3050	3
AESHM 2870	3 HDFS 2240	3
FSHN 1010 (or FSHN 2420 or FSHN 1150)	3 HDFS 2240L	1
BIOL 1010 or 1550	3 HDFS 3670 (or HDFS 3770 or HS 1100)	3
ENGL 2500	3 Math or Stat from approved list	3-4
	Communications from list	3
	16	16-17

Junior

Fall	Credits Spring	Credits
HDFS 3670	3 ENGL 3130 (or ENGL 3140, ENGL 3320, ENGL 4150, or ENGL 4160)	3
FCEDS 3250	3 HDFS 3860	3
HDFS 2700 (or COMST 2140 or COMST 3140)	3 PR 2200	3
HDFS 3690	3 JLMC 4760 (or JLMC 4770, JLMC 4620)	3
Social Sciences from approved list	3 HDFS 3950	3
HDFS 2270 or HDFS 2340	3	
HDFS 3690	3	
	21	15

Senior

Fall	Credits Spring	Credits
HDFS 4860	3 FCEDS 4910A (3-6 credits)	6
HDFS 3950	3 Electives (to equal 123 total credits)	9-11

HDFS 4200	3	
Electives	9	
	18	15-17

U.S. Cultures and Communities and International Perspectives

Requirement: Students in Family and Consumer Sciences Education fulfill the U.S. Cultures and Communities by taking HDFS 2760 and the International Perspectives Requirement by taking FSHN 3420.

Note: This sequence is only an example. The number of credits taken each semester should be based on the individual student's situation.

Factors that may affect credit hours per semester include student ability, employment, health, activities, and grade point consideration.

Family and Consumer Sciences Education and Studies, B.S.-professional studies option

Freshman

Fall	Credits Spring	Credits
HDFS 1100 or 1110	1 FCEDS 2060	2
RELIG 2050	3 Humanities	3
ENGL 1500	3 MATH or STAT Course from approved FCEDS list	3
HDFS 1020	3 CHEM 1600 (or CHEM 1630 with lab)	3
LIB 1600	1 CHEM 1630L (if taking CHEM 1630)	
FCEDS 2060	2 HDFS 2830	3
FSHN 1010	3	
	16	14

Sophomore

Fall	Credits Spring	Credits
FCEDS 3060	4 COMST 2110, 2140, 2180, SPCM 2120, or SPCM 3120	3
CHS Elective (300 level)	3 HDFS 2830 or 2390	3
HDFS 2760	3 HDFS 2490 or 2240	3
BIOL 1010 or 1550	3 Elective	3
ENGL 2500	3 HDFS 3670	3
	16	15

Junior

Fall	Credits Spring	Credits
AESHM 3420, PHIL 3400, or FDM 3620	3 CHS Elective (3000 level or above)	3
HDFS 3690	3 ECON 1010	3
HDFS 3770	3 HDFS 4860	3
Select two from:	6 ENGL 3020, 3140, PR 2200, or PR 3050	3

PR 2200	Humanities Course	3
ENGL 3020		
ENGL 3140		
PR 3050		
	15	15

Senior

Fall	Credits Spring	Credits
HDFS 4200	3 FCEDS 4910B	6
HDFS 4860	3 Electives to equal 123 total credits	8
Electives	9 CHS Elective (3000 level or above)	3
	15	17

U.S. Cultures and Communities and International Perspectives

Requirement: Students in Family and Consumer Sciences Education fulfill the U.S. Cultures and Communities by taking HDFS 2760 and the International Perspectives Requirement by taking FSHN 3420.

Note: This sequence is only an example. The number of credits taken each semester should be based on the individual student's situation.

Factors that may affect credit hours per semester include student ability, employment, health, activities, and grade point consideration.

The **Education Services in Family and Consumer Sciences** minor may be earned by completing 15 credits

HDFS 1020	Human Development	3
FCEDS 2060	Home Ec to Human Sciences: Legacy and Advocacy.	2
FCEDS 3060	Teaching Human Sciences	4
FCEDS 4130	Curriculum, Lab Management and Assessment for Family and Consumer Sciences	3
One of the following:		3
FCEDS 3980	Foundations of Career and Technical Education in Family and Consumer Sciences	
HDFS 3410	Income Tax Planning	
HDFS 3600	Housing and Services for Families and Children	
HDFS 3670	Family Stress, Abuse, and Resilience	
HDFS 3730	Death as a Part of Living	
HDFS 3950	Children, Families, and Public Policy	

Family and Consumer Sciences, MFCS

Master of Family and Consumer Sciences (M.F.C.S.)

The College of Human Sciences offers a nonthesis, professional master's degree program offered completely online through the Great Plains Interactive Distance Education Alliance (or GPIDEA).

Students select one of the following specializations (all require 36 credits): Dietetics (no longer accepting new applicants), Family Financial Planning, Gerontology, and Youth Development

The Program of Study committee, in consultation with the student, establishes the courses to be taken and the acceptability of transfer credits. The major professor is selected from the discipline in which the concentration of coursework will be taken. Written and oral final integrative examinations are required in lieu of a thesis or creative component.

Admission requirements for the MFCS include a bachelor's degree from a regionally-accredited college or university, minimum 3.00 cumulative grade point average (students below this GPA will still be considered for admission), transcripts from all colleges and universities attended, two letters of recommendation, and a goal statement. Non-English speaking international students are required to have a TOEFL score of at least 550 at time of admission.

Graduate Certificates

<https://www.hs.iastate.edu/graduate/>

Graduate Certificates

Four graduate certificates are available:

- Family Financial Planning (18 credits): fulfills educational requirements of the Certified Financial Planner Board of Standards CFP® Certification Examination.
- Gerontology (15 credits)
- Youth Development Specialist (12 credits)
- Youth Program Management and Evaluation (12 credits)

For additional information, students should contact the Great Plains IDEA Campus Coordinator, 2155 Lagomarcino, gptideainfo@iastate.edu, 515-294-5397.

Family Financial Planning Interinstitutional Graduate Program

Iowa State University offers a Master's degree in Family and Consumer Sciences with specialization in Family Financial Planning. This is an

interinstitutional online program offered through the Great Plains Interactive Distance Education Alliance (or GPIDEA). The student selects a home institution (Iowa State), which ultimately grants the degree. After admission to Iowa State, the student takes courses from Iowa State and the other participating institutions: Montana State University, North Dakota State University, Oklahoma State University; South Dakota State University, and University of Nebraska-Lincoln.

The master's degree consists of 36 credits, 24 required credits and 12 elective credits (<http://www.online.hs.iastate.edu/graduate-degrees/family-financial-planning/>). This program does not require a thesis.

Both the Master's degree and Graduate Certificate programs at Iowa State University are registered with Certified Financial Planner Board of Standards Inc. As a CFP® Board-registered Program, ISU's FFP courses satisfy CFP® Board's education requirement, allowing an individual to sit for the CFP® Certification Examination.

Iowa State University does not certify individuals to use the CFP®, CERTIFIED FINANCIAL PLANNER™ title. CFP® certification is granted only by Certified Financial Planner Board of Standards Inc. to those persons who, in addition to completing an educational requirement such as this CFP® Board-Registered Program, have met its ethics, experience and examination requirements. (CFP® Board of Standards web site: www.cfp.net (<http://www.cfp.net>)).

Certified Financial Planner Board of Standards Inc. owns the certification marks CFP®, CERTIFIED FINANCIAL PLANNER™ and the federally registered CFP®, which it awards to individuals who successfully complete initial and ongoing certification requirements.

FFP Graduate Certificate

The Graduate Certificate in Family Financial Planning requires six courses/18 credits which contain the competencies required for the Certified Financial Planner (CFP®) Certification Examination.

Required courses for the Family Financial Planning graduate certificate program include:

FFP 5400	Estate Planning for Families	3
FFP 5450	Retirement Planning, Employee Benefits, and the Family	3
FFP 5550	Insurance Planning for Families	3
FFP 5650	Personal Income Taxation	3
FFP 5830	Investing for the Family's Future	3
FFP 5950	Financial Planning - Case Studies	3

Both the Family Financial Planning Master's degree and Graduate Certificate programs at Iowa State University are registered with Certified Financial Planner Board of Standards Inc. As a CFP Board-registered

Program, ISU FFP courses satisfy CFP Board's education requirement, allowing an individual to sit for the CFP® Certification Examination.

This is an interinstitutional online program offered through the Great Plains Interactive Distance Education Alliance (or GPIDEA). The student selects a home institution (Iowa State), which ultimately grants the certificate. After admission to Iowa State, the student takes courses from Iowa State and the other participating institutions: Montana State University, North Dakota State University, Oklahoma State University; South Dakota State University, and University of Nebraska-Lincoln.

Courses primarily for graduate students, open to qualified undergraduates:

FFP 5200: Financial Theory and Research I

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Theories of family functioning, macroeconomic theory related to family resource allocation decisions, the family as an economic unit, and the interaction of the economy and families. (Typically Offered: Fall, Spring, Summer)

FFP 5250: Financial Theory and Research II

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Microeconomic theory as it relates to family resource allocation decisions, theories of household behavior, the lifecycle hypothesis, behavioral economics, behavioral finance, theories of behavioral change, and psychological theories of family well-being. Focus on empirical research investigating household financial decision-making. (Typically Offered: Fall, Spring, Summer)

FFP 5300: Fundamentals of Family Financial Planning

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to the financial planning process and establishing client-planner relationships. Applied work in cash flow, credit and debt, income tax, insurance, investment, retirement and estate planning. Review of services provided to families, documentation required, ethics in financial planning, and Certified Financial Planner licensee responsibilities. (Typically Offered: Fall, Spring, Summer)

FFP 5350: Financial Counseling

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Theory and research regarding the interactive process between the client and the practitioner, including communication techniques, motivation and esteem building, the counseling environment, ethics, and methods of data intake, verification, and analysis. Other topics include legal issues, compensation, uses of technology to identify resources, information management, and current or emerging issues. (Typically Offered: Fall, Spring, Summer)

FFP 5400: Estate Planning for Families

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Fundamentals of the estate planning process, including estate settlement, estate and gift taxes, property ownership and transfer, and powers of appointment. Tools and techniques used in implementing an effective estate plan, ethical considerations used in providing estate planning services, and new and emerging issues in the field. Case studies provide experience in developing estate plans suitable for varied family forms. (Typically Offered: Fall, Spring, Summer)

FFP 5410: Housing and Real Estate in Family Financial Planning

(Cross-listed with HDFS 5410).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

The role of housing and real estate in the family financial planning process, including taxation, mortgages, financial calculations, legal concerns, and ethical issues related to home ownership and real estate investments. Emphasis on emerging issues in the context of housing and real estate. Offered even-numbered years. (Typically Offered: Summer)

FFP 5450: Retirement Planning, Employee Benefits, and the Family

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Study of micro and macro considerations for retirement planning. Survey of various types of retirement plans, ethical considerations in providing retirement planning services, assessing and forecasting financial needs in retirement, and integration of retirement plans with government benefits. (Typically Offered: Fall, Spring, Summer)

FFP 5500: Military Personal Financial Readiness

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Overview of the topics relevant to the financial planning process that address the unique needs of military service members and their families. (Typically Offered: Fall, Summer)

FFP 5550: Insurance Planning for Families

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

In-depth study of risk management concepts, tools, and strategies for individuals and families, including life insurance; property and casualty insurance; liability insurance; accident, disability, health, and long-term care insurance; and government-subsidized programs. Current and emerging issues and ethical considerations relative to risk management. Case studies provide experience in selecting insurance products suitable for individuals and family, study of investment options for clients including common stocks, fixed income securities, convertible securities, and related choices. Relationships between investment options and employee/employer benefit plan choices. Current and emerging issues and ethics are included. (Typically Offered: Fall, Spring, Summer)

FFP 5650: Personal Income Taxation

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

In-depth information on income tax practices and procedures including tax regulations, tax return preparation, the tax audit processes, the appeals process, preparation for an administrative or judicial forum, and ethical considerations of taxation. New and emerging issues related to taxation. Family/individual case studies provide practice in applying and analyzing tax information and recommending appropriate tax strategies. (Typically Offered: Fall, Spring, Summer)

FFP 5700: Professional Practices in Financial Planning

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Challenges of managing financial planning practices including, but not limited to: business valuation, personnel, marketing, client services, ethics and technological applications. Relying both on a theoretical as well as an applied approach, students analyze case studies that provide relevant, practical exposure to practice management issues, with a strong emphasis on current research findings. (Typically Offered: Fall, Spring, Summer)

FFP 5830: Investing for the Family's Future

(Cross-listed with HDFS 5830).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Evaluation of investment markets for the household. Analysis of how families choose where to put their savings. Emphasis is on using the family's overall financial and economic goals to help inform investment choices. (Typically Offered: Fall)

FFP 5900: Family Financial Planning Seminar

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 3 credits.

Prereq: Graduate Standing or Permission of Instructor

Through a seminar format comprised of readings, guest lectures, collaborative case studies, peer interaction, and practical application, students will explore the rapidly growing and changing opportunities of sustainable, responsible, and impact investments. (Typically Offered: Spring, Summer)

FFP 5910: Practicum

Credits: 3-6. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Supervised experience in family financial planning. (Typically Offered: Fall, Spring, Summer)

FFP 5950: Financial Planning - Case Studies

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Professional issues in financial planning, including ethical considerations, regulation and certification requirements, communication skills, and professional responsibility. Students are expected to utilize skills obtained in other courses and work experiences in the completion of personal finance case studies, the development of a targeted investment policy, and other related financial planning assignments. (Typically Offered: Fall, Spring, Summer)

Fashion Design and Merchandising

Administered by the Department of Apparel, Events, and Hospitality Management. Leading to the degree Bachelor of Science.

Total credits required: 123 including a minimum of 18 credits in FDM at Iowa State University for the degree (12 of the 18 credits must be at the 3000-4000 level). The major in Fashion Design and Merchandising provides a broad-based program of study with flexibility in creating program options. Courses are required in general education and the apparel industry professional core. To complete the program, a student selects a primary option from design, product development and innovation, merchandising and retail analytics, or fashion communication.

Minors and a certificate are available in apparel, merchandising, and design: (a) textile science and product performance or (b) a textile design minor in collaboration with the College of Design; and a merchandising certificate.

Student Learning Outcomes

Upon graduation, students should be able to:

- 1. *Communication.* Use clear and effective written, oral, verbal and electronic (WOVE) communication techniques to foster inquiry, collaboration, and engagement in apparel and related industries.
- 2. *Self-assessment/self-reflection.* Analyze and evaluate one's own knowledge, abilities, and actions relative to professional standards, seek opportunities to grow professionally, and utilize self-assessment and assessment of others to foster psychological, cognitive, social and emotional well-being.
- 3. *Critical thinking.* Understand fundamental concepts of apparel, merchandising, and design and apply critical thinking to solve problems from personal, scholarly, and professional perspectives.
- 4. *Ethics, Diversity, and Social Responsibility.* Demonstrate leadership and social justice to improve quality of life for global citizens and encourage socially responsible decision-making for consumers and businesses.

UNDERGRADUATE STUDY

The program offers study for the degree of Bachelor of Science with a major in Fashion Design and Merchandising (FDM). The program offers students a broad understanding of textile and apparel products, merchandising and marketing strategies, technical and creative design, product development, production processes, and business practices leading to a wide range of careers at state, national, and international levels in business and industry. Courses in the program provide scientific, technical, and humanistic knowledge about textiles, apparel, and related products basic to career preparation. Courses also provide knowledge applicable to the development and use of apparel and textile products by individuals, families, and institutions. The program provides a foundation for graduate study. Graduates understand the production, distribution, and use of textiles and apparel, aesthetic expression, and communication. They are prepared to plan, develop, source and present textile and apparel products to meet the needs of consumers. Students understand the issues involved in textile and apparel production and marketing, both nationally and internationally.

The FDM major provides a broad-based program of study with flexibility in creating an individualized program. To complete the program, a student combines general education, FDM core classes, and a structure of focused courses to form an option in: (a) creative and technical design, (b) fashion communication, (c) product development and innovation, or (d) merchandising and retail analytics.

An option in *creative and technical design* is appropriate for those interested in the aesthetic and creative aspects of design, technical design, costuming, textile design, and product development. The *fashion communications* option prepares students for the development and delivery of visual, written, and oral communication. Career opportunities are in visual merchandising, styling, fashion influencing, social media, and communication. An option in *product development and innovation* is

appropriate for those interested in developing innovative products for special markets including accessories, footwear, performance wear, smart textiles, functional apparel, and soft goods for home. Career opportunities include designer, materials testing, quality assurance, and technical design. An option in *merchandising and retail analytics* prepares students for the planning, promotion, and presentation of market-oriented product lines and events. Career opportunities are in buying, promotion, sales, product development, branding, and management in both manufacturing and retailing sectors with a focus on the textile and apparel industry.

For additional courses of interest, see Fashion Design and Merchandising.

GRADE POINT REQUIREMENT

All students majoring in apparel, merchandising, and design are required to earn a C- or better in all AESHM and FDM courses applied toward the degree, including transfer credits.

COMMUNICATION PROFICIENCY REQUIREMENT

Undergraduate English proficiency is certified when the student has received a grade of C or better in ENGL 1500 Critical Thinking and Communication, and ENGL 2500 Written, Oral, Visual, and Electronic Composition.

Curriculum in FASHION, DESIGN, AND Merchandising

Administered by the Department of Apparel, Events, and Hospitality Management (AESHM). Leading to the degree bachelor of science.

Total credits required: 123, including a minimum of 18 credits in FDM at Iowa State University for the degree (12 of the 18 credits must be at the 3000-4000 level). Leads to the degree Bachelor of Science. Administered by the AESHM Department. All students majoring in Fashion, Design, and Merchandising (FDM) are required to earn a C- or better in all FDM, AESHM, EVENT, and HSPM courses applied toward the degree, including transfer credits. All students majoring in Fashion, Design, and Merchandising (FDM) are required to earn a C or better in ENGL 1500 and ENGL 2500. No courses may be applied to more than one degree requirement except those used to meet U.S. Cultures and Communities and International Perspectives requirements.

Cr. Degree Requirements

(10) COMMUNICATIONS AND LIBRARY

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
LIB 1600	Introduction to College Level Research	1
Select one (1) course from:		3
COMST 2100	Communication and U.S. Diversity	

COMST 2140	Professional Communication	
COMST 2180	Communication and Conflict Management	
SPCM 2120	Fundamentals of Public Speaking	

Total Credits 10

(9-12) NATURAL SCIENCE AND MATH

Select one (1) class from: 3

MATH 1040	Introduction to Probability	
MATH 1050	Introduction to Mathematical Ideas	
MATH 1400	College Algebra	
MATH 1430	Preparation for Calculus	
MATH 1500	Discrete Mathematics for Business and Social Sciences	
MATH 1510	Calculus for Business and Social Sciences	

Merchandising & Retailing Analytics: Recommended MATH 1500

Creative and Tech Design, Product Development, and Product Management Options must take: 3-5

CHEM 1630	College Chemistry	
CHEM 1630L	Laboratory in College Chemistry	

Merchandising & Retailing Analytics and Fashion Communications Options select one (1) class from:

Department of ASTRO, BIOL, CHEM, ENVS, GEN, GEOL, MTEOR, PHYS, or FSHN (101 OR 167)

Select one (1) class from: 3-4

STAT 1010	Principles of Statistics	
STAT 1040	Introduction to Statistics	
STAT 2260	Introduction to Business Statistics I	

Total Credits 9-12

(15) HUMANITIES AND SOCIAL SCIENCES

ECON 1010 Principles of Microeconomics 3

FDM 1650 Fashion, Appearance, and Diversity in U.S. Society 3

FDM 3560 Fashion History II: Mid-19th Century to the Present 3

Select one (1) class from: 3

ARTH or HIST Departments

Creative & Tech Designs must take ART H

Select one (1) course from: Humanities & Social Sciences list or one of the following courses: 3

FDM 3540	Fashion History I: Prehistoric to Mid-19th Century	
FDM 3620	Cultural Perspectives of Global Dress	
FDM 4580	Queer Fashions: History, Culture, and the Industry	

AESHM 4620X Black Lives Matter: Fashion, Politics, and Resistance Movements

Total Credits 15

ALL FDM STUDENTS COMPLETE: (12-15) AESHM PROFESSIONAL DEVELOPMENT

AESHM 1110 Professional Development for AESHM 1

AESHM 1110L AESHM Program Orientation and Learning Community 1

AESHM 2110 Leadership Experiences and Development (LEAD) 3

AESHM 3110N Seminar on Careers and Internships: Apparel, Merchandising, and Design 1

AESHM 4700MX Supervised Professional Internship: Apparel (Out-of-state) 3

OR

AESHM 4700N Supervised Professional Internship: Apparel 3

AND

If internship completed in home state, select 3 credits from: 3

AESHM 2800 Orientation to U.S. Field Study

AESHM 3800N U.S. Field Study: Apparel, Merchandising, and Design

AESHM 2810 Orientation to International Field Study

AESHM 3810N International Field Study: Apparel, Merchandising, and Design

AESHM 1700N Supervised Work Experience I: Apparel

AESHM 1800N First Year Student Field Study: Apparel, Merchandising, and Design

AESHM 2700N Supervised Work Experience II: Apparel

AESHM 2870 Principles of Management in Human Sciences

AESHM 4210 Developing Global Leadership: Maximizing Human Potential

Total Credits 15

(26) FDM INTEGRATED CORE

FDM 1310 Fashion Products and Markets 3

FDM 2040 Textile Science 4

FDM 2100 Computer Applications in Digital Design 3

FDM 2310 Product Development and Manufacturing 3

FDM 2450 Aesthetics and Brand Image 3

FDM 2750 Retail Merchandising 3

FDM 3720 Sourcing and Global Issues 3

COMS 1130 Introduction to Spreadsheets and Databases 3

Total Credits 25

PRIMARY OPTIONS

Select one professional primary option from the following 4 choices: Creative & Technical Design, Product Development & Innovation, Merchandising & Retail Analytics, and Fashion Communications (minor required)

(43) Creative & Technical Design

FDM 1200	Intro to Assembly Apparel Processes	1
FDM 1210	Apparel Assembly Processes	3
FDM 1780	Introduction to Apparel Design Studio	3
FDM 2250	Patternmaking I: Drafting and Flat Pattern	3
FDM 2780	Fashion Illustration	3
FDM 3100	Computer Aided Apparel Patternmaking	3
FDM 3210	Computer Integrated Textile and Fashion Design	3
FDM 3250	Patternmaking II: Draping	3
FDM 4260	Creative Design Processes	3
FDM 4150	Technical Design Processes	3
FDM 4950	Senior Design Studio	3
Select one (1) course from:		3
FDM 3050	Quality Assurance of Textiles and Apparel	
FDM 4040	Innovative Textiles	
FDM 4310	Apparel Production Management	
Select one (1) course from:		3
FDM 3540	Fashion History I: Prehistoric to Mid-19th Century	
FDM 3620	Cultural Perspectives of Global Dress	
FDM 4580	Queer Fashions: History, Culture, and the Industry	
AESHM 4620X	Black Lives Matter: Fashion, Politics, and Resistance Movements	
Option "electives" (work with your advisor)		6
Total Credits		43

(43) Product Development & INNOVATION

FDM 1200	Intro to Assembly Apparel Processes	1
FDM 1210	Apparel Assembly Processes	3
FDM 1780	Introduction to Apparel Design Studio	3
FDM 2250	Patternmaking I: Drafting and Flat Pattern	3
FDM 3050	Quality Assurance of Textiles and Apparel	3
FDM 3100	Computer Aided Apparel Patternmaking	3
FDM 3210	Computer Integrated Textile and Fashion Design	3
FDM 4040	Innovative Textiles	3
FDM 4150	Technical Design Processes	3
FDM 4310	Apparel Production Management	3
FDM 4960	Soft-Goods Product Development and Prototyping	3
SCM 3010	Supply Chain Management	3

(9) Option electives. Select from FDM, AESHM, THTRE, ART, DSGN, DSNS or SCM 9

Total Credits 43

(43) Merchandising & Retail Analytics

ACCT 2840	Financial Accounting	3
AESHM 3400	Hospitality and Apparel Marketing Strategies	3
or MKT 3400	Principles of Marketing	
AESHM 4740	Entrepreneurship in Human Sciences	3
FDM 3750	Omni-Channel Retailing	3
FDM 3760	Merchandise Planning and Buying	3
FDM 3760L	Merchandising Planning and Buying Lab	1
FDM 3770	Visual Presentation and Promotions	3
FDM 3880	Trend Forecasting	3
FDM 4670	Consumer Studies in Apparel and Fashion Products	3
FDM 4750	Retail Analytics	3
DS 2010	Introduction to Data Science	3
Option "electives" (work with your advisor)		12
Total Credits		43

(36-37) Fashion Communication

ACCT 2840	Financial Accounting	3
or AESHM 1750	Financial Applications for Retail and Hospitality Industries: Retail Merchandising	
AESHM 3400	Hospitality and Apparel Marketing Strategies	3
or MKT 3400	Principles of Marketing	
AESHM 4740	Entrepreneurship in Human Sciences	3
FDM 2880	Styling	3
FDM 3760	Merchandise Planning and Buying	3
FDM 3760L	Merchandising Planning and Buying Lab	1
FDM 3770	Visual Presentation and Promotions	3
FDM 3880	Trend Forecasting	3
EVENT 1710	Introduction to Event Management	3
EVENT 2770	Digital Promotion in the Service Industry	3
Option "electives" (work with your advisor)		9
A minor is required for this option, so talk with your advisor for more information.		
Total Credits		37

Fashion Design and Merchandising B.S. - Creative and Technical Design
Primary Option

Freshman

Fall	Credits	Spring	Credits
ENGL 1500		3 ENGL 2500	3
FDM 1310		3 MATH 1400	3
FDM 1650		3 FDM 1210	3
FDM 1780		3 FDM 2040	4
AESHM 1110		1 FDM 2060	Required
AESHM 1110L		1 FDM 2450	3
LIB 1600		1	
15		16	

Sophomore

Fall	Credits	Spring	Credits
FDM 2100		3 FDM 2250	3
FDM 2750		3 AESHM 2110	3
FDM 2780		3 ARTH 2810	3
Humanities & Social Science Choice		3 COMS 1130	3
CHEM 1630		4 ECON 1010	3
CHEM 1630L		1	
17		15	

Junior

Fall	Credits	Spring	Credits	Summer	Credits
FDM 2310		3 FDM 3100		3 AESHM 4700N	5
FDM 3210		3 FDM 3290		3	
FDM 3250		3 FDM 3560		3	
AESHM 3110N		1 AESHM 2800		R	
STAT 1010		4 AESHM 3800N		3	
		Speech		3	
		Choice			
14		15		5	

Senior

Fall	Credits	Spring	Credits
FDM 3720		3 Creative & Technical Design Option Elective 2	3
FDM 4150		3 FDM 4310	3
FDM 4950		3 FDM 3620	3

Creative & Technical Design Option Elective 1	3 Elective	3

12**12****Total Credits: 121**

Fashion Design and Merchandising B.S - Merchandising Retail Analytics
Primary Option

Freshman

Fall	Credits	Spring	Credits
ENGL 1500		3 ENGL 2500	3
FDM 1310		3 FDM 2450	3
FDM 1650		3 FDM 2040	4
AESHM 1110		1 COMS 1130	3
AESHM 1110L		1 ECON 1010	3
LIB 1600		1	
MATH 1400		3	
15		16	

Sophomore

Fall	Credits	Spring	Credits
FDM 2750		3 FDM 3560	3
FDM 2100		3 FDM 3760	3
Option Elective		3 FDM 3760L	1
ACCT 2840		3 AESHM 2110	3
History/ ARTH		3 DS 2010	3
		AESHM 3400	3
15		16	

Junior

Fall	Credits	Spring	Credits	Summer	Credits
FDM 2310		3 FDM 3750		3 AESHM 4700N	3
FDM 3770		3 FDM 4750		3	
Option Elective		3 FDM 3880		3	
AESHM 3110N		1 STAT 1010		4	
Science Choice		3 Merchandising Option Elective 3		3	
13		16		3	

Senior

Fall	Credits	Spring	Credits
FDM 3720		3 AESHM 4740	3
FDM 4670		3 Option Elective	3
Humanities or Social Science Elective		3 COMSTSpeech Choice	3
Elective		3 Merchandising Elective 3	3
Elective		3 Elective	2
15		14	

Total Credits: 123

Fashion Design and Merchandising B.S. - Product Development for
Apparel and Soft Goods Primary Option

Freshman

Fall	Credits	Spring	Credits
ENGL 1500		3 ENGL 2500	3
FDM 1310		3 FDM 1200	1
FDM 1650		3 FDM 1210	3
FDM 1780		3 CHEM 1630	4
AESHM 1110		1 CHEM 1630L	1
AESHM 1110L		1 MATH 1400	3
LIB 1600		1	
FDM 1200		1	
16		15	

Sophomore

Fall	Credits	Spring	Credits
FDM 2250		3 ECON 1010	3
FDM 2040		4 COMS 1130	3
Humanities/ Social science		3 AESHM 2110	3
FDM 2750		3 AESHM 3110N	1
FDM 2100		3 FDM 2450	3
16		13	

Junior

Fall	Credits	Spring	Credits	Summer	Credits
STAT 1010		4 FDM 3210		3 AESHM 4700N	3
FDM 3760		3 FDM 3560 ^{Spring}	3		
FDM 3760L		1 FDM 3100	3		

FDM 3720	3 FDM 4040 ^{Spring}	3
FDM 2310	3 History or Art History Choice	3
Elective	1	
15		15
		3

Senior

Fall	Credits	Spring	Credits
FDM 3050		3 FDM 4310	3
COMST/ Speech Choice		3 FDM 4960	3
FDM 4150		3 Product Development and Innovation Elective 3	3
SCM 3010		3 Elective	3
Option Elective		3 Elective	3
15		15	

Total Credits: 123

Fashion Design and Merchandising B.S. – Fashion Communications
Primary Option

Freshman

Fall	Credits	Spring	Credits
ENGL 1500		3 ENGL 2500	3
FDM 1310		3 FDM 2100	3
FDM 1650		3 FDM 2450	3
AESHM 1110		1 EVENT 1710	3
AESHM 1110L		1 MATH	3
LIB 1600		1	
Humanities/ Social Science		3	
15		15	

Sophomore

Fall	Credits	Spring	Credits
FDM 2040		4 AESHM 1750N	2
FDM 2750		3 FDM 3760	3
STAT 1040		3 FDM 3760L	1
COMS 1130		3 AESHM 2110	3
		ECON 1010	3

		EVENT 2770	3		
	13		15		
Junior					
Fall	Credits	Spring	Credits	Summer	Credits
FDM 2310		3 FDM 3560		3 AESHM 4700N	3
FDM 2880		3 FDM 3770		3	
Option		3 FDM 3880		3	
Elective					
AESHM 3110N		1 Option		3	
		Elective			
AESHM 3400		3 Minor		3	
MKT 3400					
Elective		2			
	15		15		3

Senior					
Fall	Credits	Spring	Credits		
FDM 3720		3 AESHM 4740		3	
COMST/ SPEECHh		3 History or ART		3	
Choice					
Minor		3 Minor		3	
Class 3		Class 5			
Minor		3 Option		3	
Class 4		Elective			
Science		3 Minor		3	
	15		15		

Total Credits: 121

Fashion Design and Merchandising

A minor in Fashion Design and Merchandising requires (15-17 cr.) of the following:

FDM 1310	Fashion Products and Markets	3
FDM 2040	Textile Science	4
FDM 2310	Product Development and Manufacturing	3
FDM 2750	Retail Merchandising	3
FDM 3720	Sourcing and Global Issues	3
Select 3 credits from:		3
FDM 3540	Fashion History I: Prehistoric to Mid-19th Century	
FDM 3560	Fashion History II: Mid-19th Century to the Present	
FDM 3620	Cultural Perspectives of Global Dress	
FDM 3750	Omni-Channel Retailing	
FDM 3760	Merchandise Planning and Buying	
FDM 3770	Visual Presentation and Promotions	

FDM 3880 Trend Forecasting

FDM 4580 Queer Fashions: History, Culture, and the Industry

AESHM 4740 Entrepreneurship in Human Sciences

Total Credits 19

FASHION, CULTURE, HISTORY, AND SOCIAL JUSTICE MINOR

The Fashion, Culture, History, and Social Justice minor will benefit emerging professionals and future leaders entering the fashion, museum, or other related industries become more critical people in regard to fashion, appearance, clothing, history, and identity. Examples of a few job titles that this minor would benefit include museum curator, collections manager, research associate, chief diversity officer, human resource roles, designers, merchandisers, product developers, and/or marketing managers.

Having an increased awareness of appearances and fashions of individuals historically experiencing oppression and marginalization can aid in societal improvements towards developing a more socially just environment. As students enter the workforce with a social justice background, they can better understand and work with others who are different from them. Additionally, having a better understanding of diverse consumers could help provide these consumers with the products they desire, in addition to avoiding public diversity issues that are far too common in the fashion industry.

Learning Outcomes:

- Examine historical, social/psychological, and cultural aspects of fashion, clothing, appearance, and identity with a focus on social justice.
- Define social justice, power, privilege, and inequity as it relates to the historical, social/psychological, and cultural aspects of fashion, clothing, appearance, and identity.
- Examine power dynamics of diverse communities and cultures and their fashions, clothing, appearance, and identities.

Requirements:

The Fashion, Culture, History, and Social Justice minor can be earned by successfully completing the following for a total of 15 credits. All course prerequisites must be completed prior to taking the course. All minor courses must be taken for a grade.

Required course: 3

FDM 1650 Fashion, Appearance, and Diversity in U.S. Society

Select from: 6

FDM 3540 Fashion History I: Prehistoric to Mid-19th Century

FDM 3560 Fashion History II: Mid-19th Century to the Present

FDM 4580 Queer Fashions: History, Culture, and the Industry

AESHM 4620X Black Lives Matter: Fashion, Politics, and Resistance Movements	
Select from:	6
African and African American Studies	
AFAM 2010	Introduction to African American Studies
AFAM 3110	Africa under Colonial Rule
AFAM 3300	Ethnic and Race Relations
AFAM 3340	Africana Religions
AFAM 3470	African American Literature
AFAM 3500	Women of Color in the U.S
AFAM 3530	History of African Americans I
AFAM 3540	History of African Americans II
AFAM 4730	Civil Rights and Ethnic Power
American Indian Studies	
AMIN 2010	Native People in American Culture
AMIN 2050	American Indians in the Movies
AMIN 2100	Introduction to American Indian Studies
AMIN 2250	American Indians of Iowa
AMIN 3100	Contemporary Topics in American Indian Studies
AMIN 3220	Peoples and Cultures of Native North America
AMIN 3460	American Indian Literature
Anthropology	
ANTHR 2250	American Indians of Iowa
ANTHR 3220	Peoples and Cultures of Native North America
ANTHR/AMIN 3320A	Current Issues in Native North America: Gender and Family
	or ANTHR 3320 Current Issues in Native North America: Indigenous Ecologies and Geographies
	or ANTHR 3320 Current Issues in Native North America: Cultural and Political Movements
	or ANTHR 3320 Current Issues in Native North America: Regional Focus
ANTHR 3420	Culture, Sex, and Gender
American Sign Language	
ASL 1070	Introduction to the Deaf-World
ASL 2750	Topics in Deaf Culture
ASL 3250	Deaf Peoples: Pre-World War II
Fashion Design and Merchandising	
FDM 3620	Cultural Perspectives of Global Dress
Arabic	
ARABC 3750	Arab Culture
Architecture	
ARCH 4260	Topics in Native American Architecture

Art History	
ARTH 3820	Art and Architecture of Asia
ARTH 3840	Art of Islam
ARTH 4940	Women/Gender in Art
Chinese	
CHIN 3700	Chinese Literature in English Translation
CHIN 3720	Introduction to Chinese Culture
CHIN 3750	China Today
CHIN 3780	Chinese Film and Society
CHIN 4030A	Seminar in Chinese Language and Culture: Translating Contemporary Chinese Texts
	or CHIN 4030B Seminar in Chinese Language and Culture: Topics on Business and Professions
	or CHIN 4030C Seminar in Chinese Language and Culture: Reading Chinese Texts
Classical Studies	
CLST 3740	Sex, Gender, and Culture in the Ancient Mediterranean World
Economics	
ECON 3210	Economics of Discrimination
English	
ENGL 3460	American Indian Literature
ENGL 3470	African American Literature
ENGL 3520	Queer Literature
History	
HIST 2550	Modern World History, Globalization in Perspective
HIST 3310	History of the Islamic World to 1800
HIST 3360	Ancient China
HIST 3370	Modern China
HIST 3400	Colonial Latin America
HIST 3410	Modern Latin America
HIST 3530	History of African Americans I
HIST 3540	History of African Americans II
HIST 3710	Mexican American History
HIST 3720	Latina/o History
HIST 3740	Sex, Gender, and Culture in the Ancient Mediterranean World
HIST 3800	History of Women in Science, Technology, and Medicine
HIST 3860	History of Women in America
HIST 4100	The Holocaust in History
HIST 4350	History of the Modern Middle East
HIST 4410	History of Modern Mexico and Central America

HIST 4570	History of American Sexualities	
HIST 4650	The American West	
HIST 4730	Civil Rights and Ethnic Power	
Leadership Studies		
LDST 3330	Women, Gender, and Leadership	3
Philosophy		
PHIL 2350	Ethical Issues in a Diverse Society	
PHIL 3380	Feminist Philosophy	
Political Science		
POLS 3850	Women in Politics	
Psychology		
PSYCH 3460	Psychology of Women	
PSYCH 3470	U.S. Latino/a Psychology	
Religious Studies		
RELIG 2100	Religion in America	
RELIG 3280	Native American Religions (RELIG 3330)	
RELIG 3340	Africana Religions	
RELIG 3360	Religion, Sex and Gender	
RELIG 3520	Religions of India	
RELIG 3580	Islam	
Sociology		
SOC 2350	Social Problems and American Values	
SOC 3270	Gender and Sexualities in Society	
SOC 3300	Ethnic and Race Relations	
SOC 3310	Social Class and Inequality	
SOC 3320	The Latino/Latina Experience in U.S. Society	
SOC 3500	Human Diversity in Agriculture and the Food System	
U.S. Latino/a Studies		
USLS 2110	Introduction to U.S. Latino/a Studies	
USLS 3230A	Latin American Anthropology: Violence and Memory	
USLS 3230B	Latin American Anthropology: Social movements and Democracy	
USLS 3230C	Latin American Anthropology: Race, Class and Gender	
USLS 3230D	Latin American Anthropology: Regional Focus	
USLS 3230E	Latin American Anthropology: Culture and Sport	
USLS 3430	Latin American Government and Politics	
USLS 3470	U.S. Latino/a Psychology	
USLS 3710	Mexican American History	
USLS 3720	Latina/o History	
USLS 4730	Civil Rights and Ethnic Power	

Women's and Gender Studies	
WGS 2010	Introduction to Women's and Gender Studies
WGS 2030	Introduction to Lesbian Communities
WGS 2050	Introduction to Queer Studies
WGS 2100	Gender and Sexuality in American Pop Culture
WGS 3010	International Perspectives on Women and Gender
ENVS 3200	Ecofeminism
WGS 3210	Economics of Discrimination
WGS 3230	Gender and Communication
WGS 3250	Portrayals of Gender and Sexualities in the Media
WGS 3270	Gender and Sexualities in Society
WGS 3330	Women, Gender, and Leadership
WGS 3360	Religion, Sex and Gender
WGS 3380	Feminist Philosophy
WGS 3420	Culture, Sex, and Gender
WGS 3460	Psychology of Women
AFAM 3500	Women of Color in the U.S
WGS 3520	Queer Literature
WGS 3740	Sex, Gender, and Culture in the Ancient Mediterranean World
WGS 3800	History of Women in Science, Technology, and Medicine
WGS 3850	Women in Politics
WGS 3860	History of Women in America
WGS 4350	Gender, Globalization and Development
WGS 4570	History of American Sexualities
WGS 4940	Women/Gender in Art
World Languages and Cultures	
WLC 3520	Religions of India
WLC 3580	Islam

TEXTILE SCIENCE AND PRODUCT PERFORMANCE MINOR

The Textile Science and Product Performance minor is targeted specifically at the scientific, innovative, evaluative, technological, and performative aspects of textiles, and will fulfill industry demands for graduates that can provide answers to complex, interdisciplinary issues linked to textile-centered products. Textiles are utilized daily in: (a) medical procedures, (b) shelters and homes, (c) transportation, (d) physical and psychological protection, (e) physical performance, (f) adornment.

The minor is designed for:

- Students in the STEM fields of chemistry, chemical and biological engineering, and materials science and engineering who desire academic experiences and knowledge in another applied product area.
- Students in the apparel, merchandising, and design, areas who want a focused concentration on textile science and the evaluation of quality and performance of textiles and textile products.

Learning Outcomes

Students who complete the Textile Science and Product Performance minor will meet the following over-arching learning objectives:

- Apply a comprehensive understanding of the characteristics (physical, chemical and structural) of textiles/textile products and the interrelationship of these characteristics to their major discipline.
- Engage in interdisciplinary research through the analysis, testing and evaluation of textiles and textile products for sustainable industry and global applications in their major.

Requirements

The Textile Science and Product Performance minor consists of 17 credits, including 14 credits distributed over four required classes. Six of the nine required 3000-4000 level credits in the minor must be taken at Iowa State University. Nine credits must be isolated to the minor only.

FDM 2040	Textile Science	4
FDM 2310	Product Development and Manufacturing	3
FDM 3050	Quality Assurance of Textiles and Apparel	3
FDM 4040	Innovative Textiles	3

Select one for 3 credits from:

AESHM 4700N	Supervised Professional Internship: Apparel
FDM 4900A	Independent Study: Textile Science
FDM 4990	Undergraduate Research

Merchandising Certificate

A certificate in Merchandising requires (22 cr.) of the following:

FDM 2750	Retail Merchandising	3
FDM 3750	Omni-Channel Retailing	3
FDM 3760	Merchandise Planning and Buying	3
FDM 4750	Retail Analytics	3

Select from: 9

AESHM 2870	Principles of Management in Human Sciences
AESHM 3400	Hospitality and Apparel Marketing Strategies
AESHM 3420	Aesthetics of Consumer Experience
AESHM 4700N	Supervised Professional Internship: Apparel

AESHM 4740	Entrepreneurship in Human Sciences
FDM 1650	Fashion, Appearance, and Diversity in U.S. Society
FDM 2450	Aesthetics and Brand Image
FDM 3720	Sourcing and Global Issues
FDM 3770	Visual Presentation and Promotions
FDM 4670	Consumer Studies in Apparel and Fashion Products

Total Credits 21

The Merchandising Certificate may be earned at the same time as an ISU baccalaureate degree or after the completion of an associate of arts (AA) or associate of science (AS) degree or a baccalaureate degree from any accredited institution.

The FDM program offers a **concurrent B.S. and M.S. degree** that allows students to obtain a B.S. and M.S. degree in Fashion Design and Merchandising in **five** years. Application for admission to the Graduate College should be made in the junior year. More information can be found here: <https://aeshm.hs.iastate.edu/graduate-students/graduate-programs/apparel-merchandising-and-design/concurrent-bs-ms/>.

Graduate Study

The program offers work for the concurrent Bachelor of Science and Master of Science; Master of Science (thesis and non-thesis options; on-campus and hybrid); and Doctor of Philosophy (on-campus and distance hybrid) with a major in apparel, merchandising, and design. For all programs the field of study is highly interdisciplinary; programs of study are tailored to students' background and interests. The program offers a concurrent B.S. and M.S. degree that allows students to obtain both the B.S. and M.S. degrees in apparel, merchandising, and design in 5 years. Application for admission to the Graduate College should be submitted in fall semester of the junior year.

Graduates understand how textiles and apparel are essential in meeting individual and societal needs and understand the interdependence of nations and cultures as producers and consumers. Graduates understand diverse philosophies of scholarship and apply multiple methods to creative activity, research, and teaching. Strong writing and oral communication skills help graduates disseminate scholarship and compete successfully for awards and grants.

Graduates accept positions relevant to their academic experience. All doctoral graduates have teaching experience. Master's and doctoral graduates have experience working in team-oriented and interactive environments. Graduates are prepared to adapt to future changes in their professions and to provide leadership in professional and public practice. They bring a strong sense of ethics to research, teaching, and business endeavors.

Program emphases for graduate study include creative design and functional design; product development; consumer behavior; entrepreneurship; merchandising and marketing aspects of textiles and clothing; acquisition and use of textiles and apparel within cultures; U.S. dress and textiles from the 19th into the 21st centuries; textiles and sustainability.

Financial Counseling and Planning

Administered by the Department of Human Development and Family Studies. Leading to the degree Bachelor of Science.

The **Financial Counseling and Planning** curriculum prepares students for careers in family financial services. Financial Counseling and Planning is a growing career field and appeals to students who want to work with individuals and families to help them meet their financial goals and improve their financial capability to better meet financial challenges. Coursework provides students with the family resource management and interpersonal skills needed to help families remain financially secure. Based on individual specific career goals, students may select courses that lead to fulfilling the education requirements for the leading designations and certifications in financial counseling and planning. Graduates of the program are prepared for employment in personal banking, financial services, insurance, financial counseling and planning, and human service organizations. Laboratory and practicum opportunities exist in the Iowa State University Financial Counseling Clinic and with industry partners. A field experience encourages students to apply their studies and to experience the profession in real-world settings.

Student Learning Outcomes

Financial Counseling and Planning graduates are prepared to:

1. Help individuals and families make personal finance decisions using time value of money calculations.
2. Deliver professional, competent, and ethical financial counseling and planning services to clients.
3. Apply principles of client psychology within consumer and financial decision making.
4. Measure individual and family financial health and use these measures to create a comprehensive personal financial plan.
5. Attain the leading designations in financial counseling and planning. Upon graduation students have completed the educational requirements for the CERTIFIED FINANCIAL PLANNER™ and Accredited Financial Counselor® designations.

Total credits required: 120

Financial Counseling and Planning core (AFC & CFP exam ready): 36 credits

HDFS 1020	Human Development	3
or PSYCH 2300 Developmental Psychology		
HDFS 2390	Consumer Issues	3
HDFS 2830	Personal Finance	3
HDFS 3170G	Field Experiences: Financial Counseling and Planning	3
HDFS 3410	Income Tax Planning	3
HDFS 3780	Retirement Planning and Employee Benefits	3
HDFS 3830	Fundamentals of Financial Planning	3
HDFS 3840	Insurance Planning	3
or FIN 3610	Personal Risk Management and Insurance	
HDFS 4820	Investment Planning	3
or FIN 3200	Investments	
HDFS 4840	Estate Planning	3
HDFS 4850	Case Studies in Financial Counseling and Planning	3
HDFS 4890	Financial Counseling	2
HDFS 4890L	Financial Counseling Laboratory	1
Total Credits		36

Communications and Library: 13 credits

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
LIB 1600	Introduction to College Level Research	1
One of the following:		3
SPCM 2120	Fundamentals of Public Speaking	
COMST 2100	Communication and U.S. Diversity	
COMST 2110	Interpersonal Communication	
COMST 2140	Professional Communication	
COMST 2180	Communication and Conflict Management	
HDFS 2700	Family Communications and Relationships	
One of the following:		3
AGEDS 3270	Survey of Agriculture and Life Sciences Communication	
ENGL 3020	Business Communication	
ENGL 3090	Proposal and Report Writing	
ENGL 3140	Technical Communication	
Total Credits		13

Natural Sciences and Mathematical Disciplines: 9 credits

One of the following:

STAT 1010	Principles of Statistics	
STAT 1040	Introduction to Statistics	
STAT 2260	Introduction to Business Statistics I	
ACCT 2840	Financial Accounting	3
COMS 1130	Introduction to Spreadsheets and Databases	3
	or Computer Science course	

Total Credits 9

Social Sciences: 9 credits

ECON 1010	Principles of Microeconomics	3
SOC 1340	Introduction to Sociology	3
	or PSYCH 2800 Social Psychology	
	Social Science course from approved general education options	3

Total Credits 9

Humanities: 6 credits

Choose from one of the following:

PHIL 2300	Moral Theory and Practice	
PHIL 2350	Ethical Issues in a Diverse Society	
	Choose from approved Humanities list*	3

HDFS orientation: 1 credit

HDFS 1100	Freshman Learning Community Orientation	1
	or HDFS 1110 New Transfer Student Seminar	

Total Credits 1

Electives: 46 credits as needed to equal 120 total credits

Recommended HDFS Electives (part of total electives).

HDFS 2340	Young Adulthood Through Later Life	3
HDFS 2490	Family Studies	3
HDFS 2760	Human Sexuality	3
HDFS 3210	Happiness Across the Lifespan	3
HDFS 3670	Family Stress, Abuse, and Resilience	3
HDFS 3690	Research Methods in Human Development and Family Studies	3
HDFS 3770	Aging and the Family	3
HDFS 3860	Human Services Management I	3
HDFS 3950	Children, Families, and Public Policy	3
HDFS 4790	Families Through a Social and Cultural Lens	3

Other recommended electives include courses from accounting, community and regional planning, economics, finance, gerontology, human development and family studies, journalism, management, marketing, political science, psychology, and sociology.

Total credits: 120 credits

U.S. Cultures and Communities and International Perspectives Requirement: Students fulfill the U.S. Cultures and Communities and International Perspectives Requirement by choosing three credits of coursework from each of the university-approved lists.

The courses listed in this section are approved general education course options for this major.

Natural Sciences and Mathematics: 9 credits total (3 credits from list below). Coursework designed to facilitate students' understanding of the structure and behavior of the natural world and appreciate mathematics as a valuable tool of the sciences and an intrinsically important way of thinking.

Computer Science (COMS)

Accounting (ACCT)

Mathematics (MATH)

Statistics (STAT)

Social Sciences: 9 credits. Coursework designed to help students develop an understanding of the principal methods of studying human behavior and an understanding of the structure and functioning of institutions.

ACCT 2150	Legal Environment of Business	3
AESHM 4210	Developing Global Leadership: Maximizing Human Potential	3
AFAM 3300	Ethnic and Race Relations	3
AMIN 3100	Contemporary Topics in American Indian Studies	3
AMIN 3150	Archaeology of North America	3
AMIN 3220	Peoples and Cultures of Native North America	3
	Anthropology (ANTHR) - except 2020	
	Economics (ECON)	
FSHN 3420	World Food Issues: Past and Present	3
INTST 2350	Introduction to International Studies	3
LING 2190	Introduction to Linguistics	3
LING 4710	Language and Reading Development in Children	3
	Political Science (POLS)	
	Psychology (PSYCH) - except 1310	
	Sociology (SOC), including Criminal Justice (CJST)	
WGS 2010	Introduction to Women's and Gender Studies	3
WGS 2030	Introduction to Lesbian Communities	3

WGS 3010	International Perspectives on Women and Gender	3
ENVS 3200	Ecofeminism	3
WGS 3270	Gender and Sexualities in Society	3
WGS 3280	Sociology of Masculinities and Manhood	3
WGS 3460	Psychology of Women	3
AFAM 3500	Women of Color in the U.S	3
WGS 3850	Women in Politics	3
FDM 1650	Fashion, Appearance, and Diversity in U.S. Society	3
FDM 3620	Cultural Perspectives of Global Dress	3
FDM 4670	Consumer Studies in Apparel and Fashion Products	3

Humanities: 6 credits. Coursework designed to assist students to develop an understanding of human cultural heritage and history, and an appreciation of reasoning and the aesthetic value of human creativity.

AESHM 3420	Aesthetics of Consumer Experience	3
AFAM 2010	Introduction to African American Studies	3
AFAM 3340	Africana Religions	3
AFAM 3470	African American Literature	3
AFAM 3530	History of African Americans I	3
AFAM 3540	History of African Americans II	3
AMIN 2100	Introduction to American Indian Studies	3
AMIN 2400	Introduction to American Indian Literature	3
AMIN 3460	American Indian Literature	3
ARCH 2210	Histories and Theories of Architecture to 1750	3
ARCH 4200	Topics in American Architecture	3

Art History (ARTH)

American Sign Language (ASL)

Classical Studies (CLST)

DANCE 2700	Dance Appreciation	3
DANCE 3600	History and Philosophy of Dance	3
DSNS 1830	Design in Context	3
ENGL 2010	Introduction to Literature	3
ENGL 2250	Survey of British Literature to 1800	3
ENGL 2260	Survey of British Literature since 1800	3
ENGL 2270	Survey of American Literature to 1865	3
ENGL 2280	Survey of American Literature since 1865	3
ENGL 2370	Survey of Film History	3
ENGL 2400	Introduction to American Indian Literature	3

History (HIST)

HSPM 2600	Global Tourism Management	3
MUSIC 1020	Introduction to Music Listening	3
MUSIC 3020	Masterpieces of Music and Art in Western Culture	3

MUSIC 3040	History of American Rock 'n' Roll	3
MUSIC 3830	History of Music I	3
MUSIC 3840	History of Music II	3
Philosophy (PHIL)		
Religious Studies (RELIG)		
THTRE 1060	Introduction to the Performing Arts	3
THTRE 1100	Theatre and Society	3
THTRE 4650	Theatre History: Ancient to 19th Century	3
THTRE 4660	Theatre History: 19th Century to Present	3
WGS 2010	Introduction to Women's and Gender Studies	3
WGS 3360	Religion, Sex and Gender	3
WGS 3380	Feminist Philosophy	3
WGS 3450	Women's Literature	3
WGS 3700F	Studies in English Translation: French Topics on Women and Gender Studies	3
or WGS 3700R	Studies in English Translation: Russian Topics on Women or Feminism	
or WGS 3700S	Studies in English Translation: Hispanic Topics on Women or Feminism	
WGS 3740	Sex, Gender, and Culture in the Ancient Mediterranean World	3
World Languages and Cultures (ARABC, CHIN, FRNCH, GER, GREEK, RUS, SPAN)		
FDM 2570	Museum Studies	3
FDM 3540	Fashion History I: Prehistoric to Mid-19th Century	3
FDM 3560	Fashion History II: Mid-19th Century to the Present	3

Financial Counseling and Planning

Freshman

Fall	Credits Spring	Credits
COMS 1130	3 ENGL 2500	3
ENGL 1500	3 HDFS 1020 or PSYCH 2300	3
HDFS 1100 or 1110	1 HDFS 2830	3
HDFS 2390	3 STAT 1010	4
ECON 1010	3 ACCT 2150, ECON 1020, or INTST 2350 (Or Social Sciences Course)	3
LIB 1600	1	
	14	16

Sophomore

Fall	Credits Spring	Credits
ACCT 2840	3 HDFS 3830	3

HDFS 2700	3 PHIL 2300, 2350, or RELIG 2050 (Or Humanities Courses)	3
PSYCH 2800 or SOC 1340	3 Electives*	9
SPCM 2120, COMST 2110, or COMST 2180	3	
PHIL 2300, 2350, or RELIG 2050 (Or Humanities Course)	3	
		15

Junior

Fall	Credits Spring	Credits
ENGL 3020, 3090, 3140, or AGEDS 3270	3 HDFS 3780	3
HDFS 3410	3 HDFS 3840 or FIN 3610	3
Electives*	9 Electives*	9
		15

Senior

Fall	Credits Spring	Credits
HDFS 4820 or FIN 3200	3 HDFS 3170G	1-6
HDFS 4890	2 HDFS 4840	3
HDFS 4890L	1 HDFS 4850	3
Electives*	9 Electives*	6
		15

13-18

* Electives: Courses from accounting, community and regional planning, economics, family and consumer sciences education, finance, gerontology, human development and family studies, journalism, management, marketing, political science, psychology, and sociology are suggested.

**See Approved General Education options.

Students in Financial Counseling and Planning fulfill the U.S. Cultures and Communities and International Perspectives Requirement by choosing three credits of coursework from each of the university-approved lists.

This sequence is only an example. The number of credits taken each semester should be based on the individual student's situation. Factors that may affect credit hours per semester include student ability, employment, health, activities, and grade point consideration.

The **Financial Counseling and Planning** minor may be earned by completing 15 credits

HDFS 2830	Personal Finance	3
Twelve credits from the following:		12
HDFS 2390	Consumer Issues	

HDFS 3410	Income Tax Planning
HDFS 3780	Retirement Planning and Employee Benefits
HDFS 3830	Fundamentals of Financial Planning
HDFS 3840	Insurance Planning
HDFS 4820	Investment Planning
HDFS 4840	Estate Planning
HDFS 4850	Case Studies in Financial Counseling and Planning
HDFS 4890	Financial Counseling
HDFS 4890L	Financial Counseling Laboratory

Total Credits**15**

Graduate Programs

A master's degree in Family and Consumer Sciences (MFCS) with a specialization in Family Financial Planning as well as a Family Financial Planning certificate are available. More information can be found at: <https://online.hs.iastate.edu/graduate-degrees/family-financial-planning/>.

Food Science (HHSCI)

Food science is a degree program focused on the role of the food industry in producing safe, nutritious, and acceptable foods for consumers. Food scientists apply basic science (chemistry, biology, physics) to improve processing, preservation, and safety of food and to develop new food products. The food science major is approved by the Institute of Food Technologists.

Student Learning Outcomes

Upon graduation, students should be able to:

- Communicate effectively in their field of study using written, oral, visual and/or electronic forms.
- Demonstrate proficiency in ethical data collection and interpretation, literature review and citation, critical thinking and problem solving.
- Participate effectively in a group or team.
- Integrate creativity, innovation, or entrepreneurship in ways that produce value.
- Explain how human activities impact the natural environment and how societies are affected.
- Meet program specific learning outcomes for the Food Science major.

The department also offers a food science minor.

Administered by the Department of Food Science and Human Nutrition

Courses listed below are required.

Total Degree Requirement: 120 cr.

Students must fulfill International Perspectives and U.S. Cultures and Communities requirements by selecting coursework from approved lists. These courses may also be used to fulfill other area requirements. Only 65 cr. from a two-year institution may apply to the degree which may include up to 16 technical cr.; 9 P-NP cr. of electives; 2.00 minimum GPA.

International Perspectives: 3 cr.**U.S. Cultures and Communities: 3 cr.****Communications and Library: 10 cr.**

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
LIB 1600	Introduction to College Level Research	1
SPCM 2120	Fundamentals of Public Speaking	3
Total Credits		10

Humanities and Social Sciences: 6-12 cr.

Select Humanities course from approved list	3	
ECON 1010	Principles of Microeconomics	3
If HSCI student, select:	6	
Additional Humanities course		
Additional Humanities or Social Science course		

Ethics: 3 cr.

FSHN 3420	World Food Issues: Past and Present	3

Mathematical Sciences: 7-8 cr.

Select 4 credits from:

MATH 1600	Survey of Calculus	4
or MATH 1650	Calculus I	

Select at least 3 credits from:

STAT 1010	Principles of Statistics	3-4
or STAT 1040	Introduction to Statistics	

Total Credits **7-8**

Physical Sciences: 17-19 cr.

CHEM 1770 & 1770L	General Chemistry I and Laboratory in General Chemistry I	5
CHEM 1780	General Chemistry II	3
CHEM 2310 & 2310L	Elementary Organic Chemistry and Laboratory in Elementary Organic Chemistry	4-6
or CHEM 3310 & CHEM 3320	Organic Chemistry I and Organic Chemistry II	
PHYS 1150 & 1150L	Physics for the Life Sciences and Laboratory in Physics for the Life Sciences	5
or PHYS 1310 & 1310L	General Physics I and General Physics I Laboratory	

Total Credits **17-19**

Biological Sciences: 10-11 cr.

BBMB 3010	Survey of Biochemistry	3
or BBMB 3030	General Biochemistry	
or BBMB 3160	Principles of Biochemistry	
BIOL 2120	Principles of Biology II	3
BIOL 2120L	Principles of Biology Laboratory II	1
MICRO 2010	Introduction to Microbiology	2-3
or MICRO 3020	Biology of Microorganisms	
MICRO 2010L	Introductory Microbiology Laboratory	1
or MICRO 3020L	Microbiology Laboratory	

Total Credits **10-11**

Food Science and Human Nutrition: 49 cr.

FSHN 1010	Food and the Consumer	3
FSHN 1100	Professional and Educational Preparation	1
FSHN 1670	Introductory Human Nutrition and Health	3
FSHN 2030	Contemporary Issues in Food Science and Human Nutrition	1
FSHN 2070	Processing of Foods: Basic Principles and Applications	3
FSHN 3050	Food Quality Management and Control	2
FSHN 3110	Food Chemistry	3
FSHN 3110L	Food Chemistry Laboratory	1
FSHN 3140	Professional Development for Culinary Food Science and Food Science Majors	1
FSHN 3150	Professional Skills for Culinary Food Science and Food Science Majors	1
FSHN 3510	Introduction to Food Engineering Concepts	3
FSHN 4030	Food Laws and Regulations	2
FSHN 4060	Sensory Evaluation of Food	3
FSHN 4070	Microbiological Safety of Foods of Animal Origins	3
FSHN 4100	Food Analysis	3
FSHN 4110	Food Ingredient Interactions and Formulations	2
FSHN 4120	Food Product Development	3
FSHN 4200	Food Microbiology	3
FSHN 4210	Food Microbiology Laboratory	3
FSHN 4710	Food Processing	3
FSHN 4720	Food Processing Laboratory	2

Total Credits **49**

Select 5-6 credits from the following Professional Electives: 5-6

ABE 3250	Biorenewable Systems
ACCT 2150	Legal Environment of Business
ACCT 2840	Financial Accounting

ACCT 2850	Managerial Accounting
AESHM 4740	Entrepreneurship in Human Sciences
AGRON 4500	Issues in Sustainable Agriculture
ANS 2700	Foods of Animal Origin
ANS 2700L	Foods of Animal Origin Laboratory
ANS 3600	Fresh Meat Science and Applied Muscle Biology
ANS 4600	Science and Technology of Value Added Meat Products
CHEM 2110	Quantitative and Environmental Analysis
CHEM 2110L	Quantitative and Environmental Analysis Laboratory
CHEM 3160	Instrumental Methods of Chemical Analysis
CHEM 3160L	Instrumental Analysis Laboratory
ECON 2350	Introduction to Agricultural Markets
ECON 3010	Intermediate Microeconomics
ECON 3200	Labor Economics
ECON 3350	The Economics of Global Agricultural Food and Bio-energy
ECON 3370	Agricultural Marketing
ECON 3620	Applied Ethics in Agricultural Business
ECON 4600	Agricultural, Food, and Trade Policy
ENTSP 3100	Entrepreneurship and Innovation
FSHN 1150	Food Preparation Laboratory
FSHN 1200	The Biochemistry of Beer
FSHN 1200L	Biochemistry of Beer Laboratory
FSHN 2140	Scientific Study of Food
FSHN 2150	Advanced Food Preparation Laboratory
FSHN 2200	American Food and Culture
FSHN 2410	Introduction to Manufacturing Processes for Plastics
FSHN 2420	The US Food System
FSHN 2650	Metabolism, Nutrition and Health
FSHN 2760	Grape and Wine Science
FSHN 4350	Analysis of Food Markets
FSHN 4420	Food, Culture, and Sustainability
FSHN 4600	Global Nutrition, Health and Sustainability
FSHN 4900B	Independent Study: Food Science
FSHN 4910B	Supervised Work Experience: Food Science
FSHN 4910D	Supervised Work Experience: Culinary Science
FSHN 4990	Undergraduate Research
FSHN 4960A	Food Science and Human Nutrition Travel Course: International travel
FSHN 5090	Sensory Evaluation of Wines

GLOBE 2010	Introduction to Global Resource Systems
GLOBE 2200	Globalization and Sustainability
GLOBE 3030	Agricultural, Food and Natural Global Resource Systems
HORT 2210	Principles of Horticulture Science
HORT 4610	Fruit Crop Production and Management
HORT 4710	Vegetable Production and Management
HORT 4710L	Vegetable Production and Management Lab
HSPM 1330	Food Safety Certification
MGMT 3710	Organizational Behavior
MGMT 4140	International Management
MGMT 4720	Diversity, Equity, and Inclusion in Organizations
MIS 3010	Management Information Systems
MKT 3400	Principles of Marketing
MKT 4470	Consumer Behavior
MKT 4480	Global Marketing

Total Credits **5-6**

Electives: 2-13 cr. Select from any university coursework to earn at least 120 total credits. Food science internship experience is strongly recommended during the summers, and students can earn elective credits for the internship experience by enrolling in FSHN 4910B.

Go to FSHN courses.

Food Science, B.S.

First Year

Fall	Credits Spring	Credits
FSHN 1010	3 FSHN 1670	3
FSHN 1100	1 CHEM 1780	3
CHEM 1770	4 BIOL 2120	3
CHEM 1770L	1 BIOL 2120L	1
ENGL 1500	3 ECON 1010	3
LIB 1600	1 Humanities	3
Humanities or Elective	3	
	16	16

Second Year

Fall	Credits Spring	Credits
CHEM 2310 and CHEM 2310L or CHEM 3310	3-4 BBMB 3010, 3030, or 3160	3
FSHN 2030	1 CHEM 3320 (if CHEM 3310 taken) or Elective	3
ENGL 2500	3 MICRO 2010 or 3020	2-3
PHYS 1150 or 1310	4 MICRO 2010L or 3020L	1
PHYS 1150L or 1310L	1 STAT 1010 or 1040	3-4

MATH 1600 or 1650	4 FSHN 2070	3
	16-17	15-17

Third Year

Fall	Credits Spring	Credits
FSHN 3110	3 FSHN 3050	2
FSHN 3110L	1 FSHN 3510	3
FSHN 3140	1 FSHN 4030	2
FSHN 3150	1 FSHN 4110	2
FSHN 4200	3 FSHN 4210	3
SPCM 2120	3 Professional Elective	3
Professional Elective	3	
	15	15

Fourth Year

Fall	Credits Spring	Credits
FSHN 4060	3 FSHN 3420	3
FSHN 4100	3 FSHN 4120	3
FSHN 4710	3 FSHN 4720	2
FSHN 4070	3 U.S. Cultures and Communities (if not already taken) or elective	3
Elective *	2 Humanities/social science (CHHS) or elective (CALS)	3
	14	14

* Choose elective courses to total equal to or greater than 120 credits.

Note: This sequence is only an example. The number of credits taken each semester should be based on the individual student's situation. Factors that may affect credit hours per semester include student ability, employment, health, activities, and grade point considerations.

More information on the Food Science, Food Safety, and Food and Society minors can be found here: <http://catalog.iastate.edu/collegeofhumansciences/foodscienceandhumannutrition/#undergraduateminortext>.

The Department of Food Science and Human Nutrition offers a Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) in Food Science and Technology. More information can be found here: <https://www.grad-college.iastate.edu/academics/programs/apresults.php?id=50>.

Food Science and Human Nutrition

The Department of Food Science and Human Nutrition is jointly administered by the College of Agriculture and Life Sciences and the College of Health and Human Sciences. All curricula offered by the

department are available to students in either college. These majors include:

- Culinary food science
- Dietetics
- Diet and exercise
- Food science
- Nutritional science
- Nursing

Visit the department web site at: www.fshn.hs.iastate.edu (<http://www.fshn.hs.iastate.edu>).

Undergraduate Study

Culinary Food Science

Culinary food science is an interdisciplinary degree combining a strong food science foundation with culinary skills development. Culinary Food Scientists apply principles of chemistry, biology, and microbiology to understand ingredient interactions and how cooking techniques can effect flavor, texture, and the nutritional value of food products. Internship experience in the food industry is required. Culinary food science graduates are qualified to work as food product developers, food innovation managers product development chefs, culinary application specialists, and food marketing and sales managers. The Culinary Food Science major is an approved Culinology® program through the Research Chefs Association.

Dietetics

The Didactic Program in Dietetics (DPD) is accredited by the Accreditation Council for Education in Nutrition and Dietetics, the accrediting agency of the Academy of Nutrition and Dietetics. The dietetics undergraduate curriculum meets the academic requirements as the DPD. Additionally, the curriculum for concurrent bachelor's and master's degrees in diet and exercise meets the academic requirements of the DPD. Graduates of the program are eligible to apply for admission to accredited dietetics internships/supervised practice programs. Upon successful completion of the experience program and a master's degree, graduates are eligible to take the national examination administered by the Commission on Dietetic Registration to become a Registered Dietitian Nutritionist (RDN) and to practice in the field of dietetics. There is a \$30 fee for a statement of verification of completion of the DPD.

The dietetics program includes study in basic sciences, nutrition, and food science with applications to medical dietetics, nutrition counseling and education, and community nutrition. Foodservice management is also an important aspect of the program. Graduates work in clinical settings, consulting, food companies, food services, sports or athletic programs, corporate wellness programs, care facilities for patients from neonatal to geriatric, and community or school health programs.

Diet and Exercise

A program for concurrent Bachelor of Science and Master of Science (B.S./M.S.) degrees in diet and exercise (<https://fshn.hs.iastate.edu/find-your-major/diet-and-exercise/>) is available. The program is jointly administered by the Department of Food Science and Human Nutrition (FSHN), within the College of Agriculture and Life Sciences and College of Health and Human Sciences, and the Department of Kinesiology within the College of Health and Human Sciences. Students interested in this program enroll as pre-diet and exercise students. In the fall of the third year, students apply for admission to the BS/MS program. Students not accepted into the program can continue toward completion of the BS degree in dietetics or kinesiology and health. Coursework has been designed to facilitate a 4-year graduation date for those students not accepted into the program and electing to complete a single undergraduate degree. Students accepted into the program will progress toward completion of B.S./M.S. degrees in diet and exercise.

Food Science

Food science is a discipline in which the principles of biological and physical sciences are used to study the nature of foods, the causes of their deterioration, and the principles underlying the processing and preparation of food. It is the application of science and technology to the provision of a safe, wholesome, and nutritious food supply. Biotechnology and toxicology interrelate with food science in the area of food safety. In the food industry, food scientists work in research and development of products or processes, production supervision, quality control, marketing and sales, test kitchens and recipe development, product promotion and communication. Food scientists also work in government regulatory agencies and academic institutions.

The food science major is approved by the Institute of Food Technologists, the national professional organization of food science. Career options include quality control/assurance; production supervision; management and sales; research careers in the food industry, government, or academia; business; journalism; food product formulation and recipe development; food promotion and communication; and consumer services in government and industry.

Students in food science have the opportunity to pursue a Master of Business Administration (<http://www.fshn.hs.iastate.edu/undergraduate-programs/food-science/>) (MBA) concurrently with the Bachelor of Science (B.S.) degree in food science. The program is designed so students can earn both the B.S. in food science and MBA in five years, to meet the needs of students who are interested in management careers in the food industry. Students apply for admission to the MBA program in the spring of the third year. The program for concurrent B.S. in food science/MBA degrees is a rigorous 5-year program, and admission is very selective.

Nutritional Science

Nutritional science looks at the connection between diet and health. Students learn how diet can play a crucial role in the cause, treatment, and prevention of many diseases. The pre-health and research focus of the coursework prepares students for work in research laboratories, graduate study in nutrition or biological sciences, or entrance into health professional programs, such as medical, dental, physician assistant, and pharmacy schools. Students gain a strong science education along with human nutrition expertise.

Nursing

The Bachelor of Science in Nursing (BSN) program at Iowa State University is a RN-to-BSN program, designed for those who have obtained an associate degree in nursing or are eligible for NCLEX, and desire to further their nursing career and education to the next level. Iowa State's RN-to-BSN program provides interactive learning opportunities where students can apply their real-world experiences and education to inspire innovation in their places of care. RN-to-BSN students will acquire knowledge, skills, and experience in four essential areas: research, leadership, population health, and self-care/health promotion. The program emphasizes providing professional, cultural, and ethically congruent care that respects the dignity and uniqueness of individuals and groups in diverse populations and locations.

The baccalaureate nursing program at Iowa State University of Science and Technology located in Ames, Iowa is approved by the:

Iowa Board of Nursing (IBON)

6200 Park Ave #100
Des Moines, IA 50321

The baccalaureate nursing program at Iowa State University of Science and Technology located in Ames, Iowa is accredited by the:

Accreditation Commission for Education in Nursing (ACEN)

3390 Peachtree Road NE, Suite 1400
Atlanta, GA 30326
(404) 975-5000

The most recent accreditation decision made by the ACEN Board of Commissioners for the baccalaureate nursing program is initial accreditation.

View the public information disclosed by the ACEN regarding this program at <https://www.acenursing.org/acen-programs-05202024/iowa-state-university-of-science-and-technology>.

For more information and RN-to-BSN student learning outcomes: <https://nursing.iastate.edu/rn-bsn-program>

FSHN Departmental Learning Outcomes

Upon graduation, students should be able to:

- Communicate effectively in their field of study using written, oral, visual and/or electronic forms.
- Demonstrate proficiency in ethical data collection and interpretation, literature review and citation, critical thinking and problem solving.
- Participate effectively in a group or team.
- Integrate creativity, innovation, or entrepreneurship in ways that produce value.
- Explain how human activities impact the natural environment and how societies are affected.
- Meet program specific learning outcomes.

For more information: <https://fshn.hs.iastate.edu/staff-and-faculty/resources/outcomes-assessment/learning-outcomes/>.

Communication Proficiency is certified by a grade of C or better in 6 credits of coursework in composition (ENGL 1500 Critical Thinking and Communication and ENGL 2500 Written, Oral, Visual, and Electronic Composition or other communication-intensive courses) and a grade of C or better in 3 credits of coursework in oral communication.

Minors - Undergraduate

The department offers minors in:

- culinary food science
- food and society
- food safety (interdepartmental minor)
- food science
- nutrition

All minors require at least 15 credits, including at least 9 credits in courses numbered 2000 or above, of which at least 6 credits in courses numbered 3000 or above, with at least 3 credits taken at Iowa State University. The minor must include at least 3 credits that are not used to meet any other department, college, or university requirement.

Prerequisites: Students must complete prerequisite requirements for courses included in the minor.

Minor in Culinary Food Science

FSHN 1010	Food and the Consumer	3
FSHN 1150	Food Preparation Laboratory	1-2
or FSHN 2150	Advanced Food Preparation Laboratory	
FSHN 2140	Scientific Study of Food	3
Select additional credits from the following list for a minimum of 15 credits for the minor:		
FSHN 2200	American Food and Culture	3
FSHN 4110	Food Ingredient Interactions and Formulations	2
FSHN 4910D	Supervised Work Experience: Culinary Science	1-4

ANS 2700 & 2700L	Foods of Animal Origin and Foods of Animal Origin Laboratory	3
ANS 4600	Science and Technology of Value Added Meat Products	3
HSPM 1330	Food Safety Certification	1
HSPM 3800 & 3800L	Food Production Management and Food Production Management Experience	6
HSPM 3830	Wine and Spirits in Hospitality Management	2
HSPM 4870	Fine Dining Management	3

Minor in Food and Society

FSHN 1670	Introductory Human Nutrition and Health	3
FSHN 2420	The US Food System	3
FSHN 5700	Sustainable and Healthy Eating Patterns	3
Select 6 additional credits from:		6
FSHN 2200	American Food and Culture	
FSHN 3420	World Food Issues: Past and Present	
FSHN 3650	Obesity and Health	
FSHN 4420	Food, Culture, and Sustainability	
FSHN 4600	Global Nutrition, Health and Sustainability	
FSHN 4630	Community Nutrition and Health	
SOC 2200	Globalization and Sustainability	
SOC 4440	Sociology of Food and Agricultural Systems	

Interdepartmental Minor in Food Safety (Students majoring in Food Science or Culinary Food Science cannot declare a minor in Food Safety.)

FSHN 1010	Food and the Consumer	3
HSPM 1330	Food Safety Certification	1
or HSPM 2330	Hospitality Sanitation and Safety	
FSHN 4030	Food Laws and Regulations	2
FSHN 4200	Food Microbiology	3

Select 3 credits from the Food Microbiology area

FSHN/MICRO 4070	Microbiological Safety of Foods of Animal Origins	
FSHN/MICRO 4210	Food Microbiology Laboratory	
Select 3 credits from the Food Processing area:		
FSHN 2070	Processing of Foods: Basic Principles and Applications	
FSHN 3050	Food Quality Management and Control	
ANS 2700 & 2700L	Foods of Animal Origin and Foods of Animal Origin Laboratory	
ANS 3600	Fresh Meat Science and Applied Muscle Biology	

FSHN 4710	Food Processing	
FSHN 4720	Food Processing Laboratory	

Minor in Food Science (Students majoring in Culinary Food Science cannot declare a minor in Food Science.)

FSHN 1010	Food and the Consumer	3
FSHN 2070	Processing of Foods: Basic Principles and Applications	3

Select 9 additional credits:

Food chemistry:

FSHN 3110	Food Chemistry (lab optional: FSHN 3110L)	3
FSHN 4100	Food Analysis	3
FSHN 4110	Food Ingredient Interactions and Formulations	2

Food microbiology:

FSHN 4070	Microbiological Safety of Foods of Animal Origins	3
FSHN 4200	Food Microbiology	3
FSHN 4210	Food Microbiology Laboratory	3

Food processing/engineering:

FSHN 3510	Introduction to Food Engineering Concepts	3
FSHN 4710	Food Processing	3
FSHN 4720	Food Processing Laboratory	2

General food science:

FSHN 3050	Food Quality Management and Control	2
FSHN 4030	Food Laws and Regulations	2
FSHN 4060	Sensory Evaluation of Food	3

Minor in Nutrition (Students majoring in Diet and Exercise, Dietetics, and Nutritional Science cannot declare a minor in Nutrition.)

FSHN 1670	Introductory Human Nutrition and Health	3
FSHN 2650	Metabolism, Nutrition and Health	3
FSHN 3600	Advanced Nutrition and the Regulation of Metabolism in Health and Disease	3

Select at least 6 credits from:

FSHN 2420	The US Food System	3
FSHN 2670	Clinical Perspectives on Nutrition	1
FSHN 3010	Nutrigenomics: From Basic Science to Translational Impact	1
FSHN 3610	Nutrition and Health Assessment	2
FSHN 3620	Nutrition and Health Throughout the Lifecycle	3
FSHN 3650	Obesity and Health	3
FSHN 4630	Community Nutrition and Health	3

FSHN 4670	Molecular Basis of Nutrition in Disease Etiology and Health Promotion	3
FSHN 4920	Research Concepts in Human Nutrition	2

Graduate Study

The Food Science and Human Nutrition (FSHN) Department offers coursework for the degrees master of science and doctor of philosophy with majors in food science and technology and in nutritional sciences, and minors in food science and technology and in nutrition. Graduate work in meat science is offered as a co-major in animal science and food science and technology.

Prerequisite to major work is a baccalaureate degree in food science, nutrition, or other physical or biological sciences or engineering that is substantially equivalent to those at Iowa State University.

Students taking major work for the degree doctor of philosophy either in food science and technology or in nutritional sciences may choose minors from other fields including anthropology, biorenewable resources and technology, chemistry, biochemistry, economics, education, journalism, microbiology, psychology, physiology, statistics, toxicology, or other related fields.

The Food Science and Technology (FST) graduate program offers MS and PhD degrees in the general areas of Food Chemistry and Functionality, Food Safety and Microbiology, and Food Processing. The FST core curriculum and interdisciplinary faculty team provides holistic graduate student training. Individuals with an undergraduate or graduate degree from a variety of academic training backgrounds, such as food sciences and the various disciplines of biology, chemistry, and agricultural sciences, may enter the FST program.

The interdepartmental graduate program in nutritional sciences, administered through the Graduate College, under the auspices of the Chairs of FSHN and Animal Science, will provide the structure for coordinating and enhancing interdisciplinary nutrition research and graduate education. Graduate students will be able to select from three specializations: animal nutrition, human nutrition, or molecular/biochemical nutrition. The three main departments are FSHN, Animal Science, and Kinesiology, whereas other departments (such as; Biochemistry, Biophysics, and Molecular Biology; Agronomy; and Statistics) may also be involved. (See Nutritional Sciences interdepartmental graduate major).

The Master of Professional Practice in Dietetics program is an online, course-work only, 12-month long, integrated graduate program that combines didactic coursework and on-site supervised experiential learning to train future Registered Dietitian Nutritionists. In addition to the required didactic coursework, students complete a minimum of 1000 hours of supervised experiential learning to meet the eligibility

requirements to take the national credentialing exam for Registered Dietitian Nutritionists. Prerequisite for the program is graduation from a Didactic Program in Dietetics.

The department also offers an online 12-13 credit Graduate Certificate in Food Safety and Defense, in conjunction with the University of Nebraska, Lincoln, Kansas State University and the University of Missouri through the Great Plains Interactive Distance Education Alliance. Course topics include food microbiology, food defense, food toxicology, HACCP, and additional topics related to food safety. Students may be admitted if qualified for admission to the food science master's degree program.

The department offers work for concurrent B.S. and M.S. degree programs that allow students to obtain both the B.S. and M.S. degrees in 5 years. The programs are available to students majoring in nutritional science or pre-diet and exercise, and students progress toward M.S. degrees in nutritional sciences or diet and exercise, respectively. Students interested in these programs should contact the department for details. Application for admission to the Graduate College should be made during the junior year. Students begin research for the M.S. thesis or creative component during the summer after their junior year and are eligible for research assistantships.

Students graduating with advanced degrees in nutritional sciences and in food science and technology will demonstrate competency in their chosen discipline. Measurable outcomes will include the ability to:

- Apply scientific thinking to the analysis, synthesis and evaluation of knowledge within the discipline of food science, nutritional sciences, or dietetics
- Apply ethical reasoning within the discipline of food science, nutritional sciences or dietetics
- Effectively communicate discipline-specific information in written and oral forms to scientific audiences
- Effectively interact within scientific teams
- Facilitate learning within FSHN courses

Minors - Graduate

The department offers coursework for graduate minors in:

- food science/technology (<https://fshn.hs.iastate.edu/graduate-students/graduate-programs/food-science-and-technology/>)
- nutritional sciences (<https://fshn.hs.iastate.edu/graduate-students/graduate-programs/interdepartmental-graduate-program-in-nutritional-sciences/>)

Food Science and Technology Graduate Minor students must complete the following:

- 9 to 12 credits. Students without a background in food chemistry, food engineering/processing, and/or food microbiology are required

to take FSHN 5110 and two 6000-level courses in two different competency areas.

- 9 credits of graduate level food science coursework as approved by the POS committee.
- Maximum of 3 credits at the 4000 level.

Nutritional Sciences Graduate Minor students must complete the following:

- 9 to 12 credits are required. Students who have not taken FSHN 3600 or its equivalent (advanced nutrition with a biochemistry prerequisite) will need to take FSHN 3600, in which case the Nutrition Graduate minor will constitute 12 credits.
- 9 credits of graduate level nutrition courses as approved by the POS Committee.
- NUTRS 5100 and NUTRS 5110

Certificate - Undergraduate

Health Coach (<https://kin.hs.iastate.edu/current-students/academics/health-coach-certificate/>)

The undergraduate health coach certificate provides a rigorous academic and theoretical background in three components of health (nutrition, exercise and motivational coaching) required to prepare workers for the challenges of being a health coach.

Certificates - Graduate

Food Safety and Defense (<http://www.fshn.hs.iastate.edu/graduate-program/food-safety-defense/>)

The department offers an online 12-13 credit Graduate Certificate in Food Safety and Defense, in conjunction with the University of Nebraska, Lincoln, Kansas State University and the University of Missouri through the Great Plains Interactive Distance Education Alliance. Students may be admitted if qualified for admission to the food science master's degree program.

Courses primarily for undergraduates:

FSHN 1010: Food and the Consumer

Credits: 3. Contact Hours: Lecture 3.

The food system from point of harvest to the consumption of the food by the consumer. Properties of food constituents. Protection of food against deterioration and microbial contamination. Introduction of foods into the marketplace. Processes for making various foods. Government regulations. Use of food additives. Current and controversial topics. High school biology and chemistry or 3 credits of college level biology and chemistry recommended. (Typically Offered: Fall, Spring, Summer)

FSHN 1020: Nutrition for Sport Performance

Credits: 1. Contact Hours: Lecture 1.

A scientific evaluation of dietary needs, dietary supplementation, and pop-culture claims relative to physical/sport performance. Discussion of safe and effective practices to enhance physical/sport performance. (Typically Offered: Fall, Spring)

FSHN 1040: Introduction to Professional Skills in Culinary Science

Credits: 2.

Prereq: Major in CUFSA or CUFSH or Culinary Science minor

Introduction to culinary science. Students will develop fundamental culinary skills by arranged on-campus work experience (100 hours). Sessions with instructor arranged. (Typically Offered: Spring)

FSHN 1100: Professional and Educational Preparation

Credits: 1. Contact Hours: Lecture 1.

Introduction to professional and educational development within the food science and human nutrition disciplines. Focus is on university and career acclimation as well as enhancement of communication skills. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

FSHN 1150: Food Preparation Laboratory

Credits: 1. Contact Hours: Laboratory 3.

Prereq: (Credit or enrollment in FSHN 1010 OR FSHN 1110 OR FSHN 2140) AND Major in DIET, FCEDS, HSPM, NS, PDEX

Practice standard methods of food preparation with emphasis on quality, nutrient retention, and safety. (Typically Offered: Fall, Spring)

FSHN 1200: The Biochemistry of Beer

(Cross-listed with BBMB 1200).

Credits: 2. Contact Hours: Lecture 2.

An introduction to the major classes of biomolecules, basic biochemical concepts, enzymology, metabolism and genetic engineering as they apply to the production and flavor of beer. All aspects of the biochemistry of beer will be covered, including the malting of barley, starch conversion, yeast fermentation and the chemical changes that occur during the aging of beer. Intended for non-majors. (Typically Offered: Fall)

FSHN 1200L: Biochemistry of Beer Laboratory

(Cross-listed with BBMB 1200L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Credit or enrollment in BBMB 1200

An introduction to biochemical methods related to the production of beer. Laboratory exercises related to water chemistry, mash enzymology, hop compound extraction and analysis, and yeast biology will be performed. Closely follows the material being taught in BBMB 1200. Graduation Restriction: Natural science majors are limited to elective credit only. (Typically Offered: Fall)

FSHN 1670: Introductory Human Nutrition and Health

Credits: 3. Contact Hours: Lecture 3.

Understanding and implementing present day knowledge of nutrition. The role of nutrition in the health and well being of the individual and family. High school biology or 3 credits of biology recommended. (Typically Offered: Fall, Spring, Summer)

FSHN 2020X: Food Literacy through Film

Credits: 1. Contact Hours: Lecture 1.

An introduction to food literacy using systems thinking. Exploration of movies and documentaries to identify how one's food choices can support personal health, community, and the environment. Development of skills to assess potential bias of multi-media messages. (Typically Offered: Fall)

FSHN 2030: Contemporary Issues in Food Science and Human Nutrition

Credits: 1. Contact Hours: Lecture 1.

Introduction to presentation of published research and discussion of current issues in food science and human nutrition. Emphasis on sources of credible information, ethics, and communication. (Typically Offered: Fall, Spring)

FSHN 2070: Processing of Foods: Basic Principles and Applications

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: FSHN 1010

Lecture and lab-based instruction on principles of food processing and packaging. Food product-based discussion and activities will highlight raw food materials; unit operations; food quality and safety; processing plant sanitation; food forming and extrusion; fermentation; properties and selection of packaging materials. (Typically Offered: Spring)

FSHN 2140: Scientific Study of Food

Credits: 3. Contact Hours: Lecture 3.

Prereq: FSHN 1670 or FSHN 2650; CHEM 2310 or CHEM 3310; plus concurrent enrollment in FSHN 1150 or 2150

Composition and structure of foods. Principles of preparation of standard quality food products. Behavior and interactions of food constituents. (Typically Offered: Fall, Spring)

FSHN 2150: Advanced Food Preparation Laboratory

Credits: 2. Contact Hours: Laboratory 6.

Prereq: Credit or enrollment in FSHN 2140

Practice standard methods of food preparation with emphasis on quality, nutrient retention, and safety. Development of culinary skills and advanced food preparation. (Typically Offered: Fall, Spring)

FSHN 2200: American Food and Culture

Credits: 3. Contact Hours: Lecture 3.

American cuisine reflects the history of the U.S. It is the unique blend of diverse groups of people from around the world, including indigenous Native American Indians, Africans, Asians, Europeans, Pacific Islanders, and South Americans. Explore factors that impact the American Cuisine of today including diverse ethnic and cultural group influences, historical events related to food diversity in the U.S., and agriculture and industrial impacts on food production. Practical knowledge and basic food preparation techniques related to the U.S. food system and trends. Class sessions will include lectures, class discussions and Tasting Immersion activities. (Typically Offered: Fall, Spring)

FSHN 2410: Introduction to Manufacturing Processes for Plastics

(Cross-listed with TSM 2410).

Credits: 2. Contact Hours: Lecture 1, Laboratory 2.

Prereq: MATH 1450 or higher.

A study of selected materials and related processes used in plastics manufacturing. Lecture and laboratory activities focus on materials, properties, and processes. (Typically Offered: Fall, Spring)

FSHN 2420: The US Food System

Credits: 3. Contact Hours: Lecture 3.

Exploration of the components of our food system including production, processing, and access. A systems approach is used to evaluate the social, environmental, and nutrition/health implications of the US food system. Controversial topics related to how food is produced, processed, marketed and consumed will be discussed. (Typically Offered: Spring)

FSHN 2650: Metabolism, Nutrition and Health

Credits: 3. Contact Hours: Lecture 3.

Prereq: FSHN 1670 AND (credit or enrollment in BBMB 2210, BBMB 3010, or BBMB 3160)

Fundamentals of nutrient metabolism and nutrient requirements. Role of macronutrient metabolism in physical performance and disease prevention. Effect of manipulation of macronutrient metabolism on physical performance and disease prevention. Applications of nutrient metabolism principles to dietary recommendations and planning. Current enrollment in 3000-level BBMB recommended. (Typically Offered: Spring, Summer)

FSHN 2670: Clinical Perspectives on Nutrition

Credits: 1. Contact Hours: Lecture 1.

Through case scenarios presented by practicing physicians and other health care professionals of various specializations, students will gain appreciation for the actual clinical impact of nutrition on health and disease. Through interactions with clinicians, students will learn about the current and future status of health care.

FSHN 2760: Grape and Wine Science

(Cross-listed with HORT 2760).

Credits: 3. Contact Hours: Lecture 4.

An introduction to viticulture (grape growing) and enology (wine making) to increase understanding of the science, including grape biology, chemistry, sensory of grape production and winemaking. Knowledge and the practical applications of grape growing and winemaking will be emphasized. No wine tasting. High school biology and chemistry or 3 credits of college biology and chemistry recommended.

FSHN 3010: Nutrigenomics: From Basic Science to Translational Impact

Credits: 1. Contact Hours: Lecture 2.

Introduction to the concepts of nutrigenomics and nutrigenetics and how it affects consumers of food, as well as the implications for human diseases. The potential impact of personalized nutrition and full genome sequencing on health maintenance, chronic disease prevention, and the ethical implications of this knowledge will be explored. (Typically Offered: Fall)

FSHN 3050: Food Quality Management and Control

Credits: 2. Contact Hours: Lecture 2.

Prereq: 3 credits in statistics

Fundamentals of statistical decision-making processes and quality control procedures used in food quality assurance programs. (Typically Offered: Spring)

FSHN 3110: Food Chemistry

Credits: 3. Contact Hours: Lecture 3.

Prereq: (CHEM 2310 or CHEM 3310); ENGL 2500

The structure, properties, and chemistry of food constituents and animal and plant commodities. Credit or enrollment in BBMB course 3000 or higher recommended. (Typically Offered: Fall)

FSHN 3110L: Food Chemistry Laboratory

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Credit or concurrent enrollment in FSHN 3110

The laboratory practices of structure, properties, and chemistry of food constituents. (Typically Offered: Fall)

FSHN 3140: Professional Development for Culinary Food Science and Food Science Majors

Credits: 1. Contact Hours: Lecture 1.

Prereq: Major or minor in Culinary Food Science or Food Science; Junior or senior classification.

Introduction to the roles culinary scientists and food scientists hold within industry. Discussions focused on professional and educational development and emerging issues and trends in the food industry. (Typically Offered: Fall)

FSHN 3150: Professional Skills for Culinary Food Science and Food Science Majors

Credits: 1. Contact Hours: Lecture 1.

Prereq: Major or minor in FSHN

Focus on the importance of professional skills and application of those skills to potential job situations. Professional skills include communication, team building, leadership vs. management styles, business ethics, and continual learning. Junior classification recommended. (Typically Offered: Fall)

FSHN 3200X: Taste of the Middle East and North Africa

(Cross-listed with ARABC 3200X).

Credits: 3. Contact Hours: Lecture 3.

Exploration of Middle Eastern and North African food cultures through historical, religious, and social lenses. Students will engage in discussions, presentations, and cooking demonstrations and tastings. Taught in English. (Typically Offered: Fall, Spring)

FSHN 3400: Foundations of Dietetic Practice

Credits: 2. Contact Hours: Lecture 2.

Prereq: Major in Dietetics (A or H) or Pre-Diet and Exercise; Junior classification

Introduction to the profession of dietetics and responsibilities associated with dietetic professional practice. Emphasis on exploring career options in dietetics and preparation for supervised practice and graduate school. Leadership and professional career development for the dietitian is addressed through self reflection and creation of materials for post-baccalaureate programs. Professional issues related to dietetic practice include Code of Ethics, legal credentialing and standards of professional practice, leadership and future trends in the profession. (Typically Offered: Fall)

FSHN 3420: World Food Issues: Past and Present

(Cross-listed with ENVS 3420/ AGRON 3420).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior classification

Issues associated with global agricultural and food systems including ethical, social, economic, environmental, and policy contexts. Investigation of various causes and consequences of overnutrition/ undernutrition, global health, poverty, hunger, access, and distribution. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

FSHN 3510: Introduction to Food Engineering Concepts

Credits: 3. Contact Hours: Lecture 3.

Prereq: (FSHN 2070; [MATH 1600 or MATH 1650]; [PHYS 1310 or PHYS 2310]) or Permission of Instructor

Methodology for solving problems in food processing and introduction to food engineering concepts including food properties, material and energy balances, sources of energy, thermodynamics, fluid flow, heat transfer, and mass transfer. (Typically Offered: Spring)

FSHN 3600: Advanced Nutrition and the Regulation of Metabolism in Health and Disease

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500; FSHN 2650

Physiological and biochemical basis for nutrient needs; assessment of nutrient deficiency and toxicity; examination of nutrient functions and the regulation of metabolism; nutrient-gene interactions; mechanistic role of nutrients in health and disease. 3 credits or concurrent enrollment in 3000-level or above Biochemistry recommended. 3 credits in physiology recommended. (Typically Offered: Fall)

FSHN 3610: Nutrition and Health Assessment

Credits: 2. Contact Hours: Lecture 2, Laboratory 2.

Prereq: FSHN 2650

The assessment of nutritional status in healthy individuals. Laboratory experiences in food composition and assessment of dietary intake, body composition, and biochemical indices of nutritional status. (Typically Offered: Spring)

FSHN 3620: Nutrition and Health Throughout the Lifecycle

Credits: 3. Contact Hours: Lecture 3.

Prereq: FSHN 3600; credit or enrollment in BIOL 2560 or 3350

Molecular, biochemical and physiological basis to understand the nutritional aspects of human development and aging. Nutrient needs and various disease states at each stage of human life cycle. (Typically Offered: Spring)

FSHN 3640: Nutrition and Prevention of Chronic Disease

Credits: 3. Contact Hours: Lecture 3.

Prereq: (BIOL 2560 or BIOL 3350) or enrolled in NRS major

Overview of nutrients, their functions, metabolism, food sources and optimal choices for the promotion of health and wellness. Nutrition strategies for the prevention of chronic disease, including cancer, diabetes and obesity, as they apply to individuals or the wider population will be discussed. (Typically Offered: Fall)

FSHN 3650: Obesity and Health

Credits: 3. Contact Hours: Lecture 3.

Multifactorial aspects of obesity, maintenance of healthy weight, and the relationship of weight status and chronic disease prevention. Traditional and novel nutrition and exercise theories as well as current popular diet and exercise trends will be discussed. (Typically Offered: Spring)

FSHN 3670: Medical Terminology for Health Professionals

Credits: 1. Contact Hours: Lecture 1.

An independent course focused on medical terminology, abbreviations, and simple clinical mathematical calculations. (Typically Offered: Fall, Spring, Summer)

FSHN 3730: Science and Practice of Brewing

(Cross-listed with ME 3730).

Credits: 3. Contact Hours: Lecture 1.5, Laboratory 4.5.

Introduction to brewing science and technology. Understanding the role of malts, hops, water, and yeast in production of ale and lager beers. Unit operations in brewing. Health, safety, and environmental sustainability in alcohol production and consumption. Weekly laboratory in practical aspects of beer production. (Typically Offered: Fall, Spring)

FSHN 3760X: Science and Practice of Cheesemaking

Credits: 2. Contact Hours: Lecture 2.

Science and Practice of Cheesemaking is designed to provide students with applied knowledge about milk chemistry and microbiology, sanitation, and cheesemaking. Small teams will engage in various aspects of research and development, including brainstorming, basic market research, food processing, sensory evaluation, and marketing pitches for a new cheese with beer or wine. The course culminates with an invitational culinary event, designed and executed by the students. (Typically Offered: Fall)

FSHN 3920: Food and Nutrition Services Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: HSPM 3800; HSPM 3800L

Functions and responsibilities related to the management of foodservice systems and nutrition services, including planning, marketing, human resource management, and cost accounting. Accounting recommended. Graduation Restriction: Only one of HSPM 3920 or FSHN 3920 may count toward graduation. (Typically Offered: Spring)

FSHN 4030: Food Laws and Regulations

Credits: 2. Contact Hours: Lecture 2.

Prereq: 3 credits in FSHN at 2000-level or above

History of food law in the US and the world. Relationship between policy, legislation and regulation. Introduction to primary US regulatory agencies and enforcement principles. Discussion of key laws related to food safety and nutrition. Overview of federal and independent research tools and sources of food law. (Typically Offered: Spring)

FSHN 4060: Sensory Evaluation of Food

(Dual-listed with FSHN 5060).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: FSHN 3050 and credit or enrollment in FSHN 4110; 3 credits in statistics

Sensory evaluation techniques used to evaluate the appearance, aroma, flavor, texture and acceptability of foods. Relationships between sensory and instrumental measurements of color and texture. Work independently and cooperatively (in a team) to identify sensory evaluation objectives, write hypotheses, design and conduct experiments, and analyze and interpret data. (Typically Offered: Fall)

FSHN 4070: Microbiological Safety of Foods of Animal Origins

(Dual-listed with FSHN 5070/ MICRO 5070). (Cross-listed with MICRO 4070).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MICRO 2010 or MICRO 3020

Examination of the various factors in the production of foods, from production through processing, distribution and final consumption which contribute to the overall microbiological safety of the food. Upon successful completion of this class, the student will receive both the Preventive Controls for Human Foods certificate (FDA program) and the International HACCP Alliance certificate (USDA-FSIS program). Recommended: FSHN 4200 or MICRO 4200 and one semester of Microbiology Laboratory. (Typically Offered: Fall, Spring)

FSHN 4080: Dairy Products Evaluation

Credits: 1. Contact Hours: Laboratory 3.

Gain experience in identifying quality defects in dairy products including milk, cottage cheese, cheddar cheese, strawberry yogurt, butter, and vanilla ice cream. Intensive training for the National Collegiate Dairy Products Evaluation competition and for dairy product evaluation in the food industry. (Typically Offered: Spring)

FSHN 4100: Food Analysis

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: FSHN 3110 or CHEM 2110

An introduction to the theory and application of chemical and instrumental methods for determining the constituents of food. Use of standard procedures for food analysis and food composition data bases. (Typically Offered: Fall)

FSHN 4110: Food Ingredient Interactions and Formulations

Credits: 2. Contact Hours: Lecture 1, Laboratory 3.

Prereq: FSHN 2140 or FSHN 3110

Application of food science principles to ingredient substitutions in food products. Laboratory procedures for standard formulations and instrumental evaluation, with emphasis on problem-solving and critical thinking. (Typically Offered: Fall, Spring)

FSHN 4120: Food Product Development

(Dual-listed with FSHN 5120).

Credits: 3. Contact Hours: Lecture 1, Laboratory 6.

Prereq: FSHN 4110; senior classification

Principles of developing consumer packaged food products. Application of skills gained in food chemistry, formulation, quality, sensory and processing. Emphasis on teamwork and effective communication. (Typically Offered: Spring)

FSHN 4190: Foodborne Hazards

(Cross-listed with MICRO 4190/ TOX 4190).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MICRO 2010 or MICRO 3020; 3 credits in BBMB

Pathogenesis of human microbiological foodborne infections and intoxications, principles of toxicology, major classes of toxicants in the food supply, governmental regulation of foodborne hazards. Assessed service-learning component. Offered even-numbered years. Graduation Restriction: Only one of FSHN 4190 and FSHN 5190 may count toward graduation. (Typically Offered: Spring)

FSHN 4200: Food Microbiology

(Cross-listed with MICRO 4200/ TOX 4200).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MICRO 2010 or MICRO 3020

Effects of microbial growth in foods. Methods to control, detect, and enumerate microorganisms in food and water. Foodborne infections and intoxications. (Typically Offered: Fall)

FSHN 4210: Food Microbiology Laboratory

(Cross-listed with MICRO 4210).

Credits: 3. Contact Hours: Lecture 1, Laboratory 5.

Prereq: MICRO 2010 or MICRO 3020; MICRO 2010L or MICRO 3020L. Credit or enrollment in FSHN/MICRO 4200

Standard techniques used for the microbiological examination of foods. Independent and group projects on student-generated questions in food microbiology. Emphasis on oral and written communication and group interaction. (Typically Offered: Spring)

FSHN 4300: U.S. Health Systems and Policy

(Dual-listed with FSHN 5300).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Junior, Senior, or Graduate Standing

Introduction to public policy for health care professionals. Emphasis on understanding the role of the practitioner for participating in the policy process, interpreting government policies and programs such as Medicare and Medicaid, determining reimbursement rates for eligible services, and understanding licensure and accreditation issues. Discussion and exploration of federal, state and professional policy-relevant resources. (Typically Offered: Fall, Spring)

FSHN 4350: Analysis of Food Markets

(Cross-listed with ECON 4350).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 3010 and STAT 2260

Food market analysis from an economics perspective; food markets and consumption; methods of economic analysis; food industry structure and organization; food and agriculture regulations; labeling; consumer concerns; agricultural commodity promotion. Final project required. (Typically Offered: Spring)

FSHN 4420: Food, Culture, and Sustainability

Credits: 3. Contact Hours: Lecture 2.

Prereq: Sophomore classification

Sustainable food, social, and health systems depend on positive interactions between culture, biology, and the environment. Historical and current cultural characteristics, such as common foods, meal patterns, food taboos, therapeutic uses of food, religion, immigration, and food acquisition patterns will be studied. Cultural acceptability, socio-economic equity, inclusion of diversity beyond culture, and ways to leverage healthy behaviors will be discussed. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall)

FSHN 4450: Strategies for Personal Food Waste Reduction

Credits: 1. Contact Hours: Lecture 1.

Prereq: Junior standing

In-depth analysis and discussion of economic, environmental, social, and ethical implications of food waste. Overview of personal food waste reduction strategies, food recycling/recovery, and responsible waste disposal methods. Discussion and application of advocacy tactics for the promotion of food waste reduction in local communities. (Typically Offered: Spring)

FSHN 4600: Global Nutrition, Health and Sustainability

(Dual-listed with FSHN 5600).

Credits: 3. Contact Hours: Lecture 3.

Nutrition, health, and agriculture related issues in low- and middle-income countries are discussed using the framework of the Sustainable Development Goals. Topics include malnutrition, climate change, food insecurity/famine, micronutrient deficiencies, food production, the nutrition transition, water and sanitation challenges, and chronic diseases to enhance awareness of diverse worldviews and cultural humility. Systems thinking and the interaction of culture, biology, and the environment are emphasized. Meets International Perspectives requirement. Meets International Perspectives Requirement. (Typically Offered: Spring)

FSHN 4610: Medical Nutrition and Disease I

(Dual-listed with NUTRS 5610).

Credits: 4. Contact Hours: Lecture 4.

Prereq: BIOL 2560 or BIOL 3350; FSHN 3600; FSHN 3610; FSHN 3670

Pathophysiology of selected chronic disease states and their associated medical problems. Specific attention will be directed to medical nutrition needs of patients in the treatment of each disease state to optimize nutritional status and improve health. (Typically Offered: Fall)

FSHN 4630: Community Nutrition and Health

(Dual-listed with NUTRS 5630).

Credits: 3. Contact Hours: Lecture 3.

Prereq: FSHN 3610

Dual listed with FSHN 4630. Survey of current public health nutrition problems among nutritionally vulnerable individuals and groups. Discussion of the multidimensional nature of those problems and of community programs addressing them. Grant writing as a means for funding community nutrition program development. Significant emphasis on written and oral communication at the lay and professional level. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall, Spring)

FSHN 4640: Medical Nutrition and Disease II

(Dual-listed with NUTRS 5640).

Credits: 4. Contact Hours: Lecture 4.

Prereq: FSHN 4610 or NUTRS 5610

Dual listed with FSHN 4640. Pathophysiology of selected acute and chronic disease states and their associated medical problems. Specific attention will be directed to medical nutrition needs of patients in the treatment of each disease state to optimize nutritional status and promote health. (Typically Offered: Fall, Spring, Summer)

FSHN 4660: Nutrition Counseling and Education Methods

(Dual-listed with FSHN 5660).

Credits: 3.

Prereq: FSHN 3610 and FSHN 3620

Application of counseling and learning theories with individuals and groups in community and clinical settings. Includes discussion and experience in building rapport, assessment, diagnosis, intervention, monitoring, evaluation, and documentation. Literature review of specific counseling and learning theories. (Typically Offered: Fall, Spring)

FSHN 4670: Molecular Basis of Nutrition in Disease Etiology and Health Promotion

Credits: 3. Contact Hours: Lecture 3.

Prereq: BBMB course 2000 or higher OR instructor permission

Understanding the molecular basis for the role of nutrients, nutrient-derivatives, and bioactive compounds in the development, prevention, and treatment of common diseases including diabetes, cancer, vascular disease, obesity, neurological disease, aberrant mineral metabolism, and autoimmune disease. Translating this understanding into practical approaches for improving the health of individuals and populations. Credit for FSHN 3600 suggested. (Typically Offered: Spring)

FSHN 4710: Food Processing

Credits: 3. Contact Hours: Lecture 3.

Prereq: (AE 4510 or CHE 3570 or FSHN 3510)

Principles and application of food processing using both thermal (ex., blanching, pasteurization, canning, drying, freezing, evaporation, aseptic processing, extrusion) and non-thermal (ex., high pressure, irradiation, pulsed electric field, fermentation) unit operations. Emphasis on microbial inactivation, process heat and mass balance, and numerical problem solving. (Typically Offered: Fall)

FSHN 4720: Food Processing Laboratory

Credits: 2. Contact Hours: Lecture 1, Laboratory 3.

Prereq: FSHN 4710

Hands-on and demonstration laboratory activities related to food processing principles and applications using lab and pilot-scale equipment. Laboratory experiences include important food processing operations, e.g., blanching/pasteurization, canning, freezing, drying, corn wet milling, fermentation, baking etc. Emphasis on mass balance, interpreting data, writing reports, and presentations. Occasional field trips. (Typically Offered: Spring)

FSHN 4900A: Independent Study: Dietetics

Credits: 1-6. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

Independent work in food science, nutrition, or dietetics. Graduation Restriction: A maximum of 6 credits of FSHN 4900 may be used toward graduation. (Typically Offered: Fall, Spring, Summer)

FSHN 4900B: Independent Study: Food Science

Credits: 1-6. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

Independent work in food science, nutrition, or dietetics. Graduation Restriction: A maximum of 6 credits of FSHN 4900 may be used toward graduation. (Typically Offered: Fall, Spring, Summer)

FSHN 4900C: Independent Study: Nutrition

Credits: 1-6. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

Independent work in food science, nutrition, or dietetics. Graduation Restriction: A maximum of 6 credits of FSHN 4900 may be used toward graduation. (Typically Offered: Fall, Spring, Summer)

FSHN 4900D: Independent Study: International Experience

Credits: 1-6. Repeatable, maximum of 6 credits.

Independent work in food science, nutrition, or dietetics. Graduation Restriction: A maximum of 6 credits of FSHN 4900 may be used toward graduation. (Typically Offered: Fall, Spring, Summer)

FSHN 4900E: Independent Study: Entrepreneurship

Credits: 1-6. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

Independent work in food science, nutrition, or dietetics. Graduation Restriction: A maximum of 6 credits of FSHN 4900 may be used toward graduation. (Typically Offered: Fall, Spring, Summer)

FSHN 4900H: Independent Study: Honors

Credits: 1-6. Repeatable, maximum of 6 credits.

Prereq: Permission of Instructor; Membership in the University Honors Program

Independent work in food science, nutrition, or dietetics. Graduation Restriction: A maximum of 6 credits of FSHN 4900 may be used toward graduation. (Typically Offered: Fall, Spring, Summer)

FSHN 4910A: Supervised Work Experience: Dietetics

Credits: 1-4. Repeatable, maximum of 4 credits.

Prereq: Permission of Instructor; Permission of Advisor

Supervised off-campus work experience relevant to the academic major. Graduation Restriction: No More Than 4 Credits Of FSHN 4910A,B,C May Be Applied Toward Graduation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

FSHN 4910B: Supervised Work Experience: Food Science

Credits: 1-4. Repeatable, maximum of 4 credits.

Prereq: Permission of Instructor; Permission of Advisor

Supervised off-campus work experience relevant to the academic major. Graduation Restriction: A maximum of 4 credits of FSHN 4910 may be used toward graduation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

FSHN 4910C: Supervised Work Experience: Nutrition

Credits: 1-4. Repeatable, maximum of 4 credits.

Prereq: Permission of Instructor; Permission of Advisor

Supervised off-campus work experience relevant to the academic major. Graduation Restriction: A maximum of 4 credits of FSHN 4910 may be used toward graduation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

FSHN 4910D: Supervised Work Experience: Culinary Science

Credits: 1-4. Repeatable, maximum of 4 credits.

Prereq: Permission of Instructor; Permission of Advisor

Supervised off-campus work experience relevant to the academic major. Graduation Restriction: No More Than 4 Credits Of FSHN 4910A,B,C May Be Applied Toward Graduation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

FSHN 4920: Research Concepts in Human Nutrition

Credits: 2.

Prereq: Junior standing or Permission of Instructor

Students will develop and implement research projects with faculty supervision, based on knowledge gained from nutrition, biology and chemistry courses and write a formal science paper to share the results of their research. Students will gain appreciation for independent research and experience creative and innovative aspects of nutrition research. (Typically Offered: Fall)

FSHN 4930: Food Preparation Workshop

Credits: 1-3. Repeatable, maximum of 3 credits.

Selected topics in food preparation including scientific principles, culture and culinary techniques. Variable format may include laboratory, recitation, and lecture. Offered on a satisfactory-fail basis only.

FSHN 4960A: Food Science and Human Nutrition Travel Course: International travel

(Dual-listed with FSHN 5960A).

Credits: 1-4. Repeatable.

(One credit per week traveled.) Limited enrollment. Tour and study of food industry, dietetic and nutritional agencies in different regions of the world. Pre-travel session arranged. Travel expenses paid by students. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

FSHN 4960B: Food Science and Human Nutrition Travel Course: Domestic travel

(Dual-listed with FSHN 5960B).

Credits: 1-4. Repeatable.

(One credit per week traveled.) Limited enrollment. Tour and study of food industry, dietetic and nutritional agencies in different regions of the world. Pre-travel session arranged. Travel expenses paid by students. (Typically Offered: Fall, Spring, Summer)

FSHN 4980: Cooperative Education

Credits: Required. Repeatable, maximum of 0 credits.

Prereq: Department Chair Permission for Course

Required for students completing professional work periods in a cooperative education program. Students must register prior to commencing each work period. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

FSHN 4990: Undergraduate Research

Credits: 1-6. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

Research under staff guidance. Graduation Restriction: A maximum of 6 credits of FSHN 4990 may be used toward graduation. (Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

FSHN 5060: Sensory Evaluation of Food

(Dual-listed with FSHN 4060).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: FSHN 3050 and credit or enrollment in FSHN 4110; 3 credits in statistics

Sensory evaluation techniques used to evaluate the appearance, aroma, flavor, texture and acceptability of foods. Relationships between sensory and instrumental measurements of color and texture. Work independently and cooperatively (in a team) to identify sensory evaluation objectives, write hypotheses, design and conduct experiments, and analyze and interpret data. (Typically Offered: Fall)

FSHN 5070: Microbiological Safety of Foods of Animal Origins

(Dual-listed with FSHN 4070/ MICRO 4070). (Cross-listed with MICRO 5070).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MICRO 4200 or Graduate Classification

Examination of the various factors in the production of foods, from production through processing, distribution and final consumption which contribute to the overall microbiological safety of the food. Upon successful completion of this class, the student will receive both the Preventive Controls for Human Foods certificate (FDA program) and the International HACCP Alliance certificate (USDA-FSIS program). Recommended: FSHN 4200 or MICRO 4200 and one semester of Microbiology Laboratory. (Typically Offered: Fall, Spring)

FSHN 5080: Consumer Perceptions and Nutrition Communication

Credits: 2. Contact Hours: Lecture 2.

Prereq: Acceptance in the Master of Professional Practice in Dietetics program

Examination of current consumer food and nutrition trends. Critical analysis of consumer perceptions relative to current research base. Use of various media, such as infographic, print/publication, and YouTube video) to create effective nutrition messages for consumers. Activities designed to meet accreditation standards. (Typically Offered: Fall, Spring, Summer)

FSHN 5090: Sensory Evaluation of Wines

Credits: 2. Contact Hours: Lecture 1, Laboratory 2.

Prereq: Must be at least 21 years of age; senior or graduate classification

Principles of sensory evaluation and their application to wine evaluation. Sensory testing methods such as discrimination tests, ranking, descriptive analysis and scoring of wines will be covered. Students will have the opportunity to evaluate and learn about major types and styles of wines of the world. Lab fee. (Typically Offered: Spring)

FSHN 5110: Integrated Food Science

Credits: 3. Contact Hours: Lecture 3.

Prereq: 3 credits in organic chemistry, physics, mathematics, and microbiology

Critical review of the key principles of food science and applications in the chemistry, microbiology, and processing of food. Understanding of the impact of processing on the quality of foods with respect to composition, quality and safety. (Typically Offered: Fall)

FSHN 5120: Food Product Development

(Dual-listed with FSHN 4120).

Credits: 3. Contact Hours: Lecture 1, Laboratory 6.

Prereq: FSHN 4110; senior classification

Principles of developing consumer packaged food products. Application of skills gained in food chemistry, formulation, quality, sensory and processing. Emphasis on teamwork and effective communication. (Typically Offered: Spring)

FSHN 5160: Advanced Nutrition I

Credits: 2. Contact Hours: Lecture 2.

Prereq: Acceptance in the Master of Professional Practice in Dietetics program

Examination of current literature relative to molecular, cellular, and physiologic aspects of macronutrient and micronutrient metabolism. Integration of current evidence-based information, including peer-reviewed literature, to inform nutrition practice. Activities designed to meet accreditation standards. (Typically Offered: Fall)

FSHN 5170: Gut Microbiome: Implications for Health and Diseases

(Cross-listed with ANS 5170/ MICRO 5170/ VMPM 5170).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 2-3 credits in microbiology and/or immunology.

Explore current research on gut microbiome including modern tools used to study the gut microbiome. Examine the linkages between gut microbiome and health status, diseases, and manipulation of gut microbiome to improve health. (Typically Offered: Fall)

FSHN 5180: Advanced Nutrition II

Credits: 3. Contact Hours: Lecture 3.

Prereq: Acceptance in the Master of Professional Practice in Dietetics program

Principles of research design/methods and interpreting results/statistics in the current peer-reviewed scientific literature. Critical evaluation of the evidence-base to inform nutrition practice. Activities designed to meet accreditation standards. (Typically Offered: Spring)

FSHN 5210: Microbiology of Food

Credits: 2. Contact Hours: Lecture 2.

Prereq: A course in microbiology with laboratory; enrollment IDEA Food Safety and Defense Graduate Certificate or permission of instructor

Identification, enumeration, and characterization of bacteria, yeasts, and mold associated with foods and food processing. Effects of physical and chemical agents on micro-organisms will be studied. Microbiological problems in food spoilage, food preservation, food fermentation, and food-borne disease will be discussed. (Typically Offered: Spring, Summer)

FSHN 5220: Advanced Food Microbiology and Biotechnology

Credits: 2. Contact Hours: Lecture 2.

Prereq: Enrollment in IDEA Food Safety and Defense Graduate Certificate or permission of instructor

Basic principles in biotechnology and applied food microbiology, including current topics of interest in food biotechnology. Introduction to recombinant DNA techniques and how they are applied to genetically modify microorganisms, the use of nucleic acids as tools of rapid detection of microorganisms in foods, basic enzyme immobilization and down-stream processing techniques, and regulatory aspects of food biotechnology. Offered odd-numbered years. (Typically Offered: Spring).

FSHN 5230: A Multidisciplinary Overview of Food Safety and Security

Credits: 2. Contact Hours: Lecture 2.

Prereq: A course in biology or chemistry; enrollment in IDEA Food Safety and Defense Graduate Certificate or permission of instructor

Multidisciplinary food safety and security perspectives provided by numerous subject matter experts. Topics include food safety policy, ag bioterrorism, border security, animal ID, food defense and site security, risk analysis, crisis communication, epidemiology, HACCP, and more. (Typically Offered: Fall, Summer)

FSHN 5240: Food Microbiology

Credits: 3. Contact Hours: Lecture 3.

Prereq: A course in microbiology with laboratory; enrollment IDEA Food Safety and Defense Graduate Certificate or permission of instructor

Food Microbiology looks at the nature, physiology, and interactions of microorganisms in foods. The course is an introduction to food-borne diseases, the effect of food processing systems on the microflora of foods, principles of food preservation, food spoilage, and foods produced by microorganisms. Additionally, the course looks at food plant sanitation and criteria for establishing microbial standards for food products. (Typically Offered: Fall)

FSHN 5250: Principles of HACCP

Credits: 2. Contact Hours: Lecture 2.

Prereq: Enrollment in IDEA Food Safety and Defense Graduate Certificate or permission of instructor

A comprehensive study of the Hazard Analysis and Critical Control Point System and its application in the food industry. (Typically Offered: Fall)

FSHN 5260: Ethnic Foods: Food Safety, Food Protection and Defense

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate standing; enrollment in IDEA Food Safety and Defense Graduate Certificate or permission of instructor

Understanding of the various factors that impact safety of ethnic and imported ethnic foods; knowledge about the handling, preparation, processing and storage of ethnic and imported foods and food products; science-based characterization of representative ethnic foods. (Typically Offered: Summer)

FSHN 5270: Microbiology of Fermented Foods

Credits: 2. Contact Hours: Lecture 2.

Prereq: Enrollment in IDEA Food Safety and Defense Graduate Certificate or permission of instructor

Microbiology of fermented foods covers the physiology, biochemistry, and genetics of microorganisms important in food fermentations. The course looks at how microorganisms are used in fermentations and the effects of processing and manufacturing conditions on production of fermented foods. (Typically Offered: Summer)

FSHN 5280: Food Protection and Defense-Essential Concepts

Credits: 2. Contact Hours: Lecture 2.

Prereq: Enrollment in IDEA Food Safety and Defense Graduate Certificate or permission of instructor

This course will provide students with an understanding of the principles required in a food defense program for a food manufacturing, warehousing or distribution center. The topics covered include: defining threats and aggressors; the Bioterrorism Act; food defense teams; vulnerability assessments; security programs; recall and traceability basics; security inspections; crisis management; emergency preparedness; and workplace violence. (Typically Offered: Spring)

FSHN 5290: Foodborne Toxicants

(Cross-listed with TOX 5290).

Credits: 2. Contact Hours: Lecture 2.

Mechanisms of action, metabolism, sources, remediation/detoxification, risk assessment of major foodborne toxicants of current interest, design of HACCP plans for use in food industries targeting foodborne toxicants, discussion of toxicants from a food defense perspective. Offered online only. (Typically Offered: Fall, Spring, Summer)

FSHN 5300: U.S. Health Systems and Policy

(Dual-listed with FSHN 4300).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Junior, Senior, or Graduate Standing

Introduction to public policy for health care professionals. Emphasis on understanding the role of the practitioner for participating in the policy process, interpreting government policies and programs such as Medicare and Medicaid, determining reimbursement rates for eligible services, and understanding licensure and accreditation issues. Discussion and exploration of federal, state and professional policy-relevant resources. (Typically Offered: Fall, Spring)

FSHN 5330: Diet and Integrative Therapies for Prevention and Treatment of Diseases

Credits: 2. Contact Hours: Lecture 2.

Prereq: Acceptance in the Master of Professional Practice in Dietetics program

Explore the role of specific nutrients, dietary bioactive compounds and integrative therapies on disease prevention and treatment. Activities designed to meet accreditation standards. (Typically Offered: Fall)

FSHN 5370: Leadership and Management in Dietetics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Acceptance in the Master of Professional Practice in Dietetics program

Application of leadership and management theories and approaches relevant to dietetics practice. Use of self-reflection and self-assessment to assist in recognition and development of leadership behaviors. Activities designed to meet accreditation standards. (Typically Offered: Summer)

FSHN 5380: Advanced Medical Nutrition Therapy

Credits: 3. Contact Hours: Lecture 3.

Prereq: Acceptance in the Master of Professional Practice in Dietetics program

Medical Nutrition Therapy for complex medical problems utilizing the scope and standards of dietetics practice, Nutrition Care Process, and practice-specific resources such as the Standards of Professional Performance. Evidence-based practice will be integrated into each topic. Capstone project. Activities designed to meet accreditation standards. (Typically Offered: Spring)

FSHN 5420A: Introduction to Molecular Biology Techniques: DNA Techniques

(Cross-listed with BMS 5420A/ EEOB 5420A/ BBMB 5420A/ GDCB 5420A/ HORT 5420A/ NREM 5420A/ NUTRS 5420A/ VDPAM 5420A/ VMPM 5420A).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes genetic engineering procedures, sequencing, PCR, and genotyping. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

FSHN 5420B: Introduction to Molecular Biology Techniques: Protein

(Cross-listed with BMS 5420B/ EEOB 5420B/ BBMB 5420B/ GDCB 5420B/ HORT 5420B/ NREM 5420B/ NUTRS 5420B/ VDPAM 5420B).

Credits: 1. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. Offered on a satisfactory-fail basis only. (Typically Offered: Spring, Summer)

FSHN 5420C: Introduction to Molecular Biology Techniques: Cell Techniques

(Cross-listed with BMS 5420C/ EEOB 5420C/ BBMB 5420C/ GDCB 5420C/ HORT 5420C/ NREM 5420C/ NUTRS 5420C/ VMPM 5420C/ VDPAM 5420C).

Credits: 1. Contact Hours: Laboratory 2.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. Includes biology techniques and related procedures. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

FSHN 5420D: Introduction to Molecular Biology Techniques: Plant Transformation

(Cross-listed with BMS 5420D/ EEOB 5420D/ BBMB 5420D/ GDCB 5420D/ HORT 5420D/ NREM 5420D/ NUTRS 5420D/ VMPM 5420D/ VDPAM 5420D).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: Agrobacterium and particle gun-mediated transformation of tobacco, Arabidopsis, and maize, and analysis of transformants. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

FSHN 5420E: Introduction to Molecular Biology Techniques: Proteomics

(Cross-listed with BMS 5420E/ EEOB 5420E/ BBMB 5420E/ GDCB 5420E/ HORT 5420E/ NREM 5420E/ NUTRS 5420E/ VMPM 5420E/ VDPAM 5420E).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: two-dimensional electrophoresis, laser scanning, mass spectrometry, and database searching. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

FSHN 5420F: Introduction to Molecular Biology Techniques:**Metabolomics**

(Cross-listed with BMS 5420F/ EEOB 5420F/ BBMB 5420F/ GDCB 5420F/ HORT 5420F/ NREM 5420F/ NUTRS 5420F/ VMPM 5420F/ VDPAM 5420F).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: metabolomics and the techniques involved in metabolite profiling. For non-chemistry majoring students who are seeking analytical aspects into their biological research projects. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

FSHN 5420G: Introduction to Molecular Biology Techniques: Genomic

(Cross-listed with BMS 5420G/ EEOB 5420G/ BBMB 5420G/ GDCB 5420G/ HORT 5420G/ NREM 5420G/ NUTRS 5420G/ VMPM 5420G/ VDPAM 5420G).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

FSHN 5540: Supervised Experience in Food Systems Management

Credits: 3.

Prereq: Acceptance in the Master of Professional Practice in Dietetics program

Combined supervised practice experiential and didactic learning course. Students demonstrate their competence of food service and management principles to ensure safe and efficient delivery of food and water to various populations; implement change management principles and demonstrate leadership in a variety of organizational settings. Experiences and course-related activities designed to meet accreditation standards. Capstone project. (Typically Offered: Summer)

FSHN 5550: Supervised Experience in Community Nutrition

Credits: 3.

Prereq: Acceptance in the Master of Professional Practice in Dietetics program

Combined supervised practice experiential and didactic learning course. Application of systems thinking and principles of sustainable, resilient, and healthy food and water systems to identify and assess nutrition problems in the community, design, implement and evaluate effectiveness of programs, and demonstrate competence in the relationship between policy, food, nutrition, health, and the environment. Experiences and course-related activities designed to meet accreditation standards. (Typically Offered: Fall)

FSHN 5560: Supervised Experience in Medical Nutrition Therapy

Credits: 5.

Prereq: Acceptance in the Master of Professional Practice in Dietetics program

Combined supervised practice experiential and didactic learning course. The Nutrition Care Process will be implemented in various populations, conditions and settings. Two weeks of staff relief at the end of the rotation. Experiences and course-related activities are designed to meet accreditation standards. (Typically Offered: Spring)

FSHN 5600: Global Nutrition, Health and Sustainability

(Dual-listed with FSHN 4600).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Nutrition, health, and agriculture related issues in low- and middle-income countries are discussed using the framework of the Sustainable Development Goals. Topics include malnutrition, climate change, food insecurity/famine, micronutrient deficiencies, food production, the nutrition transition, water and sanitation challenges, and chronic diseases to enhance awareness of diverse worldviews and cultural humility. Systems thinking and the interaction of culture, biology, and the environment are emphasized. Meets International Perspectives requirement. (Typically Offered: Spring)

FSHN 5620: Advanced Nutrition Assessment

Credits: 4. Contact Hours: Lecture 4.

Prereq: Acceptance in the Master of Professional Practice in Dietetics program

Overview and practical applications of methods for assessing nutritional status, including: theoretical framework of nutritional health and disease, dietary intake, biochemical indices, nutrition focused physical exam and body composition across the lifecycle. Activities designed to meet accreditation standards. (Typically Offered: Fall)

FSHN 5660: Nutrition Counseling and Education Methods

(Dual-listed with FSHN 4660).

Credits: 3.

Prereq: FSHN 3610 and FSHN 3620

Application of counseling and learning theories with individuals and groups in community and clinical settings. Includes discussion and experience in building rapport, assessment, diagnosis, intervention, monitoring, evaluation, and documentation. Literature review of specific counseling and learning theories. (Typically Offered: Fall)

FSHN 5680X: Foundations of Sustainable, Resilient, and Healthy Food Systems

Credits: 3. Contact Hours: Lecture 3.

Prereq: FSHN 1670 or FSHN 2420

Critically analyze current and future nutrition, health, and policy issues in the US food system using a systems-based approach. Controversial topics influencing multiple sectors of the US food system will be discussed. Identify pathways forward for local and regional food system transformation and propose community-based solutions. . (Typically Offered: Fall)

FSHN 5690X: Food Disconnected - What We Eat Matters

Credits: 3. Contact Hours: Lecture 3.

Prereq: FSHN 1670; Credit or concurrent enrollment in FSHN 5680X

Our food systems are at a crossroad and sustainability is a pressing need. In this course, students will apply a systems-based approach to critically evaluate food production and processing challenges in the US food system using domestic and global case studies. We will consider how food production can be done in environmentally friendly way and reflect on whether consumers can play a role through their food choices. Finally, students will enhance their knowledge regarding food literacy and the ability to apply skills to engage in enterprises that can transform current food systems. (Typically Offered: Fall)

FSHN 5700: Sustainable and Healthy Eating Patterns

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate classification

Utilize a systems-based approach to consider health implications, economic considerations, environmental impacts, and sociocultural wellbeing to comprehensively explore sustainable diets. Evaluate benefits and challenges of transitioning to sustainable diets in the context of current and future food systems. Address the role of food environments, connect dietary guidelines to sustainability issues, and identify how sustainable diets fit in the context of global environmental goals. Food systems frameworks and models will be applied to evaluate the sustainability of select foods and eating patterns at the local and global level. (Typically Offered: Spring)

FSHN 5750: Processed Foods

Credits: 3. Contact Hours: Lecture 3.

Prereq: FSHN 2140 or FSHN 3110; A course in nutrition

This course will examine effect of industrial and domestic food processing on the nutrient content of food and risk of developing chronic disease. Offered odd-numbered years. (Typically Offered: Spring).

FSHN 5890: Systems Neuroscience: Brain, Behavior, and Nutrition-Related Integrative Physiology

(Cross-listed with NUTRS 5890/ GERON 5890/ NEURO 5890/ PSYCH 5890).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Qualified Undergraduate with Permission of Instructor

Structural, functional, and biochemical aspects of brain and non-motor behavior across the human lifespan. Types of neuroimaging used to assess the brain. Current research is leveraged to gauge how nutrition, diseases related to nutrition, and associated physiological processes influence the brain, particularly for common developmental, psychological, and neurological disorders. (Typically Offered: Spring)

FSHN 5900A: Special Topics: Nutrition

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

FSHN 5900B: Special Topics: Food Science

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

FSHN 5900C: Special Topics: Teaching

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

FSHN 5960A: Food Science and Human Nutrition Travel Course: International Travel

(Dual-listed with FSHN 4960A).

Credits: 1-4. Repeatable.

(One credit per week traveled.) Limited enrollment. Tour and study of food industry, dietetic and nutritional agencies in different regions of the world. Pre-travel session arranged. Travel expenses paid by students. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

FSHN 5960B: Food Science and Human Nutrition Travel Course:**Domestic travel**

(Dual-listed with FSHN 4960B).

Credits: 1-4. Repeatable.

Prereq: Instructor Permission for Course

(One credit per week traveled.) Limited enrollment. Tour and study of food industry, dietetic and nutritional agencies in different regions of the world. Pre-travel session arranged. Travel expenses paid by students.

(Typically Offered: Fall, Spring, Summer)

FSHN 5990: Creative Component

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Nonthesis option only. (Typically Offered: Fall, Spring, Summer)

Courses for graduate students:**FSHN 6060: Advanced Food Analysis and Instrumentation**

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: FSHN 3110 or FSHN 4100 or FSHN 5110 or equivalent

Instrumental methods for measuring chemical and physical properties of foods, food quality and functionality. Techniques for methods development, sample preparation, optimization of operating conditions, and data analysis needed to obtain accurate, reproducible results by means of instrumentation. Offered even-numbered years. (Typically Offered: Fall).

FSHN 6110: Advanced Food Processing

Credits: 3. Contact Hours: Lecture 3.

Recent advances in the science and technology of food processing and preservation; examples include both thermal and non-thermal processes, including cold plasma, nanotechnology, and extrusion. Advances in extraction and separation technologies, by-product utilization, and sustainability in food processing industry will also be discussed. Students to research on select topics and present. Offered odd-numbered years. (Typically Offered: Fall).

FSHN 6120: Advanced Food Chemistry

Credits: 3. Contact Hours: Lecture 3.

Prereq: FSHN 3110 or FSHN 4110 or FSHN 5110 or BBMB 4040 or equivalent

Structure, chemical and physical properties of lipids, proteins and carbohydrates, and their food and industrial applications. Changes in functionalities during processing and storage. Offered even-numbered years. (Typically Offered: Spring).

FSHN 6260: Advanced Food Microbiology

(Cross-listed with MICRO 6260/ TOX 6260).

Credits: 3. Contact Hours: Lecture 3.

Prereq: FSHN 4200 or FSHN 4210 or FSHN 5040

Topics of current interest in food microbiology, including new foodborne pathogens, rapid identification methods, effect of food properties and new preservation techniques on microbial growth, and mode of action of antimicrobials. Offered odd-numbered years. (Typically Offered: Spring)

FSHN 6530: Food and Agricultural Traceability

Credits: 3. Contact Hours: Lecture 3.

Prereq: Enrollment in the Ivy Executive MBA program within the Ivy College of Business

Current issues and concepts of food and agricultural product traceability in the U.S., from production to consumption. Food types, microbial agents of concern, adulterants, disease investigations, risk analysis, risk mitigation, prevention and regulatory policy and advocacy. Travel to Washington, D.C. (Typically Offered: Fall)

FSHN 6810: Seminar

Credits: 1. Contact Hours: Lecture 1.

Repeatable, maximum of 2 credits.

Presentation of thesis or dissertation research. Must be taken once for each graduate program; once for the M.S. program and once for the Ph.D. program. Offered on a satisfactory-fail basis only. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

FSHN 6820: Research Presentation and Discussion

Credits: 0. Contact Hours: Lecture 1.

Repeatable.

Development of presentation skills and critical thinking skills through the presentation and discussion of research within student's discipline. Required each semester for all FSHN graduate students. . Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

FSHN 6900: Special Problems

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

FSHN 6950: Grant Proposal Writing

(Cross-listed with NUTRS 6950).

Credits: 1. Contact Hours: Lecture 1.

Prereq: 3 credits of graduate course work in food science or nutritional sciences

Grant proposal preparation experiences including writing and critiquing of proposals and budget planning. Understanding the grant funding process from federal, foundation, and commodity agencies. Includes preparing a grant for possible submission and participation in the review of proposals. Discussion of the role of successful grant writing in career development. (Typically Offered: Fall, Spring)

FSHN 6990: Research in Food Science and Technology

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

Gerontology

Interdepartmental Undergraduate and Graduate Minors and Graduate Degree Programs

The gerontology program is designed for students interested in improving their understanding of adult development and aging across contexts and desiring careers in a variety of aging-related fields. Graduates understand the ways in which individual and societal aging influence, and are impacted by, developments in their major field of study. They have an appreciation and understanding of the interdisciplinary aspects of human aging.

Undergraduate

Undergraduate students may elect to minor in Gerontology, complementing their major. Courses prepare students to apply aging-related expertise to their field of study.

Graduate

Students enrolled in the on-campus master's and doctoral programs are able to choose a home department in any unit across campus including, but not limited to Design, Human Development and Family Studies, Kinesiology, Political Science, School of Education, and Sociology. Students take courses and engage in research and outreach to develop the necessary interdisciplinary breadth which, in combination with other disciplinary training, can prepare them for diverse career pathways. Students work with their Major Professor and Program of Study Committee members to chart a course of study. Current Iowa State graduate students can enroll in the Gerontology graduate minor.

Students enrolled in the online graduate certificate and master's programs take courses from experts across partnering institutions to

prepare them for translational and applied positions in the field of aging. The program is designed to be flexible and meet student needs.

Undergraduate Study

Undergraduate study in this program provides the student with an opportunity to develop a minor in gerontology. A balanced grouping of courses assists the student in developing both a sensitivity to the issues and the ability to synthesize ideas from the variety of disciplines important to the study of the aging process.

Minor

Undergraduate students may minor in gerontology by taking 16 semester hours of gerontology related courses. Nine of these credits must come from the following courses:

GERON 3730	Death as a Part of Living	3
GERON 3770	Aging and the Family	3
GERON 3780	Retirement Planning and Employee Benefits	3

Students will participate in a prepracticum seminar, GERON 4660 Gerontology Prepracticum Seminar, and will complete a supervised field practicum after all gerontology coursework is completed (GERON 4670 Gerontology Practicum). A minimum of 3 semester credits must be selected from a list of supportive gerontology related courses. Supportive courses include units or topics related to aging and can be used to complement the student's major interests. The minor must include at least 9 credits that are not used to meet any other department, college, or university requirement. The student's minor program must be approved by the undergraduate gerontology coordinator.

Graduate Minor

A graduate minor in Gerontology is available to any current ISU graduate student and consists of a minimum of 12 credits taken from a list of acceptable courses, and from at least two departments. Nine of the 12 credits must be in courses that are focused specifically on aging. One 5900 course (3 credits maximum) can be taken as part of the 12 credits. At least one member of the Gerontology faculty will be on a student's Program of Study Committee.

On-Campus Programs

Our on-campus Gerontology master's and doctoral degree programs are interdepartmental in nature. This means students receive content and training in Gerontology as well as a complementary discipline. We believe an interdisciplinary and collaborative approach allows students to enhance their experiences, training, and skills and ultimately their marketability and career success. Students work with their Major Professor and committee members to craft a program of study which encompasses core Gerontology and home department curriculum while fitting the unique needs of the student.

Online Programs

Iowa State University offers a Master's degree in Family and Consumer Sciences with specialization in Gerontology. This is an interinstitutional online program offered through the Great Plains Interactive Distance Education Alliance (or GPIDEA). The student selects a home institution (Iowa State), which ultimately grants the degree. After admission to Iowa State, the student takes courses from Iowa State and the other participating institutions North Dakota State University, Oklahoma State University, Texas Tech University, and University of Arkansas.

The master's degree consists of 36 credits, 24 required credits and 12 elective credits (<https://online.hs.iastate.edu/graduate-degrees/gerontology/.html>). This program does not require a thesis.

Graduate Certificate

The 15-credit Graduate Certificate in Gerontology (<https://online.hs.iastate.edu/graduate-degrees/gerontology/>) is offered completely online through the Great Plains Interactive Distance Education Alliance (or GPIDEA). The student selects a home institution (Iowa State), which ultimately grants the certificate. After admission to Iowa State, the student takes courses from Iowa State and the other participating institutions North Dakota State University, Oklahoma State University, Texas Tech University, and University of Arkansas. This is a stand-alone graduate certificate available to any student with a bachelor's degree.

Courses primarily for undergraduates:

GERON 2340: Young Adulthood Through Later Life

(Cross-listed with HDFS 2340).

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 2300 or HDFS 1020

Exploration of the health, individual and social factors associated with adult development including emerging, younger, middle, and older adulthood. Information is presented from a biopsychosocial lens of change across the lifespan. . (Typically Offered: Spring)

GERON 3730: Death as a Part of Living

(Cross-listed with HDFS 3730).

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 2300 or HDFS 1020

Consideration of death in the life span of the individual and the family with opportunity for exploration of personal and societal attitudes. (Typically Offered: Fall, Spring, Summer)

GERON 3770: Aging and the Family

(Cross-listed with HDFS 3770).

Credits: 3. Contact Hours: Lecture 3.

Interchanges of older adults and their families. Emphasis on role changes, social interaction, and independence as influenced by health, finances, lifestyles, and community support. (Typically Offered: Fall, Summer)

GERON 3780: Retirement Planning and Employee Benefits

(Cross-listed with HDFS 3780).

Credits: 3. Contact Hours: Lecture 3.

Financial needs analysis for retirement, characteristics of employer-sponsored and individual retirement plans, tax implications of retirement plans, Social Security funding and benefits, strategies for meeting varying retirement needs in a diverse society, financial counseling and planning practice, and overview of employee benefits. (Typically Offered: Spring)

GERON 4660: Gerontology Prepracticum Seminar

Credits: 1. Contact Hours: Lecture 1.

Prepracticum training for students planning a gerontology practicum. Exploration of possible agencies for the practicum, in-depth study of a selected agency, and development of goals and objectives for the practicum. (Typically Offered: Fall, Spring, Summer)

GERON 4670: Gerontology Practicum

Credits: 3-6. Repeatable.

Supervised field experience related to aging. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

GERON 4900: Independent Study

Credits: 1-30.

Prereq: Instructor Permission for Course

Consult program coordinator for procedure. (Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

GERON 5010: Seminar

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

(Typically Offered: Fall, Spring, Summer)

GERON 5010J: Gerontology Seminar: Gerontechnology

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Gerontology Seminar: Gerontechnology. (Typically Offered: Fall, Spring, Summer)

GERON 5010M: Gerontology Seminar: Spiritual & Aging

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Gerontology Seminar: Spiritual & Aging. (Typically Offered: Fall, Spring, Summer)

GERON 5100: Survey of Gerontology

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Provides an overview of important gerontological issues. (Typically Offered: Fall, Spring, Summer)

GERON 5210: Biological Principles of Aging

(Dual-listed with BIOL 4210). (Cross-listed with EEOB 5210).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Basic biological principles of aging. Course modules include an introduction to the aging process, body systems and normal aging, and environment and the biology of aging. In addition, disorders and diseases of aging, prevention and treatment and exercise and aging topics will be covered. (Typically Offered: Summer)

GERON 5220: Long-Term Care

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Administration principles involved in the planning, organizing and directing of long-term care agencies. Includes an in-depth exposure to federal and state standards and regulations governing long-term care. (Typically Offered: Fall)

GERON 5230: Mental Health and Aging

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to the range of issues involved in aging and mental health. From a systems framework the major emotional and psychiatric problems encountered in old age will be examined including mood, anxiety, adjustment and personality disorders, dementia, cognitive problems, substance abuse, and suicide. Barriers to treatment and cohort and cultural issues will be explored. (Typically Offered: Spring)

GERON 5240: Cognitive Health

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Cognitive skills form the foundation for functioning in everyday life and these skills take on added importance in older adulthood. This course focuses on selected theoretical approaches and current research related to cognitive aging. We will review normative and non-normative cognitive changes, assessment techniques, and prevention/intervention efforts. Throughout the course we will keep the role of environment and life-span implications in the forefront of our discussion. (Typically Offered: Summer)

GERON 5300: Perspectives in Gerontology

(Cross-listed with HDFS 5300).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Overview of current aging issues including theory and research, critical social and political issues in aging, the interdisciplinary focus of gerontology, career opportunities, and aging in the future. (Typically Offered: Fall)

GERON 5310: Foundations in Integrative Aging Studies

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to foundational concepts in the interdisciplinary field of aging studies, including: core theories of adult development and aging how to be critical consumers of aging research; developing writing and other professional skills; and exploring career options in aging. Offered even-numbered years. (Typically Offered: Spring)

GERON 5340: Adult Development

(Cross-listed with HDFS 5340).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Exploration of the biological, psychological and social factors associated with aging. Although the focus is on the later years, information is presented from a life-span developmental framework. Empirical studies are reviewed and their strengths, limitations and implications for normative and optimal functioning are discussed. (Typically Offered: Spring)

GERON 5400: Nutrition and Physical Activity in Aging

(Cross-listed with DIET 5400).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

WWW only. Basic physiologic changes during aging and their impacts in health and disease. The focus will be on successful aging with special emphasis on physical activity and nutrition. Practical application to community settings is addressed. (Typically Offered: Fall)

GERON 5450: Economics, Public Policy, and Aging

(Cross-listed with HDFS 5450).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Policy development in the context of the economic status of the older adult population. Retirement planning and the retirement decisions; social security and public transfer programs; intra-family transfers to/ from the aged; private pensions; financing medical care; prospects and issues for the future. (Typically Offered: Fall)

GERON 5630: Environments for the Aging

(Dual-listed with HDFS 4630/ GERON 4630). (Cross-listed with HDFS 5630).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Emphasis on independent living within residential settings including specialized shelter, supportive services and housing management. Application of criteria appropriate for accessibility and functional performance of activities; universal design principles. Creative project provides service learning opportunities. (Typically Offered: Spring)

GERON 5710: Design for All People

(Cross-listed with ARCH 5710).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Principles and procedures of inclusive design in response to the varying ability level of users. Assessment and analysis of existing buildings and sites with respect to standards and details of accessibility for all people, including visually impaired, mentally impaired, and mobility restricted users. Design is neither a prerequisite nor a required part of the course. Enrollment open to students majoring in related disciplines. Credit counts toward fulfillment of History, Theory, Culture requirements. (Typically Offered: Spring)

GERON 5770: Aging in the Family Setting

(Cross-listed with HDFS 5770).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Theories and research related to personal and family adjustments in later life affecting older persons and their intergenerational relationships. Related issues including demographics also are examined through the use of current literature. (Typically Offered: Spring)

GERON 5840: Program Evaluation and Research Methods in Gerontology

(Cross-listed with HDFS 5840).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Overview of program evaluation, research methods, and grant writing in gerontology. Includes application of quantitative and qualitative methods in professional settings. (Typically Offered: Spring)

GERON 5890: Systems Neuroscience: Brain, Behavior, and Nutrition-Related Integrative Physiology

(Cross-listed with FSHN 5890/ NUTRS 5890/ NEURO 5890/ PSYCH 5890).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Qualified Undergraduate with Permission of Instructor

Structural, functional, and biochemical aspects of brain and non-motor behavior across the human lifespan. Types of neuroimaging used to assess the brain. Current research is leveraged to gauge how nutrition, diseases related to nutrition, and associated physiological processes influence the brain, particularly for common developmental, psychological, and neurological disorders. (Typically Offered: Spring)

GERON 5900: Special Topics

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Consult program coordinator for procedure. (Typically Offered: Fall, Spring, Summer)

GERON 5910: Internship

Credits: 1-9. Repeatable, maximum of 9 credits.

Prereq: Instructor Permission for Course

Supervised experience in an area of gerontology. (Typically Offered: Fall, Spring, Summer)

GERON 5940: Professional Seminar in Gerontology

(Cross-listed with HDFS 5940).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

An integrative experience for gerontology students designed to be taken near the end of the degree program. By applying knowledge gained in earlier coursework, students will strengthen skills in ethical decision-making behavior, applying these skills in gerontology-related areas such as advocacy, professionalism, family and workplace issues. Students from a variety of professions will bring their unique perspectives to bear on topics of common interest. (Typically Offered: Summer)

GERON 5990: Creative Component

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

Courses for graduate students:

GERON 6300: Theories of Aging

Credits: 3. Contact Hours: Lecture 3.

Historical, contemporary, and interdisciplinary basis of aging theory. Biological, psychological, sociological, and human developmental conceptualizations of aging will be critically assessed. Emphasis will be placed on conceptual models, as well as theoretical development and application within gerontological research and the field of aging. (Typically Offered: Summer)

GERON 6350: Adult Development, Aging, and Health

(Cross-listed with HDFS 6350).

Credits: 3. Contact Hours: Lecture 3.

Review of the impact of the growing older adult population as well as individual development and aging on individuals, families, and society. Exploration of theoretical perspectives applied to adult development and aging and distinction of normative and non-normative changes in adulthood. Discussion of methods to assess development across adulthood and consideration of the role of individual and environmental factors impacting efforts to optimize adult development. Offered odd-numbered years. (Typically Offered: Fall)

GERON 6990: Research

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

Global Human Sciences Minor

Students can earn a Global Human Sciences Minor by completing a minimum of 15 credits (17 for those participating in International Student Teaching), including 6 credits of required core courses and between 9 and 11 credits selected from a designated list of courses offered by the departments and school in the College of Human Sciences. This minor is available to any undergraduate student at Iowa State University.

The Global Human Sciences Minor will contribute to students' ability to:

- Develop and demonstrate effective and professional oral and written communication skills regarding global human sciences
- Reflect on their experience with global human sciences and on how it has influenced their understanding of what it means to be a human scientist
- Analyze how social, cultural, technological, and economic contexts have affected the development of human sciences disciplines at home and abroad
- Identify and explain how issues of ethics, diversity, and social responsibility influence global human sciences

Required Core Courses (6 credits)

HHSCI 3010	Introduction to Global Human Sciences	1
HHSCI 3020	Global Human Sciences Capstone	2
AESHM 4210	Developing Global Leadership: Maximizing Human Potential	3

Additional Courses (9-11 credits)

All students except International Student Teaching participants: Select 9 credits from the list below.

CHS students only: Select at least 3 credits from the list below that are outside the home department or school.

International Student Teaching participants only: select 8 credits from EDUC 4160D, EDUC 4160E, or EDUC 4170N, and 3 credits from the list below outside the School of Education for a total of 11 credits.

FDM 3540	Fashion History I: Prehistoric to Mid-19th Century	3
FDM 3620	Cultural Perspectives of Global Dress	3
FDM 3720	Sourcing and Global Issues	3
AESHM 2810	Orientation to International Field Study	1
AESHM 3810D	International Field Study: Hospitality Management	1-3
AESHM 3810F	International Field Study: Event Management	1-3
AESHM 3810N	International Field Study: Apparel, Merchandising, and Design	1-3
ATR 5490A	Athletic Training Clinical Education Study Abroad: Preparing for the Experience	1
ATR 5490B	Athletic Training Clinical Education Study Abroad	2
DANCE 2110	Fundamentals and Methods of Social and World Dance	1
DANCE 2700	Dance Appreciation	3
DANCE 3850	Methods of Teaching Dance	2
EDUC 2750	International Travel Study - Pre-departure Orientation	1
EDUC 4160D	Supervised Student Teaching - Elementary: International Student Teaching - Primary Grades	8
EDUC 4160E	Supervised Student Teaching - Elementary: International Student Teaching - Intermediate Grades	8
EDUC 4170N	Student Teaching: International	8
EDUC 4750	International Travel Study in Education	1-6
EVENT 4230	International Sports and Entertainment Event Management	3
FSHN 3420	World Food Issues: Past and Present	3
FSHN 4420	Food, Culture, and Sustainability	3
FSHN 4600	Global Nutrition, Health and Sustainability	3
FSHN 4900D	Independent Study: International Experience	1-6

FSHN 4960A	Food Science and Human Nutrition Travel Course: International travel	1-4
HDFS 4790	Families Through a Social and Cultural Lens	3
HDFS 5750	Cross-cultural Perspectives about Families and Children	3
HSPM 2600	Global Tourism Management	3
HSPM 4870	Fine Dining Management	3
KIN 3810A	Study Abroad Experience in Kinesiology: Preparing for the Experience	1
KIN 3810B	Study Abroad Experience In Kinesiology	2
NRS 4900C	Independent Study: International Experience	1-2
Internship or work experience course		1-6
Courses completed at an international institution as part of a study abroad experience from the following options *		1-6
Accademia Italiana		
Australia: Semester at University of Deakin		
Australia: Semester at University of Newcastle		
Fu Jen Catholic University Exchange		
Glasgow Caledonian University Exchange		
London College of Fashion		
Lorenzo de' Medici Institute		
New Zealand: Semester at University of Otago		
Paris American Academy		

* Coursework must be in a human sciences discipline.

Students may request a review of coursework to be completed as part of a study abroad experience at other international institutions that would meet this requirement.

Health Coach Certificate

Health Coach - Certificate

The undergraduate health coach certificate provides a rigorous academic and theoretical background in three components of health (nutrition, exercise and motivational coaching) required to prepare workers for the challenges of being a health coach. The certificate provides additional credentials for students already pursuing a bachelor's degree in food science and human nutrition, kinesiology, or psychology. Students would be able to sit for the American Council on Exercise exam should they choose to do so.

Any Iowa State University student may apply for the undergraduate health coach certificate. Students should contact their academic advisor to add the Health Coaching Certificate.

The Health Coach certificate requires 23 credits:

Note: Pre-requisites apply for all courses required in the health coach certificate.

FSHN 2650	Metabolism, Nutrition and Health	3
FSHN 3640	Nutrition and Prevention of Chronic Disease	3
or FSHN 3650	Obesity and Health	
FSHN 3610	Nutrition and Health Assessment	2
KIN 4580	Principles of Fitness Assessment and Exercise Prescription	4
KIN 4670	Exercise and Health: Behavior Change	3
PSYCH 4220	Counseling Theories and Techniques	3
PSYCH 4850	Health Psychology	3
KIN 4940A	Practicum in Motivational Interviewing for Health: Principles of Motivational Interviewing	2
or KIN 4940B	Practicum in Motivational Interviewing for Health: Supervised Experience	

Total Credits **23**

Hospitality Management

Administered by the Department of Apparel, Events, and Hospitality Management

The Hospitality Management program offers study for the degree of Bachelor of Science with a major in hospitality management. As the only 4-year hospitality program in the state of Iowa, the program prepares undergraduate students with essential principles of managing a variety of hospitality organizations, such as hotels, restaurants, clubs, and foodservice companies. Students also develop expertise in managing diverse areas, such as: (a) food/beverage management, (b) lodging management, (c) senior living management, and (d) tourism and attractions.

Students get hands-on experience at the Joan Bice Underwood Tearoom and SPARKS. The Joan Bice Underwood Tearoom is a 105-seat learning laboratory where students take responsibility for meal preparation and service. The Joan Bice Underwood Tearoom is the earliest established student run restaurant that is still in operation on a college campus in the United States. SPARKS is the student operated café in the Student Innovation Center, where students have the opportunity to manage all the operations of the facility from menu development, inventory, human resources, and much more.

Our students participate in internships locally, nationally, and internationally with a range of hotels, restaurants, caterers, theme parks, sports facilities, cruise ships convention and visitors' bureaus, independent businesses, and country clubs. Courses provide students with opportunities to develop and apply management techniques in hospitality organizations. The Hospitality Management curriculum

provides students with the opportunity to obtain professional certifications in multiple areas.

The Hospitality Management program mission is to create, share, and apply knowledge to provide hospitality consumers with products, services, and experiences to enhance overall well-being. We accomplish our mission with a personalized, nationally ranked program. Our students learn in a nurturing, safe, and inclusive environment, with caring faculty with industry experience.

Student Learning Outcomes

Upon graduation, students should be able to:

1. Identify and apply the knowledge and skills necessary for hospitality and tourism operations
2. Develop and integrate a core set of business skills necessary to successfully operate a hospitality and tourism organization
3. Demonstrate competence in the communication skills necessary for hospitality and tourism management
4. Formulate business decisions in hospitality and tourism management
5. Evaluate leadership principles necessary in the diverse and global hospitality and tourism industry

UNDERGRADUATE STUDY

The program offers a Bachelor of Science degree in hospitality management. Coursework is planned to provide students with a general education plus professional preparation for supervisory and executive positions in hospitality organizations such as clubs, hotels, dining, theme parks, cruise lines, and casinos. Principles of business management are presented, as well as fundamentals of hospitality operations.

Graduates demonstrate leadership characteristics and make decisions based on integrating knowledge of financial, human resources, marketing, and operational principles for managing hospitality operations. They demonstrate best practices in meeting customer expectations and use of technology (e.g., Point-of-Sales systems, property management systems, and revenue management systems) to achieve operational efficiency and effectiveness.

Learning experiences are provided in the food and beverage, casino, lodging, senior living, and tourism industries and other approved establishments. Students are required to have a total of at least 800 hours of relevant work experience prior to graduation. Of the 800 hours, 200 hours are required prior to completing one year in the program.

The Bachelor of Science Degree

Total credits required: 123, including a minimum of 18 credits from the AESHM Department at Iowa State University for the degree.

The program offers a **concurrent B.S. and M.S. degree** that allows students to obtain a B.S. and M.S. degree in hospitality management in *five* years. Application for admission to the Graduate College should be made in the junior year.

Minor in Hospitality Management

The Hospitality Management minor (HSPM) requires the completion of at least 15 credits from the Hospitality Management curriculum. The minor must include at least 6 credits in courses numbered 3000 or above taken at ISU. All course pre-requisites must be completed prior to taking the course. All minor courses must be taken for a grade.

Minor in Beverage Management

The Beverage Management minor (BVM) requires the completion of at least 15 credits from the Beverage Management minor curriculum. The minor must include at least 6 credits in HSPM courses and 6 credits in courses numbered 3000 or above taken at ISU. All course pre-requisites must be completed prior to taking the course. All minor courses must be taken for a grade.

Curriculum in Hospitality Management

Administered by the Apparel, Events, and Hospitality Management Department. Leading to the Bachelor of Science degree.

The curriculum in Hospitality Management develops students as leaders for the hospitality professions.

A minor in Hospitality Management is available; see requirements under Hospitality Management, Courses and Programs.

Students majoring in Hospitality Management are required to earn C- or better in all AESHM and HSPM courses. Communication Proficiency Requirement: Grade of C or better in ENGL 1500 Critical Thinking and Communication, and ENGL 2500 Written, Oral, Visual, and Electronic Composition.

Degree Requirements

(10) Communications and Library

ENGL 1500	Critical Thinking and Communication (Grade of C or better required in ENGL 1500)	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition (Grade of C or better required in ENGL 2500)	3
LIB 1600	Introduction to College Level Research	1
Select one (1) COMMUNICATION course:		3
COMST 2110	Interpersonal Communication	
COMST 2140	Professional Communication	
SPCM 2120	Fundamentals of Public Speaking	

Total Credits **10**

(9-10) Natural Sciences and Mathematical Disciplines

Select one (1) MATH course: 3

MATH 1040	Introduction to Probability	
MATH 1050	Introduction to Mathematical Ideas	
MATH 1400	College Algebra	
MATH 1430	Preparation for Calculus	
MATH 1500	Discrete Mathematics for Business and Social Sciences	
MATH 1600	Survey of Calculus	

FSHN 1010 Food and the Consumer 3

Select one (1) STATISTICS course: 3-4

STAT 1010	Principles of Statistics	
STAT 1040	Introduction to Statistics	
STAT 2260	Introduction to Business Statistics I	

Total Credits 9-10**(9) Social Sciences**

ECON 1010 Principles of Microeconomics 3

Select two (2) courses: 6

HDFS 1020	Human Development	
PSYCH 1010	Introduction to Psychology	
SOC 1340	Introduction to Sociology	

Total Credits 9**(6) Humanities**

AESHM 3420 Aesthetics of Consumer Experience 3

Select one (1) course: 3

Dept of AFAM, AMIN, ANTR, ARTH, CLST, ENGL, HIST, LING, PHIL, RELIG, MUSIC, DANCE, WGS, WLS, DSNS 1830, or INTST 2350

Total Credits 6**(13-14) GENERAL Electives****(16) Other Professional Courses**

AESHM 1110 Professional Development for AESHM 1

AESHM 1110L AESHM Program Orientation and Learning Community 1

AESHM 2110 Leadership Experiences and Development (LEAD) 3

AESHM 3110E Seminar on Careers and Internships: Event Management and Hospitality Management 1

ACCT 2840 Financial Accounting 3

EVENT 1710 Introduction to Event Management 3

FSHN 1150 Food Preparation Laboratory 1

HSPM 4700 Supervised Professional Internship 3

*Requires 400 hours of documented work experience

Total Credits 16**(37) Hospitality Management Professional Core**

AESHM 2380 Human Resource Management 3

AESHM 2870 Principles of Management in Human Sciences 3

AESHM 3400 Hospitality and Apparel Marketing Strategies 3

HSPM 1010 Introduction to the Hospitality Industry 3

HSPM 1330 Food Safety Certification 1

HSPM 2300 Introduction to Hospitality Performance Analysis 3

HSPM 3150 Hospitality Law 3

HSPM 3330 Hospitality Operations Cost Controls 3

HSPM 3520 Lodging Operations Management I 3

HSPM 3800 Food Production Management 3

HSPM 3800L Food Production Management Experience 3

HSPM 4330 Hospitality Financial Management 3

HSPM 4550 Strategic Management in Hospitality 3

Total Credits 37**(22) Hospitality Management electives**

Select from: 22

AESHM 1800E First Year Student Field Study: Hospitality and Event Management

AESHM 2810 Orientation to International Field Study

AESHM 3800D U.S. Field Study: Hospitality Management

AESHM 3810D International Field Study: Hospitality Management

AESHM 4210 Developing Global Leadership: Maximizing Human Potential

AESHM 4740 Entrepreneurship in Human Sciences

AESHM 4790 Data Analytics for Apparel, Events, and Hospitality Management

FDM 3750 Omni-Channel Retailing

HSPM 2010 Casino Management I

HSPM 2600 Global Tourism Management

HSPM 2800 Non-Alcoholic Beverages and Cafe Operations

HSPM 2890 Contemporary Club Management

HSPM 3010 Hospitality Revenue Management

HSPM 3200 Attractions and Amusement Park Administration

HSPM 3830 Wine and Spirits in Hospitality Management

HSPM 3830L Wine, Spirits, and Mixology Laboratory in Hospitality Management

HSPM 3850 Beer and Brewed Beverages in Hospitality Management

HSPM 4200 Fairs, Festivals, and Events Management

HSPM 4370 Hospitality Technology Applications

HSPM 4520 Lodging Operations Management II

HSPM 4870 Fine Dining Management

EVENT 2120	Digital Production in Event Management
EVENT 2770	Digital Promotion in the Service Industry
EVENT 2780	Sustainability Essentials for Service-Related Businesses
EVENT 3670	Event Sales
EVENT 3280	Incentive Meeting Management
EVENT 3330	Entertainment Venue Management
EVENT 4710	Event Production
EVENT 3730	Wedding Planning and Management
EVENT 3790	Nonprofit Fundraising Event Planning
Mgmt.	
EVENT 4820	Sport Event Marketing
EVENT 3830	Sports Event Management
EVENT 3930	Event Management Workshop
EVENT 3710	Conference and Meeting Planning
EVENT 4230	International Sports and Entertainment Event Management
EVENT 4850	Advanced Event Production: Special Event
EVENT 4860	Advanced Event Production
Conference	
Total Credits	

22

- * A student who has not had high school chemistry is required to take CHEM 1600 Chemistry in Modern Society
- * Grade of C or better required in ENGL 1500 Critical Thinking and Communication and ENGL 2500 Written, Oral, Visual, and Electronic Composition
- * Grade of C– or better required in all AESHM and HSP M courses.
- * BIOL 1010 Introductory Biology required if student has not completed high school biology.
- * CHEM 1600 Chemistry in Modern Society required if student has not completed high school chemistry.
- * AESHM 1750D Financial Applications for Retail and Hospitality Industries: Hospitality Management required if C+ or lower in MATH credits

123.0 Total credits

Hospitality Management, B.S.

Freshman

Fall	Credits	Spring	Credits
ENGL 1500		3 HSPM 1330	1
LIB 1600		1 HSPM Elective	3
AESHM 1110		1 ENGL 2500	3

AESHM 1110L	1 ECON 1010	3
HSPM 1010	3 EVENT 1710	3
FSHN 1010	3 Social Science (HDFS 1020, PSYCH 1010 or SIC 1340)	3
Social science (HDFS 1020, PSYCH 1010, or SOC 1340)	3	

15

16

Sophomore

Fall	Credits	Spring	Credits
AESHM 2110		3 MATH (Math 1040, 1400, 1500, OR 1600)	3
FSHN 1150		1 Speech or Comm. (COMST 2210, 2140, or SPCM 2120)	3
ACCT 2840		3 Humanities Course	3
AESHM 2870		3 HSPM 2300 ^{Spring}	3
AESHM 3400		3 HSPM Elective	3
General Elective	3		

16

15

Junior

Fall	Credits	Spring	Credits	Summer	Credits
HSPM 3330 ^{Fall}		3 AESHM 3420		3 HSPM 4700	3
HSPM 3520 ^{Fall}		3 HSPM 3150			3
HSPM 3800		3 Statistics (STAT 1010 or 1040)		3-4	

HSPM 3800L	3 International Perspective Course	3
HSPM Elective	3 HSPM Elective	3
AESHM 3110E or 3110N	1	
16		15-16 3

Senior

Fall	Credits	Spring	Credits
AESHM 2380	3	HSPM 4330 ^{Spring}	3
General Electives	3	HSPM 4550 ^{Spring}	3
HSPM Electives	4	General Elective Course	2
US Cultures & Communities Course	3	HSPM Electives Course	6
13		14	

Total Credits: 123-124

*Grade of C or better required in ENGL 1500 and ENGL 2500

*Grade of C- or better required in all AESHM and HSPM courses

Note: This sequence is only an example. The number of credits taken each semester should be based on the individual student’s situation. Factors that may affect credit hours per semester include student ability, employment, health, activities, and grade point considerations. Updated September 2024.

Hospitality Management Minor

A minor in Hospitality Management can be earned by successfully completing the following for a total of 15 credits. The minor must include at least nine (9) credits in courses numbered 2000 or above, of which at least six (6) credits are in courses numbered 3000 or above. All course prerequisites must be completed prior to taking the course. All minor courses must be taken for a grade. The Hospitality Management Minor requires students to complete HSPM 1010 and HSPM 1330. The remaining 11 credits may be selected from any HSPM designated course, as well as AESHM 2380, AESHM 2870, AESHM 3400, and AESHM 4740.

The Hospitality Management Minor requires students to complete the following courses:

HSPM 1010	Introduction to the Hospitality Industry	3
HSPM 1330	Food Safety Certification	1
Total Credits		4

The remaining eleven (11) credits may be selected from the following:

AESHM 2380	Human Resource Management
AESHM 2870	Principles of Management in Human Sciences
AESHM 3400	Hospitality and Apparel Marketing Strategies
AESHM 4740	Entrepreneurship in Human Sciences
HSPM 2010	Casino Management I
HSPM 2250	Introduction to Food Service Operations
HSPM 2300	Introduction to Hospitality Performance Analysis
HSPM 2330	Hospitality Sanitation and Safety
HSPM 2480	Introduction to Senior Living Management
HSPM 2600	Global Tourism Management
HSPM 2800	Non-Alcoholic Beverages and Cafe Operations
HSPM 2890	Contemporary Club Management
HSPM 3010	Hospitality Revenue Management
HSPM 3150	Hospitality Law
HSPM 3200	Attractions and Amusement Park Administration
HSPM 3520	Lodging Operations Management I
HSPM 3580	Economics for Senior Living Management
HSPM 3830	Wine and Spirits in Hospitality Management
HSPM 3830L	Wine, Spirits, and Mixology Laboratory in Hospitality Management
HSPM 3850	Beer and Brewed Beverages in Hospitality Management
HSPM 4200	Fairs, Festivals, and Events Management
HSPM 4330	Hospitality Financial Management
HSPM 4370	Hospitality Technology Applications
HSPM 4520	Lodging Operations Management II
HSPM 4550	Strategic Management in Hospitality

Beverage Management Minor

The AESHM Department offers a minor in Beverage Management through the Hospitality Management program. The minor can be earned by successfully completing the following for a total of 15 credits. The minor must include at least six (6) credits in HSPM courses. The minor must include nine (9) credits in courses numbered 2000 or above, of which at least six (6) credits are in courses numbered 3000 or above. All course prerequisites must be completed prior to taking the course. All minor courses must be taken for a grade. The Beverage Management Minor requires students to complete HSPM 1010 and HSP M 1330. The remaining 11 credits may be selected from any of the courses below.

The Beverage Management Minor requires students to complete the following courses:

HSPM 1010	Introduction to the Hospitality Industry	3
HSPM 1330	Food Safety Certification	1
Total Credits		4

The remaining eleven (11) credits may be selected from the following:

BBMB 1200	The Biochemistry of Beer
BBMB 1200L	Biochemistry of Beer Laboratory
FSHN 5090	Sensory Evaluation of Wines
FSHN 3730	Science and Practice of Brewing
FSHN 2760	Grape and Wine Science
HSPM 2800	Non-Alcoholic Beverages and Cafe Operations
HSPM 3830	Wine and Spirits in Hospitality Management
HSPM 3830L	Wine, Spirits, and Mixology Laboratory in Hospitality Management
HSPM 3850	Beer and Brewed Beverages in Hospitality Management
HSPM 4870	Fine Dining Management
HSPM 3150	Hospitality Law
HSPM 4200	Fairs, Festivals, and Events Management

Graduate Study

The Hospitality Management program offers work for the Master of Science and Doctor of Philosophy degrees in hospitality management. Graduates of the program are able to interpret trends and adapt operating practices of hospitality organizations to changing economic, social, political, technological, and environmental conditions. The master's degree program is designed to prepare individuals for managerial and leadership positions in industry, business, and non-profit organization; teaching careers; and continued graduate study.

The doctoral program is designed to prepare individuals to teach in programs at the university level; provide leadership in non-profit organizations; and/or conduct advanced research at the corporate level or with research firms.

A degree in hospitality management is the usual background for graduate study; however, applicants with preparation in dietetics, business, or closely related fields are encouraged to apply. Ph.D. applicants must have two (2) years of professional work experience in the field.

The Master of Science degree requires either a thesis or non-thesis (creative component) project. Students also are required to take three core courses out of the four offered in the core areas (human resources, financial management, marketing, and strategic management).

The Ph.D. program requires a minimum of 72 credits, up to 30 of which may be applied from the master's degree. All Ph.D. students take a minimum of 15 research/dissertation credits.

Human Development and Family Studies

Administered by the Department of Human Development and Family Studies. Leading to the degree of Bachelor of Science.

Total credits required: 120. The human development and family studies curriculum prepare graduates to pursue careers in helping professions with employment opportunities in government, non-profit, and private agencies, as well as continue on to graduate studies programs.

Student Learning Outcomes

The following set of learning goals was established for the bachelor's degree in Human Development and Family Studies (HDFS). Upon completion of the undergraduate degree in HDFS, students will:

Learning Objective 1: Lifespan Developmental Understanding: Students will demonstrate a comprehensive understanding of human development and families across the lifespan.

Learning Objective 2: Applied Research and Practice: Students will learn to apply research findings in their work with individuals and families, enhancing their ability to understand and address real-world challenges in the field.

Learning Objective 3: Promotion of Well-Being and Resilience: Students will learn strategies to promote and support well-being and resilience in diverse contexts, such as mental health, relationships, and personal development.

Learning Objective 4: Professionalism, Ethics, and Cultural Responsiveness: Students will develop skills for successful professional practice, ethical decision-making, and cultural responsiveness in the field.

A minor in human development and family studies is available; see requirements under Human Development and Family Studies, Undergraduate Minor.

Human Development and Family studies

Human Development and Family Studies Core: 33-34 credits

HDFS 1020	Human Development	3
HDFS 1100	Freshman Learning Community Orientation	1
or HDFS 1110	New Transfer Student Seminar	
HDFS 2200	Introduction to Professional Practice	3
Select one Individual Development course from:		3
HDFS 2240	Child Development	

HDFS 2270	Middle Childhood and Adolescence	
HDFS 2340	Young Adulthood Through Later Life	
HDFS 2490	Family Studies	3
HDFS 3690	Research Methods in Human Development and Family Studies	3
HDFS 3860	Human Services Management I	3
HDFS 3870	Trauma-Informed Practice	3
HDFS 4200	Advanced Professional Practice	3
HDFS 4910	Internship	8-9
Total Credits		33-34

Supporting Courses in HDFS

Select 27 credits from: 27

HDFS 2390	Consumer Issues
HDFS 2240L	Child Development Practicum
HDFS 2400	Children's Literature
HDFS 2700	Family Communications and Relationships
HDFS 2760	Human Sexuality
HDFS 2830	Personal Finance
HDFS 3170B	Field Experiences: Human Development and Family Studies
HDFS 3210	Happiness Across the Lifespan
HDFS 3410	Income Tax Planning
HDFS 3420	Social-Emotional Development and Guidance
HDFS 3440	Programming for Children in Early Care and Education
HDFS 3450	Inclusive Teaching and Interaction Strategies
HDFS 3670	Family Stress, Abuse, and Resilience
HDFS 3730	Death as a Part of Living
HDFS 3770	Aging and the Family
HDFS 3780	Retirement Planning and Employee Benefits
HDFS 3950	Children, Families, and Public Policy
HDFS 4560	Family Partnerships in Early Childhood
HDFS 4790	Families Through a Social and Cultural Lens
HDFS 4860	Human Services Management II
HDFS 4900I	Independent Study: Human Development and Family Studies

Additional courses not used in the "Individual Development" section can also be used as Supporting Courses.

Total Credits 27

Communications and Library: 10 credits

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3

LIB 1600	Introduction to College Level Research	1
One of the following:		3
COMST 2100	Communication and U.S. Diversity	
COMST 2110	Interpersonal Communication	
COMST 2180	Communication and Conflict Management	
HDFS 2700	Family Communications and Relationships	
SPCM 2120	Fundamentals of Public Speaking	
Total Credits		10

Natural Sciences and Mathematical Disciplines: 9 credits

STAT 1040	Introduction to Statistics	3
Select two courses (6 credits) from the HDFS approved list of Science and Math courses		6
Total Credits		9

Social Sciences: 9 credits

Select from HDFS list of approved social sciences courses.

Humanities: 6 credits

Select one course from:		3
PHIL 2300	Moral Theory and Practice	
PHIL 2350	Ethical Issues in a Diverse Society	
Select one additional course (3 credits) from the HDFS approved Humanities list		3
Total Credits		6

Electives: 26 credits

Elective course options may include additional HDFS courses.

Total credits: 120 credits

U.S. Cultures and Communities Requirement: Students fulfill the U.S. Cultures and Communities Requirement by choosing three credits of coursework from each of the university-approved lists.

THE COURSES LISTED IN THIS SECTION ARE APPROVED GENERAL EDUCATION COURSE OPTIONS FOR THIS MAJOR.

Social Sciences: 9 credits. Coursework designed to help students develop an understanding of the principal methods of studying human behavior and an understanding of the structure and functioning of institutions.

AESHM 4210	Developing Global Leadership: Maximizing Human Potential	3
AFAM 3300	Ethnic and Race Relations	3
FDM 1650	Fashion, Appearance, and Diversity in U.S. Society	3
FDM 3620	Cultural Perspectives of Global Dress	3

FDM 4670	Consumer Studies in Apparel and Fashion Products	3
AMIN 3100	Contemporary Topics in American Indian Studies	3
AMIN 3150	Archaeology of North America	3
AMIN 3220	Peoples and Cultures of Native North America	3
Anthropology (ANTHR) - except 2020		
Economics (ECON)		
FSHN 3420	World Food Issues: Past and Present	3
INTST 2350	Introduction to International Studies	3
LING 2190	Introduction to Linguistics	3
LING 4710	Language and Reading Development in Children	3
Political Science (POLS)		
Psychology (PSYCH) - except 131		
Sociology (SOC), including Criminal Justice (CJ)		
WGS 2010	Introduction to Women's and Gender Studies	3
WGS 2030	Introduction to Lesbian Communities	3
WGS 3010	International Perspectives on Women and Gender	3
ENVS 3200	Ecofeminism	3
WGS 3270	Gender and Sexualities in Society	3
WGS 3280	Sociology of Masculinities and Manhood	3
WGS 3460	Psychology of Women	3
AFAM 3500	Women of Color in the U.S	3
WGS 3850	Women in Politics	3

Humanities: 6 credits. Coursework designed to assist students to develop an understanding of human cultural heritage and history, and an appreciation of reasoning and the aesthetic value of human creativity.

AESHM 3420	Aesthetics of Consumer Experience	3
AFAM 2010	Introduction to African American Studies	3
AFAM 3340	Africana Religions	3
AFAM 3470	African American Literature	3
AFAM 3530	History of African Americans I	3
AFAM 3540	History of African Americans II	3
FDM 3540	Fashion History I: Prehistoric to Mid-19th Century	3
FDM 3560	Fashion History II: Mid-19th Century to the Present	3
AMIN 2100	Introduction to American Indian Studies	3
AMIN 2400	Introduction to American Indian Literature	3
AMIN 3460	American Indian Literature	3
ARCH 2210	Histories and Theories of Architecture to 1750	3
ARCH 4200	Topics in American Architecture	3

Art History (ARTH)

American Sign Language (ASL)

Classical Studies (CLST)

DANCE 2700	Dance Appreciation	3
DANCE 3600	History and Philosophy of Dance	3
DSNS 1830	Design in Context	3
ENGL 2010	Introduction to Literature	3
ENGL 2250	Survey of British Literature to 1800	3
ENGL 2260	Survey of British Literature since 1800	3
ENGL 2270	Survey of American Literature to 1865	3
ENGL 2280	Survey of American Literature since 1865	3
ENGL 2370	Survey of Film History	3
ENGL 2400	Introduction to American Indian Literature	3
History (HIST)		
HSPM 2600	Global Tourism Management	3
MUSIC 1020	Introduction to Music Listening	3
MUSIC 3020	Masterpieces of Music and Art in Western Culture	3
MUSIC 3040	History of American Rock 'n' Roll	3
MUSIC 3830	History of Music I	3
MUSIC 3840	History of Music II	3
Philosophy (PHIL)		
Religious Studies (RELIG)		
THTRE 1060	Introduction to the Performing Arts	3
THTRE 1100	Theatre and Society	3
THTRE 4650	Theatre History: Ancient to 19th Century	3
THTRE 4660	Theatre History: 19th Century to Present	3
WGS 2010	Introduction to Women's and Gender Studies	3
WGS 3360	Religion, Sex and Gender	3
WGS 3380	Feminist Philosophy	3
WGS 3450	Women's Literature	3
WGS 3700F	Studies in English Translation: French Topics on Women and Gender Studies	3
or WGS 3700G	Studies in English Translation: German Topics on Women or Feminism	
or WGS 3700R	Studies in English Translation: Russian Topics on Women or Feminism	
or WGS 3700S	Studies in English Translation: Hispanic Topics on Women or Feminism	
WGS 3740	Sex, Gender, and Culture in the Ancient Mediterranean World	3
World Languages and Cultures (ARABC, CHIN, FRNCH, GER, GREEK, RUS, SPAN)		

Human Development and Family Studies, B.S.

Freshman

Fall	Credits Spring	Credits
HDFS 1020	3 HDFS 2490	3
HDFS 1100 or 1110	1 HDFS Individual Development Course	3
LIB 1600	1 Gen Ed: Science Course	3
ENGL 1500	3 Gen Ed: Social Sciences Course	3
Gen Ed: Social Sciences Course	3 Elective Course	3
Gen Ed: Humanities Course	3	
	14	15

Sophomore

Fall	Credits Spring	Credits
HDFS 2200	3 Gen Ed: Communications Course	3
ENGL 2500	3 Gen Ed: Science Course	3
STAT 1040	3 PHIL 2300 or PHIL 2350	3
Gen Ed: Social Science Course	3 HDFS Supporting Courses	6
HDFS Supporting Course	3	
	15	15

Junior

Fall	Credits Spring	Credits
HDFS 3690	3 HDFS Supporting Courses	6
HDFS 3860	3 Electives	9
HDFS Supporting Courses	6	
Electives	4	
	16	15

Senior

Fall	Credits Spring	Credits
HDFS 3870	3 HDFS 4910	8
HDFS 4200	3 Electives	6
HDFS Supporting Courses	6	
Electives	4	
	16	14

* This sequence is only an example. The number of credits taken each semester should be based on the individual student's situation.

Student ability, employment, health, activities, and grade point considerations affect credit hours per semester.

* Study Abroad opportunities are available in fall, spring, and summer.

Advance planning is critical to avoid adding an additional semester to the graduation plan. Be sure to talk to an adviser if you plan to study abroad.

The **Human Development and Family Studies** minor can be earned by successfully completing the following for a total of 18 credits. All minors consist of at least 3 credits taken at Iowa State. All minors must have 9 credits in courses 2000 or above, of which at least 6 credits are in courses numbered 3000 or above. The minor must include at least 3 credits not being used to meet any other department, college, or university requirement.

HDFS 1020	Human Development	3
HDFS 2490	Family Studies	3
Four of the following:		12
HDFS 2240	Child Development	
HDFS 2270	Middle Childhood and Adolescence	
HDFS 2340	Young Adulthood Through Later Life	
HDFS 2700	Family Communications and Relationships	
HDFS 2760	Human Sexuality	
HDFS 3170B	Field Experiences: Human Development and Family Studies	
HDFS 3210	Happiness Across the Lifespan	
HDFS 3670	Family Stress, Abuse, and Resilience	
HDFS 3690	Research Methods in Human Development and Family Studies	
HDFS 3730	Death as a Part of Living	
HDFS 3770	Aging and the Family	
HDFS 3860	Human Services Management I	
HDFS 3870	Trauma-Informed Practice	
HDFS 3950	Children, Families, and Public Policy	
HDFS 4790	Families Through a Social and Cultural Lens	
HDFS 4860	Human Services Management II	
HDFS 4900	Independent Study	

Total Credits **18**

* Total number of electives will vary. A minimum of 120 credits are required to graduate.

* See the list of HDFS General Education approved courses.

* ISU requires 3 credits of U.S. Cultures & Communications coursework and 3 credits of International Perspectives coursework.

GRADUATE PROGRAMS

More information on the variety of graduate programs offered through the Department of Human Development and Family Studies can be found here: <https://hdfs.hs.iastate.edu/graduate-students/graduate-programs/>.

Human Development and Family Studies Department

The Department of Human Development and Family Studies offers courses that focus on the interactions among individuals, families, their resources, and their environments throughout the life span. The department offers work for the Bachelor of Science degree in five curricula: Early Childhood Education, Family and Consumer Sciences Education and Studies, Financial Counseling and Planning, Human Development and Family Studies, and an affiliated program: Early Childcare Education and Programming (a distance education program offered in collaboration with six other universities).

Students graduating in Human Development and Family Studies will

1. Communicate with clear purpose, workable organization and effective style in written, oral, visual and electronic (WOVE) formats to foster collaboration, provide information and advance knowledge related to child, adult, family, and community services.
2. Consistently and realistically analyze and evaluate one's own knowledge, abilities and actions in comparison to professional standards and create action plans to enhance personal and professional efficacy related to working with children, adults, families and communities.
3. Understand content related to working with children, adults, families, and communities within a chosen program. Use critical thinking skills to evaluate and utilize evidence-based practices. Use logical and ethical reasoning to make decisions and solve problems.
4. Understand the diverse needs of children, adults, and families. Ensure equitable access of children, adults, and families to appropriate environments that support healthy living. Engage children, adults, and families with socially responsible and respectful behavior.

Communication Proficiency requirement: A student must achieve a grade of C or higher in ENGL 1500, Critical Thinking and Communication, and ENGL 2500, Written, Oral, Visual, and Electronic Composition. A student achieving a grade of C– or lower in 1500 and/or 2500 must either repeat the course(s), earning a minimum grade of C, or, in consultation with the advisor and the coordinator of freshman English, complete another appropriate English writing course with a minimum grade of C.

The **Human Development and Family Studies** curriculum leads to work in helping professions with employment opportunities in public and private agencies. Graduates of the program are prepared for employment in agencies and organizations serving children, youth, families, and adults in the areas of education/prevention, treatment, and administration. This flexible program provides a broad emphasis in theory, research, and application in child, adult and family services including attention to community issues and public policy.

Students in Human Development and Family Studies may choose coursework that leads to becoming a Certified Family Life Educator (CFLE), a program that has been approved by the National Council on Family Relations. These courses provide the basic education for students interested in working with families, including adolescents, parents, or adults working to strengthen relationships. The student takes courses that support the development of knowledge and skills in family life content areas selected by the National Council on Family Relations. The certification is a voluntary credential that requires the individual to complete a degree in an approved program and to have at least two years of work experience in family life education settings. Iowa State University does not grant the Certified Family Life Educator credential. The certification is granted only by the National Council on Family Relations. See <https://hdfs.hs.iastate.edu/future-students/find-your-major/certified-family-life-educator/> and/or <http://www.ncfr.org/cfle-certification>.

The curriculum in **Early Childhood Education – Unified** prepares graduates to teach young children and work with their families. This curriculum has been approved by the Iowa Department of Education and meets requirements for candidates to seek teacher licensure in early childhood education – unified, which permits individuals to teach general and special education for children from birth through third grade. Graduates may be employed by either public or private agencies or schools to teach in early childhood classrooms (preschool through third grade) or in home-based programs. The program is an interdepartmental major administered by the Department of Human Development and Family Studies and the School of Education. For more information about the program, see <https://hdfs.hs.iastate.edu/find-your-major/early-childhood-education/>.

Students who enroll in the early childhood education – unified program must apply to and be accepted into the teacher education program prior to enrolling in advanced courses.

Family and Consumer Sciences Education and Studies offers a curriculum for the Bachelor of Science degree. (<http://catalog.iastate.edu/collegeofhumansciences/familyandconsumerscienceseducationandstudies>)

The curriculum in Family and Consumer Sciences Education and Studies (FCEDS) prepares graduates with a broad understanding of individual and family well-being. Graduates apply knowledge and research in family and consumer sciences content in global professional settings. They work in an integrative fashion to improve well-being by addressing and acting on complex problems confronting individuals, families, and communities. The study of Family and Consumer Sciences Education incorporates the following 16 content areas (https://opi.mt.gov/Portals/182/Page%20Files/Career%20%26%20Technical%20Education/Docs/FCS/15FCS_NationalStandards.pdf): Career, Community and

Family Connections; Consumer and Family Resources; Consumer Services; Education and Early Childhood; Facilities Management and Maintenance; Family; Family and Community Services; Food Production and Services; Food Science, Dietetics, and Nutrition; Hospitality, Tourism and Recreation; Housing and Interior Design; Human Development; Interpersonal Relationship; Nutrition and Wellness; Parenting; and Textiles, Fashion and Apparel.

Students in the program choose one of three options, Teacher Licensure, Communications, or Professional Studies.

Students in Family and Consumer Sciences Education and Studies may choose coursework that leads to becoming a Certified Family Life Educator (CFLE), a program that has been approved by the National Council on Family Relations. These courses provide the basic education for students interested in working with families, including adolescents, parents, or adults working to strengthen relationships. The student takes courses that support the development of knowledge and skills in family life content areas selected by the National Council on Family Relations. The certification is a voluntary credential that requires the individual to complete a degree in an approved program and to have at least two years of work experience in family life education settings. Iowa State University does not grant the Certified Family Life Educator credential. The certification is granted only by the National Council on Family Relations. See <https://hdfs.hs.iastate.edu/future-students/find-your-major/certified-family-life-educator/> and/or <http://www.ncfr.org/cfle-certification/>.

Graduates may also choose from one of several nationally recognized professional certifications available from the American Association of Family and Consumer Sciences (AAFCS) Council for Certification. This program measures competencies of FCS professionals using high-quality, rigorous assessments. Certifications that are currently available are (<http://www.aafcs.org/home> (<https://www.aafcs.org/home/>)): CFCS: Certified in Family and Consumer Sciences; CFCS-HDFS: Certified in Human Development and Family Studies; CFCS-HNFS: Certified in Hospitality, Nutrition, and Food Science; and CPFFE: Certified Personal and Family Finance Educator.

There is also an opportunity to take courses that will allow you to be recommended for a family and consumer sciences endorsement or teacher licensure as a post baccalaureate student.

The **Financial Counseling and Planning (FCP)** curriculum prepares students for careers in family financial services. Financial Counseling and Planning is a growing career field and appeals to students who want to work with individuals and families to help them meet their financial goals and improve their financial capability to better meet financial challenges. Coursework provides students with the family resource management and interpersonal skills needed to help families remain financially secure. Based on career goals, students select a path that leads to fulfilling the

education requirements for the leading designations and certifications in financial counseling and planning. Graduates of the program are prepared for employment in personal banking, financial services, insurance, financial counseling and planning, and human service organizations. Laboratory and practicum opportunities exist in the Iowa State University Financial Counseling Clinic and with program partners in the financial services industry. A field work experience helps students apply their studies and experience the profession in real-world settings.

Financial Counseling and Planning majors are also prepared to enter graduate programs in family financial planning, financial education, economics, finance, and law.

Juniors and seniors in Financial Counseling and Planning who are interested in graduate study may apply for concurrent enrollment in the Graduate College to simultaneously pursue both a B.S. in Financial Counseling and Planning and a M.S. in Human Development and Family Studies or a B.S. in Financial Counseling and Planning and a Graduate Certificate in Family Financial Planning. Under concurrent enrollment, students simultaneously take undergraduate and graduate courses and may be eligible for assistantships. See Graduate Study for more information (<https://hdfs.hs.iastate.edu/graduate-students/graduate-programs/>).

The Financial Counseling and Planning major is registered with Certified Financial Planner Board of Standards Inc. as a CFP Board-registered Program. ISU courses satisfy CFP Board's education requirement, allowing an individual to sit for the CFP® Certification Examination.

Iowa State University does not certify individuals to use the CFP® CERTIFIED FINANCIAL PLANNER™ title. CFP certification is granted only by Certified Financial Planner Board of Standards Inc. to those persons who, in addition to completing an educational requirement such as this CFP Board-Registered Program, have met its ethics, experience and examination requirements (CFP Board of Standards website <https://www.cfp.net/>).

Certified Financial Planner Board of Standards Inc. owns the certification marks CFP®, CERTIFIED FINANCIAL PLANNER™ and the federally registered CFP (with flame logo), which it awards to individuals who successfully complete initial and ongoing certification requirements.

FCP majors also satisfy the education requirements for the Accredited Financial Counselor (AFC®) designation offered through the Association for Financial Counseling and Planning Education (AFCPE).

Affiliated Programs

The **Early Childcare Education and Programming (ECP)** curriculum, offered by the Great Plains Interactive Distance Education Alliance (GPIDEA), is designed to prepare graduates to work in a variety of early care and education programs in local communities and on military

installations. Some of these programs are childcare centers and homes, infant/toddler and preschool programs, Head Start programs, and before and after-school programs for children ages birth to eight. This is an online program offered through a collaboration of seven universities as part of GPIDEA where the program is referred to as Early Care and Education for a Mobile Society. For more information see <https://www.gpidea.org/program/early-care-and-education-in-a-mobile-society> (<https://www.gpidea.org/program/early-care-and-education-in-a-mobile-society/>).

The ECP curriculum is designed to provide content for the final two years of a student's program; the content is focused specifically on topics directly relevant to the major. Students will complete a total of 120 credits for the major, 51 of which are specific to the ECP curriculum. These 51 credit hours are comprised of 12 core courses and 3 practica; the final practicum will be a 6-credit capstone experience. Students must complete 30 credits of college work, a lifespan development course, and have a 2.5 GPA to be admitted to ECP. If students prefer to be admitted to ISU before being admitted to the ECP major, they can enroll as Pre ECP (PECP) students until they are eligible for the ECP major. For more information about the program at Iowa State, see <https://online.hs.iastate.edu/early-childcare-programming> (<https://online.hs.iastate.edu/early-childcare-programming/>).

Curricula:

- **Early Childhood Education – Unified**
- **Family and Consumer Sciences Education and Studies**
- **Financial Counseling and Planning**
- **Human Development and Family Studies**
- **Affiliated Program: Early Childcare Education and Programming (GPIDEA program)**

Minors

The department offers minors in Human Development and Family Studies and Financial Counseling and Planning. Minors consist of at least 15 credits including 6 credits taken at Iowa State University in courses numbered 3000 or above. The minor must include at least 9 credits that are not used to meet any other department, college, or university requirement.

The **Human Development and Family Studies** minor may be earned by completing 15 credits.

HDFS 1020	Human Development	3
One of the following:		3
HDFS 2230	Child Development and Health	
HDFS 2260	Development and Guidance in Middle Childhood	
HDFS 2270	Middle Childhood and Adolescence	
HDFS 2340	Young Adulthood Through Later Life	

HDFS 2490	Family Studies	
HDFS 2700	Family Communications and Relationships	
HDFS 3770	Aging and the Family	
Three of the following:		9
HDFS 2760	Human Sexuality	
HDFS 3600	Housing and Services for Families and Children	
HDFS 3670	Family Stress, Abuse, and Resilience	
HDFS 3730	Death as a Part of Living	
HDFS 3860	Human Services Management I	3
HDFS 3870	Trauma-Informed Practice	
HDFS 3950	Children, Families, and Public Policy	
HDFS 4790	Families Through a Social and Cultural Lens	
Total Credits		18

The **Education Services in Family and Consumer Sciences** minor may be earned by completing 15 credits.

HDFS 1020	Human Development	3
FCEDS 2060	Home Ec to Human Sciences: Legacy and Advocacy.	2
FCEDS 3060	Teaching Human Sciences	4
FCEDS 3980	Foundations of Career and Technical Education in Family and Consumer Sciences	3
FCEDS 4130	Curriculum, Lab Management and Assessment for Family and Consumer Sciences	3
One of the following:		3
HDFS 3410	Income Tax Planning	
HDFS 3600	Housing and Services for Families and Children	
HDFS 3670	Family Stress, Abuse, and Resilience	
HDFS 3730	Death as a Part of Living	
HDFS 3950	Children, Families, and Public Policy	

The **Financial Counseling and Planning** minor may be earned by completing 15 credits.

HDFS 2830	Personal Finance	3
Twelve credits from the following:		12
HDFS 2390	Consumer Issues	
HDFS 3410	Income Tax Planning	
HDFS 3780	Retirement Planning and Employee Benefits	
HDFS 3830	Fundamentals of Financial Planning	
HDFS 3840	Insurance Planning	
HDFS 4820	Investment Planning	
HDFS 4840	Estate Planning	
HDFS 4850	Case Studies in Financial Counseling and Planning	

HDFS 4890 Financial Counseling

HDFS 4890L Financial Counseling Laboratory

Total Credits**15**

Graduate Study

The department offers work for the Master of Science (thesis or non-thesis options) and Doctor of Philosophy degrees with the major in Human Development and Family Studies. Minors are also available for students taking major work in other departments. Graduates of M.S. and Ph.D. programs in the department will understand and apply relevant theories to educational, research, and/or intervention or prevention programs. It is intended that they will produce and disseminate research results and provide leadership in human development and family studies professions.

Graduate study in Human Development and Family Studies at Iowa State University is multidisciplinary and focuses on research and practice in several content areas such as adolescent/youth development, adult development and aging, family studies and policy, family economic well-being and financial planning, infant and child development, health and well-being; and lifespan development.

Prerequisite to work in the major is the completion of a related undergraduate program with basic courses and/or experiences in areas such as child/human development, community and regional planning, economics, education, family studies, psychology, or sociology. Additional coursework or prerequisites (e.g., basic statistics) may be required depending on the undergraduate program and program of study. Students may be admitted to our doctoral program with either a bachelor's (M.S./Ph.D. Track, 5 years) or a master's degree (Ph.D. Track only, 3 years). Students admitted to the Ph.D. Track without a prior master's degree complete requirements for a thesis-based master's degree as part of their doctoral program of study.

All students take a core set of courses; the program of study is then completed with a selection of courses that meet the individual needs of the student. The variety of and flexibility in the coursework allows a student to tailor a program to specific academic interests. The graduate programs are based on a theory, research, and application interactive paradigm with all three areas integrated into content and method courses.

The department offers a graduate minor in Human Development and Family Studies. For more detailed information about the minor, see the Graduate Minors tab.

The department also offers four Graduate Certificates available to HDFS majors as well as students in other departments and professionals in the field.

The department also participates in several Master of Family and Consumer Sciences (MFCS) degree programs (<http://catalog.iastate.edu/collegeofhumansciences/familyandconsumersciences/>). Admission to the youth (YTH), family financial planning (FFP) and gerontology (GERON) specialization programs require submission of the Graduate College application form, transcripts, 2 letters of recommendation, resume and a goal statement. Students in a MFCS program select one of the options listed below.

1. Master of Family and Consumer Sciences - Human Development and Family Studies (MFCS-HDFS). The Master of Family and Consumer Sciences degree specialization track in Human Development and Family Studies (HDFS) provides students with the opportunity to enhance their background knowledge and skills for working with children and families (37 credits).
2. Master of Family and Consumer Sciences - Youth Development (MFCS-YD). This is an entirely online degree focusing on the skills to serve today's young people. The degree uses a strengths-based curriculum that supports you to grow socially, emotionally, and cognitively. There are also two youth development related certificates available for students (see Graduate Certificates tab for details) (36 credits).
3. Master of Family and Consumer Sciences - Family Financial Planning Program (MFCS-FFP). This is a master's degree program offered entirely online, designed to prepare individuals to work in the financial planning field (36 credits). Completion of course works in the master's degree, or a graduate certificate meets the educational requirements to sit for the Certified Financial Planner (CFP) Board of Standards Certification Examination.

The department offers a Financial Counseling and Planning (FCP) concurrent degree program that allows students to obtain a B.S. in FCP and an M.S. in HDFS or a B.S. in FCP and a Graduate Certificate in Family Financial Planning in 5 years. Application for admission to the Graduate College should be made near the end of the junior year. Under concurrent enrollment, students simultaneously take undergraduate and graduate courses and may be eligible for assistantships. Students interested in these programs should contact the department for details.

Finally, the department collaborates with the interdepartmental Gerontology program; students may declare a minor in Gerontology. The Master of Family and Consumer Sciences - Gerontology program (MFCS-GERON) and the Graduate Gerontology Certificate program are designed to prepare professionals who work directly with older people or are involved in education and research related to older adults. Professionals offering direct services often are involved in health promotion programs, directing inter-generational activities, managing senior centers or retirement communities, counseling older people and their families, and helping people plan for retirement. Professionals involved in education

and research may evaluate community-based services, teach others about the aging process, develop policies and programs to serve the needs of older adults, and work with business and industry on issues related to an aging work force.

Graduate Minors

The department offers a graduate minor in Human Development and Family Studies. To earn this minor, students in a master's program must take 9 credits in HDFS graduate courses (5000, 6000 level) with a limit of 3 credits in seminar or workshop credit (credits in 5910 or 6910 not allowed). To earn a minor in HDFS students in a Doctoral program must take 12 credits in HDFS graduate courses (5000, 6000 level) with a limit of 3 credits in seminar or workshop credit (credits in 5910 or 6910 not allowed). A graduate faculty member from the minor program must serve on the student's POS Committee.

HDFS Certificates

The department offers four Graduate Certificates available to HDFS majors as well as students in other departments and professionals in the field. The certificates emphasize application and relevance to growing diversity and demands on the work force. The four certificate areas are:

1. Developmental and Family Sciences Advanced Research Design and Methods (15 credits)
2. Family Well-Being in Diverse Society (12 credits)
3. Infant and Early Childhood Mental Health (12 credits, online)
4. Life-Span Development (12 credits, online)

For more information about courses for the certificates, go to <https://hdfs.hs.iastate.edu/graduate-students/graduate-programs/graduate-certificates/>. (<https://hdfs.hs.iastate.edu/graduate-students/graduate-programs/graduate-certificates/>)

Youth Development Certificates

The department also collaborates to offer two certificates related to youth development through the MFCS program. Both certificates are designed to prepare individuals who work directly with youth or are involved in education and research related to youth. For more information, go to <http://www.online.hs.iastate.edu/graduate-programs/masters/mfcs-youth-development/>.

1. Youth Development Specialist Certificate (13 credits)
2. Youth Program Management and Evaluation Certificate (13 credits)

Family Financial Planning Certificates

The MFCS – Family Financial Planning (FFP) program also offers two certificates listed below. More information can be found at <http://www.online.hs.iastate.edu/graduate-programs/masters/mfcs-ffp/>.

1. FFP certificate. Master of Family and Consumer Sciences with Family Financial Planning (FFP) specialization graduate certificate program (18 credits)
2. FHC certificate. Master of Family and Consumer Sciences Financial and Housing Counseling (FHC) specialization graduate certificate program (18 credits)

Kinesiology

Mission

We promote health and well-being by creating and disseminating knowledge about physical activity and active living. Through discovery, learning and engagement we improve the lives of citizens of Iowa, the United States and the world.

Goals

The department has identified the following goals to support this mission:

1. We seek to improve the lives of citizens of Iowa, the United States, and the world by the creation and dissemination of knowledge about physical activity and its relationship to health and well-being.
2. We prepare scholars and professionals in the study of physical activity at the undergraduate and graduate levels.
3. We educate the public and the University community in the scientific aspects of physical activity especially exercise, sport, and the role of movement throughout the lifespan.

UNDERGRADUATE STUDY

The Department of Kinesiology offers a Bachelor of Science degree in Kinesiology & Health. The undergraduate curriculum major/option is comprised of three components: general education, required departmental courses and major/option courses. The intent of the general education component is to promote intellectual and personal growth and to prepare students for success in the basic, advanced and major/option components. Required courses provide an introduction to the field and fundamental principles of physical activity, fitness, health and disease.

B.S. degree in Kinesiology & Health

The Kinesiology & Health major includes five specialization options. Options comprise a focused area of study within Kinesiology and Health. Coursework within each specialization option builds upon personal and scholarly learning by enabling students to master content and skills specific to career applications. Options available are:

1. Community and Public Health
2. Exercise Science
3. Physical Activity and Health Promotion

4. Physical Education Teacher Education
5. Pre-Health Professions

Academic options within the Kinesiology & Health major

Students in the **Community and Public Health** option are prepared for professional employment at local, state or national health agencies, medical centers, and other public or private organizations that seek to promote health in the population.

Students in the **Exercise Science** option is prepared for professional roles as health and fitness leaders or program managers. Employment opportunities include work in corporate fitness programs, health/fitness facilities, clinics, or hospitals. Graduates are able to plan, implement and supervise exercise programs which will improve fitness and health. Graduates also have a basic understanding of management issues related to business applications in the health and fitness field.

Students in the **Physical Activity and Health Promotion** option are prepared for careers focused on health and physical activity. This option provides more emphasis on behavioral and psychological aspects of physical activity. Students are prepared for careers in community-based settings, including work sites, schools, hospitals, and other community agencies.

Students in the **Physical Education/Teacher Education** option is prepared to teach physical education in grades K-12 and to meet the State of Iowa learning outcomes for teachers. Graduates can plan developmentally appropriate physical education and individualize instruction and assessment for diverse audiences.

Students in the **Pre-Health Professions** option utilize an interdisciplinary approach to the study of human movement. In so doing, they become prepared for graduate study in Kinesiology or advanced study leading to careers in human medicine, physical therapy, physician assistant or other healthcare professions.

Student Learning Outcomes for the Undergraduate Degree

Despite the diversity of options, the learning outcomes comprise a common framework for each student as they progress through Iowa State University.

The learning outcomes emphasized in academic coursework in the Department of Kinesiology are:

COMMUNICATION

Uses clear and effective written, oral, visual, and electronic (WOVE) communication techniques to foster inquiry, collaboration, and engagement in physical activity and health related settings.

LIFELONG LEARNING, ASSESSMENT, AND SELF-REFLECTION

Analyzes and evaluates one's own knowledge, abilities and actions relative to professional standards, seeks opportunities to grow

professionally, and utilizes self-assessment and assessment of others to foster physical, cognitive, social, and emotional well-being.

CONTENT KNOWLEDGE, DISCOVERY, AND CRITICAL THINKING

Understands fundamental concepts of physical activity and health, conducts scientific inquiry, and applies critical thinking to solve problems from personal, scholarly, and professional perspectives.

ETHICS, DIVERSITY, AND SOCIAL JUSTICE

Demonstrates leadership and social responsibility to improve quality of life for others and ensures equitable access for diverse groups by creating appropriate environments to initiate and maintain a physically active, healthy lifestyle.

Other Program Offerings:

ENDORSEMENT TO COACH INTERSCHOLASTIC ATHLETICS

The State Department of Education has provided for the endorsement of licensed teachers for the coaching of athletic teams in schools. The endorsement does not lead to licensure to teach physical education. For requirements of the program, leading to the coaching endorsement, see School of Education, Teacher Education. More information can be found at: <http://www.kin.hs.iastate.edu/>. (<http://www.kin.hs.iastate.edu/>)

ENDORSEMENT TO TEACH HEALTH EDUCATION

Those interested in teaching health education in the public schools may get a primary licensure or an additional endorsement. The State Department of Education has approved the Health Teaching Licensure for grades 5-12.

BASIC ACTIVITY INSTRUCTION PROGRAM

The department offers a wide selection of beginning, intermediate, and advanced courses in the areas of aquatics, dance, fitness, martial arts, and sports. These courses are designed to serve general education purposes for all students.

DANCE

Coursework in dance provides opportunities for students to develop an understanding and appreciation of dance as part of a liberal education. Those interested in teaching dance and physical education in the public schools may major in Kinesiology and Health (Physical Education Teacher Education) and minor in Dance.

An interdisciplinary Performing Arts major with a Dance emphasis is available through the College of Liberal Arts and Sciences. For further information see Index: Performing Arts to find Performing Arts Major, Emphasis in Dance.

Curriculum in Athletic Training

The athletic training major prepares students for a career as an athletic trainer in high school, college or professional settings or for work in other settings (such as sports medicine clinics, the military, industry, and fitness centers). Program details including course requirements, admission procedures and technical standards can be found at

<http://www.kin.hs.iastate.edu/programs/athletic-training/#program-information-and-requirements>.

Curriculum in Kinesiology and Health

The curriculum in Kinesiology and Health is designed for students preparing to enter professional areas related to the medical, health, physical activity, exercise or sport science fields. Students majoring in Kinesiology & Health may select one of five options:

1. Community and Public Health
2. Exercise Science
3. Physical Activity and Health Promotion
4. Physical Education Teacher Education
5. Pre-Health Professions

Minors in dance, exercise science, health promotion, and kinesiology, are available; see requirements under Kinesiology, Undergraduate Programs.

A major in Performing Arts with a dance emphasis is available; see requirements under Curriculum in Performing Arts Program, Dance.

Communication Proficiency

In order to meet graduation requirements, all students must pass ENGL 1500 and pass ENGL 2500 with a grade no lower than a C. Students not meeting this condition must earn a C or better in an advanced writing course:

ENGL 3020	Business Communication	3
or ENGL 3140	Technical Communication	
LIB 1600	Introduction to College Level Research	1
SPCM 2120	Fundamentals of Public Speaking	3

U.S. Cultures and Communities and International Perspectives

In order to meet graduation requirements, all students must complete 3 cr. of course work in U.S. Cultures and Communities and 3 cr. in International Perspectives. KIN 3600 meets the U.S. Cultures and Communities requirement and DANCE 2700 meets the International Perspectives requirement. See university approved list for other courses.

General Education:

Physical and Life Sciences:

BIOL 2550	Fundamentals of Human Anatomy	3
BIOL 2550L	Fundamentals of Human Anatomy Laboratory	1
BIOL 2560	Fundamentals of Human Physiology	3
BIOL 2560L	Fundamentals of Human Physiology Laboratory	1

Additional option-specific requirements are:

Community and Public Health

BIOL 2110	Principles of Biology I	3
BIOL 2110L	Principles of Biology Laboratory I	1
CHEM 1630	College Chemistry	4
CHEM 1630L	Laboratory in College Chemistry	1
FSHN 1670	Introductory Human Nutrition and Health	3
MICRO 2010	Introduction to Microbiology	2
MICRO 2010L	Introductory Microbiology Laboratory	1

Exercise Science

FSHN 1670	Introductory Human Nutrition and Health	3
PHYS 1150	Physics for the Life Sciences	4

Physical Activity and Health Promotion

BIOL 2110	Principles of Biology I	3
BIOL 2110L	Principles of Biology Laboratory I	1
CHEM 1630	College Chemistry	4
CHEM 1630L	Laboratory in College Chemistry	1
FSHN 1670	Introductory Human Nutrition and Health	3
MICRO 2010	Introduction to Microbiology	2
MICRO 2010L	Introductory Microbiology Laboratory	1

Physical Education Teacher Education

PHYS 1150	Physics for the Life Sciences	4

Pre-Health Professions

PHYS 1310	General Physics I	4-5
& 1310L	and General Physics I Laboratory	
or PHYS 1150	Physics for the Life Sciences	

Mathematics and Statistics:

Community and Public Health

From the following: 3-4

STAT 1010	Principles of Statistics
or STAT 104	Introduction to Statistics

Exercise Science

From the following: 3-4

MATH 1400	College Algebra
or MATH 14	Preparation for Calculus
or MATH 14	Applied Trigonometry
or MATH 16	Calculus I

From the following: 3-4

STAT 1010	Principles of Statistics
or STAT 104	Introduction to Statistics

Physical Activity and Health Promotion

One of the following: 3-4

STAT 1010	Principles of Statistics
or STAT 104	Introduction to Statistics

Physical Education Teacher Education

One of the following: 3-4

MATH 1040	Introduction to Probability
or MATH 14	College Algebra
or STAT 101	Principles of Statistics
or STAT 104	Introduction to Statistics

Pre-Health Professions

One of the following: 3-4

MATH 1400	College Algebra
or MATH 14	Preparation for Calculus
or MATH 14	Applied Trigonometry
or MATH 16	Calculus I

From the following: 3-4

STAT 1010	Principles of Statistics
or STAT 104	Introduction to Statistics

Social Sciences: 9 cr. min required**Option-specific requirements are:****Community and Public Health**

PSYCH 1010	Introduction to Psychology	3
PSYCH 2300	Developmental Psychology	3
SOC 1340	Introduction to Sociology	3

Exercise Science

PSYCH 1010	Introduction to Psychology	3
or PSYCH 2300	Developmental Psychology	
SOC 1340	Introduction to Sociology	3

Physical Activity and Health Promotion

PSYCH 1010	Introduction to Psychology	3
or PSYCH 2300	Developmental Psychology	

SOC 1340	Introduction to Sociology	3

Physical Education Teacher Education

PSYCH 2300	Developmental Psychology	3
SOC 1340	Introduction to Sociology	3

Pre-Health Professions

PSYCH 1010	Introduction to Psychology	3
or PSYCH 2300	Developmental Psychology	
SOC 1340	Introduction to Sociology	3

Humanities: 6 cr. min required

Choose from department approved list.

Communications: 13 cr. min required

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
LIB 1600	Introduction to College Level Research	1
SPCM 2120	Fundamentals of Public Speaking	3

One of the following 3

ENGL 3020	Business Communication
or ENGL 314	Technical Communication
or SPCM 312	Business and Professional Speaking

Program requirements:

The following courses are required in all majors and options:

HS 1100	Personal and Consumer Health	3
HS 3500	Human Diseases (*)	3
KIN 2520	Introduction to the Discipline of Kinesiology	1
KIN 2530	Orientation and Learning Community in Kinesiology and Health	1
KIN 2580	Principles of Physical Fitness and Conditioning	2
KIN 3580	Exercise Physiology (*)	3
KIN 3590	Exercise Physiology Lab (*)	1

* A grade of C- or better is required.

Total cr. required to graduate: A minimum of 124 credits is required, with a minimum of 46 credits in courses numbered 3000 or above.

Courses for Kinesiology and Health Major**Option 1. Community and Public Health**

This option prepares students for a diverse array of careers in public and private health agencies as well as local, state and federal government programs. Students are qualified for careers in a variety of health and human service agencies, community organizations, and hospitals. This option also provides the ideal background training for credentials as a Certified Health Education Specialist (CHES).

Option Requirements:

PR 2200	Principles of Public Relations	3
or PR 3050	Publicity Methods	
HS 1050	First Aid and Emergency Care	2
HS 2850	Pre-Internship in Kinesiology and Health	1-2
KIN 3600	Sociology of Physical Activity and Health (*)	3
HS 3100	Community and Public Health (*)	3
HS 3850	Preparation and Search Strategies for Kinesiology and Health Internships	0.5
HS 4300	Community Health Program Development	3
HS 4640	Physical Activity Epidemiology	3

or VDPAM 4280 Principles of Epidemiology and Population Health

HS 4850A	Internship in Health Studies: Community and Public Health	8-12
HDFS 2700	Family Communications and Relationships	3
ENGL 3090	Proposal and Report Writing	3
PSYCH 4850	Health Psychology	3
One of the following		
HDFS 3770	Aging and the Family	3
or HDFS 3950	Children, Families, and Public Policy	
Electives: 8-12 credits		

* A grade of C- or better is required.

Option 2. Exercise Science

This option prepares students for careers in exercise/fitness promotion. Students are prepared as health/fitness specialists, personal trainers, strength and conditioning specialists, and health coaches. Students find work in fitness centers, worksite health programs, medical facilities, cardiac rehabilitation centers, and other agencies that provide fitness services. Students are eligible to sit for certification exams offered by the American College of Sports Medicine and the National Strength & Conditioning Association.

Option Requirements:

KIN 2590	Leadership Techniques for Fitness Programs	3
KIN 2660	Strength Training and Conditioning	2
KIN 2850	Pre-Internship in Kinesiology and Health	1-2
KIN 3450	Management of Health-Fitness Programs and Facilities	3
KIN 3550	Biomechanics (*)	3
KIN 3660	Exercise Psychology (*)	3
KIN 3720	Motor Control and Learning Across the Lifespan (*)	3
KIN 3730	Biomechanics and Motor Control Laboratory	1
HS 3850	Preparation and Search Strategies for Kinesiology and Health Internships	
KIN 4580	Principles of Fitness Assessment and Exercise Prescription (*)	4
KIN 4590	Internship in Exercise Leadership	1
KIN 4620	Medical Aspects of Exercise	3
or KIN 4610	Advanced Strength Training and Conditioning	
KIN 4800	Functional Anatomy	3
KIN 4850A	Internship in Exercise Science	8-12
HS 3800	Worksite Health Promotion	3
ATR 2200	Basic Athletic Training	2

or HS 3050 Instructor's First Aid and Cardiopulmonary Resuscitation

Electives: 12-16 credits

* A grade of C- or better is required.

Option 3. Physical Activity and Health Promotion

This option prepares students for a variety of career outlets focused on health and physical activity promotion. The coursework provides the ideal background for students interested in worksite wellness programming. Students are also well suited to pursue career opportunities in health coaching and health promotion in schools, community agencies, as well as clinical settings. This option provides ideal background training for students interested in pursuing the Physical Activity in Public Health Specialist Certification offered by the American College of Sports Medicine.

Option Requirements:

FSHN 3650	Obesity and Health	3
HS 2850	Pre-Internship in Kinesiology and Health	1-2
HS 3100	Community and Public Health (*)	3
HS 3800	Worksite Health Promotion	3
HS 3850	Preparation and Search Strategies for Kinesiology and Health Internships	
HS 4300	Community Health Program Development	3
HS 4640	Physical Activity Epidemiology	3
HS 4850B	Internship in Health Studies: Physical Activity and Health Promotion	8-12
KIN 2590	Leadership Techniques for Fitness Programs	3
KIN 3600	Sociology of Physical Activity and Health (*)	3
KIN 3660	Exercise Psychology (*)	3
KIN 4580	Principles of Fitness Assessment and Exercise Prescription (*)	4
KIN 4670	Exercise and Health: Behavior Change	3
Electives: 15-19 credits		

* A grade of C- or better is required.

Option 4. Physical Education Teacher Education

This option is for students seeking a license to teach K-12 physical education. All courses required for licensure have a minimum grade requirement of a C or C-. Students interested in a coaching and/or a health endorsement must complete additional coursework.

Option Requirements:

KIN 2310	Fundamentals of Tumbling and Gymnastics (**)	1
KIN 2320	Fundamentals of Team Sports (**)	1

KIN 2360	Fundamentals of Individual Sports and Fitness (**)	1
KIN 2590	Leadership Techniques for Fitness Programs	3
KIN 2800	Directed Field Experience in Elementary Physical Education	1
KIN 2810	Directed Field Experience in Secondary Physical Education	1
KIN 2820	Field Experience with Educational Outreach	1
KIN 3120	Movement Education in Elementary School Physical Education (**)	3
KIN 3130	Teaching Secondary Physical Education (**)	3
KIN 3550	Biomechanics (*)	3
KIN 3650	Sport Psychology (*)	3
or KIN 3660	Exercise Psychology	
KIN 3720	Motor Control and Learning Across the Lifespan (*)	3
KIN 3950	Adapted Physical Education (**)	3
KIN 4170	Supervised Teaching in Physical Education in the Secondary School (**)	8
KIN 4180	Supervised Teaching in Physical Education in the Elementary School (**)	8
KIN 4710	Measurement in Physical Education (**)	3
KIN 4750	Physical Education Curriculum Design and Program Organization (**)	3
DANCE 2110	Fundamentals and Methods of Social and World Dance (**)	1
EDUC 2040	Social Foundations of Education in the United States: Secondary (**)	3
EDUC 4060	Teaching and Learning in a Pluralistic Society: Secondary (**)	3
HS 1050	First Aid and Emergency Care (*)	2
HS 3050	Instructor's First Aid and Cardiopulmonary Resuscitation (*)	2
Electives: 5 credits		

** A grade of C or better is required.

* A grade of C- or better is required.

Option 5. Pre-Health Professions

This option is for students interested in graduate study or for those who are preparing for professional programs in medicine, physical therapy, physician associate / physician assistant, and other healthcare professions. Course work provides background in human movement while completing the requirements for entry into graduate or professional school.

Option Requirements:

BIOL 2110	Principles of Biology I	3

BIOL 2110L	Principles of Biology Laboratory I	1
BIOL 2120	Principles of Biology II	3
BIOL 2120L	Principles of Biology Laboratory II	1
KIN 2420	Planning for Success in a Health Career	0.5
KIN 2850	Pre-Internship in Kinesiology and Health	1-2
KIN 3550	Biomechanics (*)	3
KIN 3650	Sport Psychology (*)	3
or KIN 3660	Exercise Psychology	
KIN 3720	Motor Control and Learning Across the Lifespan (*)	3
KIN 3730	Biomechanics and Motor Control Laboratory	1
9 cr. from the following		9
HS 4640	Physical Activity Epidemiology	3
KIN 4580	Principles of Fitness Assessment and Exercise Prescription	4
KIN 4620	Medical Aspects of Exercise	3
KIN 4660	Exercise for Mental Health	3
KIN 4670	Exercise and Health: Behavior Change	3
KIN 4720	Neural Basis of Human Movement	3
KIN 4730	Physical Dimensions of Aging	3
KIN 4800	Functional Anatomy	3
Specialization Requirements: Other prerequisites as required by professional schools.		
Electives: 6-14 credits		

* A grade of C- or better is required.

FOUR YEAR PLANS

Students must complete a 3-credit course in U.S. Cultures and Communities and a 3-credit course in International Perspectives. Check the ISU homepage for a list of approved courses. You must complete a minimum of 46 credits in 3000/4000 level courses and a total of 124 credits for graduation. Four-year plans are arranged with courses in prerequisite sequence and within the term a course is usually offered. These are SAMPLE plans - use the degree audit as "official" documentation of progress toward your degree.

Kinesiology and Health, B.S. - Community/Public Health

Freshman

Fall	Credits Spring	Credits
BIOL 2110	3 CHEM 1630	4
BIOL 2110L	1 CHEM 1630L	1
ENGL 1500	3 FSHN 1670	3
HS 1100	3 HS 1050	2
KIN 2520	1 KIN 2580	2

KIN 2530	1 PSYCH 2300	3	KIN 2520	1 MATH 1400, 1430, 1450, or 1650	3-4
LIB 1600	1 Elective	1			
PSYCH 1010	3		KIN 2530	1 SOC 1340	3
	16	16	LIB 1600	1 SPCM 2120	3
Sophomore			PSYCH 1010 or 2300	3 Electives	2
Fall	Credits Spring	Credits	Humanities/International Perspectives	3	
BIOL 2550	3 BIOL 2560	3		15	16-17
BIOL 2550L	1 BIOL 2560L	1	Sophomore		
ENGL 2500	3 HS 2850	1-2	Fall	Credits Spring	Credits
HDFS 2700	3 PR 2200 or 3050	3	BIOL 2550	3 BIOL 2560	3
SOC 1340	3 SPCM 2120	3	BIOL 2550L	1 BIOL 2560L	1
STAT 1010 or 1040	3-4 Elective	1	ENGL 2500	3 KIN 2660	2
	Humanities/International Perspectives	3	KIN 2590	3 STAT 1010 or 1040	3-4
	16-17	15-16	KIN 2850	1-2 Electives	3
Junior			Electives	2 Humanities/U.S. Cultures and Communities (formerly U.S. Diversity)	3
Fall	Credits Spring	Credits	Social Science Choice	3	
HDFS 3770 or 3950	3 ENGL 3090	3		16-17	15-16
HS 3100	3 HS 3850	0.5	Junior		
HS 3500	3 KIN 3600	3	Fall	Credits Spring	Credits
KIN 3580	3 MICRO 2010	2	ATR 2200 or HS 3050	2 HS 3800	3
KIN 3590	1 MICRO 2010L	1	HS 3500	3 KIN 3450	3
Elective	1 PSYCH 4850	3	KIN 3580	3 KIN 3550	3
Humanities/U.S. Cultures and Communities (formerly U.S. Diversity)	3 Electives	3	KIN 3590	1 KIN 3660	3
	17	15.5	KIN 3720	3 KIN 3850	0.5
Senior			PHYS 1150	4 Electives	5
Fall	Credits Spring	Credits		16	17.5
ENGL 3020, 3140, or SPCM 3120	3 HS 4850A	8-12	Senior		
HS 4300	3		Fall	Credits Spring	Credits
HS 4640	3		ENGL 3020, 3140, or SPCM 3120	3 KIN 4850A	8-12
Electives	2		KIN 3730	1	
Electives (3000+ Level Courses)	6		KIN 4580	4	
	17	8-12	KIN 4590	1	
			KIN 4620	3	
			KIN 4800	3	
				15	8-12

Kinesiology and Health, B.S. - Exercise Science

Freshman

Fall	Credits Spring	Credits
ENGL 1500	3 FSHN 1670	3
HS 1100	3 KIN 2580	2

Kinesiology and Health, B.S. - Physical Activity and Health Promotion

Freshman

Fall	Credits Spring	Credits
BIOL 2110	3 CHEM 1630	4
BIOL 2110L	1 CHEM 1630L	1
ENGL 1500	3 FSHN 1670	3
HS 1100	3 KIN 2580	2
KIN 2520	1 SOC 1340	3
KIN 2530	1 Humanities/U.S. Cultures and Communities (formerly U.S. Diversity)	3
LIB 1600	1	
PSYCH 1010 or 2300	3	
	16	16

Sophomore

Fall	Credits Spring	Credits
BIOL 2550	3 BIOL 2560	3
BIOL 2550L	1 BIOL 2560L	1
ENGL 2500	3 SPCM 2120	3
KIN 2590	3 STAT 1010 or 1040	3-4
KIN 2850	1-2 Electives	3
MICRO 2010	2 Social Science Choice	3
MICRO 2010L	1	
Elective	1	
	15-16	16-17

Junior

Fall	Credits Spring	Credits
HS 3100	3 FSHN 3650	3
HS 3500	3 HS 3800	3
KIN 3580	3 HS 3850	0.5
KIN 3590	1 KIN 3600	3
KIN 3660	3 KIN 4670	3
Electives	4 Humanities/International Perspectives	3
	17	15.5

Senior

Fall	Credits Spring	Credits
ENGL 3020, 3140, or SPCM 3120	3 HS 4850B	8-12
HS 4300	3	
HS 4640	3	
KIN 4580	4	

Electives	4	
	17	8-12

Kinesiology and Health, B.S. - Physical Education Teacher Education

Freshman

Fall	Credits Spring	Credits
EDUC 2040	3 DANCE 2110	1
ENGL 1500	3 KIN 2360	1
HS 1100	3 KIN 2580	2
KIN 2520	1 KIN 2800	1
KIN 2530	1 MATH 1040, 1400, STAT 1010, or STAT 1040	3-4
LIB 1600	1 SOC 1340	3
PSYCH 2300	3 Humanities/International Perspectives	3
	15	14-15

Sophomore

Fall	Credits Spring	Credits
BIOL 2550	3 BIOL 2560	3
BIOL 2550L	1 BIOL 2560L	1
ENGL 2500	3 HS 3050	2
HS 1050	2 KIN 2820	1
KIN 2310	1 SPCM 2120	3
KIN 2320	1 Electives	3
KIN 2590	3 Humanities	3
KIN 2810	1	
	15	16

Junior

Fall	Credits Spring	Credits
KIN 3120	3 ENGL 3020, 3140, or SPCM 3120	3
KIN 3720	3 HS 3500	3
PHYS 1150	4 KIN 3130	3
Electives	3 KIN 3580	3
Social Science Choice	3 KIN 3590	1
	KIN 4710	3
	16	16

Senior

Fall	Credits Spring	Credits
EDUC 4060	3 KIN 4170	8
KIN 3550	3 KIN 4180	8
KIN 3660 or 3650	3	

KIN 3950	3	
KIN 4750	3	
Elective	1	
16		16

Kinesiology and Health, B.S. - Pre-Health Professions - Chiropractic

Freshman

Fall	Credits Spring	Credits
BIOL 2110	3 BIOL 2120	3
BIOL 2110L	1 BIOL 2120L	1
CHEM 1770	4 CHEM 1780	3
CHEM 1770L	1 CHEM 1780L	1
ENGL 1500	3 HS 1100	3
KIN 2520	1 MATH 1400, 1430, 1450, or 1650	3-4
KIN 2530	1 Elective	1
LIB 1600	1	
15		15-16

Sophomore

Fall	Credits Spring	Credits
BIOL 2550	3 BBMB 3010 or CHEM 3320 and CHEM 3320L	3-4
BIOL 2550L	1 BIOL 2560	3
CHEM 3310	3 BIOL 2560L	1
CHEM 3310L	1 SOC 1340	3
ENGL 2500	3 SPCM 2120	3
KIN 2420	0.5 Humanities/U.S. Cultures and Communities (formerly U.S. Diversity)	3
KIN 2580	2	
KIN 2850	1-2	
PSYCH 1010 or 2300	3	
17.5-18.5		16-17

Junior

Fall	Credits Spring	Credits
KIN 3660 or 3650	3 HS 3500	3
KIN 3720	3 KIN 3550	3
PHYS 1310	4 KIN 3730	1
PHYS 1310L	1 PHIL 3310	3
STAT 1010 or 1040	3-4 Electives (3000+ Level Courses)	3
Social Science Choice	3 Electives	3
17-18		16

Senior

Fall	Credits Spring	Credits
ENGL 3020, 3140, or SPCM 3120	3 KIN 4000 Level Courses *	9
FSHN 3670	1 Electives	6
KIN 3580	3	
KIN 3590	1	
Electives (3000+ Level Courses)	3	
Humanities/International Perspectives	3	
14		15

* KIN 4000 Level Course Choices (9 cr): KIN 4580, 4620, 4660, 4670, 4720, 4730, 4800, HS 4640.

Kinesiology and Health, B.S. - Pre-Health Professions - Dentistry

Freshman

Fall	Credits Spring	Credits
BIOL 2110	3 BIOL 2120	3
BIOL 2110L	1 BIOL 2120L	1
CHEM 1770	4 CHEM 1780	3
CHEM 1770L	1 CHEM 1780L	1
ENGL 1500	3 HS 1100	3
KIN 2520	1 MATH 1430, 1450, or 1650	3-4
KIN 2530	1	
LIB 1600	1	
15		14-15

Sophomore

Fall	Credits Spring	Credits
BIOL 2550	3 BIOL 2560	3
BIOL 2550L	1 BIOL 2560L	1
CHEM 3310	3 CHEM 3320	3
CHEM 3310L	1 CHEM 3320L	1
ENGL 2500	3 SOC 1340	3
KIN 2420	0.5 STAT 1010 or 1040	3-4
KIN 2580	2	
KIN 2850	1-2	
PSYCH 1010 or 2300	3	
17.5-18.5		14-15

Junior			Sophomore		
Fall	Credits Spring	Credits	Fall	Credits Spring	Credits
BBMB 4040	3 HS 3500	3	BIOL 2550	3 BIOL 2560	3
KIN 3660 or 3650	3 KIN 3550	3	BIOL 2550L	1 BIOL 2560L	1
KIN 3720	3 PHYS 1320	4	CHEM 3310	3 CHEM 3320	3
PHYS 1310	4 PHYS 1320L	1	CHEM 3310L	1 CHEM 3320L	1
PHYS 1310L	1 Electives	3	ENGL 2500	3 SOC 1340	3
SPCM 2120	3 Humanities/U.S. Cultures and Communities (formerly U.S. Diversity)	3	KIN 2420	0.5 STAT 1010 or 1040	3-4
			KIN 2580	2	
			KIN 2850	1-2	
			PSYCH 1010 or 2300	3	
	17	17			
			17.5-18.5		14-15

Senior			Junior		
Fall	Credits Spring	Credits	Fall	Credits Spring	Credits
ENGL 3020, 3140, or SPCM 3120	3 BIOL 3130, 3140, 3280, 3350, 3500, or BBMB 4050	3-4	BBMB 4040	3 BIOL 3130, 3140, 3280, 3350, 3500, or BBMB 4050	3-4
KIN 3580	3 Electives (3000+ Level Courses)	3	KIN 3660 or 3650	3 HS 3500	3
KIN 3590	1 KIN 4000 Level Courses *	9	KIN 3720	3 KIN 3550	3
KIN 3730	1		PHYS 1310	4 PHYS 1320	4
Electives (3000+ Level Courses)	2		PHYS 1310L	1 PHYS 1320L	1
Humanities/International Perspectives	3		SPCM 2120	3 Humanities/International Perspectives	3-4
Social Science Choice	3				
	16	15-16		17	17-19
			Senior		
			Fall	Credits Spring	Credits
			ENGL 3020, 3140, or SPCM 3120	3 KIN 4000 Level Courses *	9
			KIN 3580	3 Electives	3
			KIN 3590	1 Humanities/U.S. Cultures and Communities (formerly U.S. Diversity)	3
			KIN 3730	1	
			Electives (3000+ Level Courses)	3	
			Social Science Choice	3	
				14	15

* KIN 4000 Level Course Choices (9 cr): KIN 4580, 4620, 4660, 4670, 4720, 4730, 4800, HS 4640.

Kinesiology and Health, B.S. - Pre-Health Professions - Human Medicine

Freshman			Sophomore		
Fall	Credits Spring	Credits	Fall	Credits Spring	Credits
BIOL 2110	3 BIOL 2120	3	BIOL 2550	3 BIOL 2560	3
BIOL 2110L	1 BIOL 2120L	1	BIOL 2550L	1 BIOL 2560L	1
CHEM 1770	4 CHEM 1780	3	CHEM 3310	3 CHEM 3320	3
CHEM 1770L	1 CHEM 1780L	1	CHEM 3310L	1 CHEM 3320L	1
ENGL 1500	3 HS 1100	3	ENGL 2500	3 SOC 1340	3
KIN 2520	1 MATH 1650	4	KIN 2420	0.5 STAT 1010 or 1040	3-4
KIN 2530	1		KIN 2580	2	
LIB 1600	1		KIN 2850	1-2	
	15	15	PSYCH 1010 or 2300	3	

* KIN 4000 Level Course Choices (9 cr): KIN 4580, 4620, 4660, 4670, 4720, 4730, 4800, HS 4640.

Kinesiology and Health, B.S. - Pre-Health Professions - Occupational Therapy

Freshman

Fall	Credits Spring	Credits
BIOL 2110	3 BIOL 2120	3
BIOL 2110L	1 BIOL 2120L	1
ENGL 1500	3 KIN 2580	2
HS 1100	3 MATH 1400, 1430, 1450, or 1650	3-4
KIN 2520	1 SOC 1340	3
KIN 2530	1 Humanities/International Perspectives	3
LIB 1600	1	
PSYCH 1010	3	
	16	15-16

Sophomore

Fall	Credits Spring	Credits
BIOL 2550	3 BIOL 2560	3
BIOL 2550L	1 BIOL 2560L	1
CHEM 1630 or 1770	4 PHYS 1150 or 1310 <i>and</i> 1310L	4-5
CHEM 1630L or 1770L	1 Electives	3
ENGL 2500	3 Humanities/U.S. Cultures and Communities (formerly U.S. Diversity)	3
KIN 2420	0.5	
KIN 2850	1-2	
PSYCH 2300	3	
Elective	1	
	17.5-18.5	14-15

Junior

Fall	Credits Spring	Credits
KIN 3660 or 3650	3 FSHN 3670	1
KIN 3720	3 HS 3500	3
SPCM 2120	3 KIN 3550	3
STAT 1010 or 1040	3-4 PHIL 3310	3
Electives	3 Electives (3000+ Level Courses)	6
	15-16	16

Senior

Fall	Credits Spring	Credits
ENGL 3020, 3140, or SPCM 3120	3 KIN 4000 Level Courses *	9

KIN 3580	3 PSYCH, SOC, or Humanities Choice	3
KIN 3590	1 Elective	1
KIN 3730	1 Electives (3000+ Level Courses)	3
PSYCH 4600	3	
Electives (3000+ Level Courses)	3	
Electives	3	
	17	16

* KIN 4000 Level Course Choices (9 cr): KIN 4580, 4620, 4660, 4670, 4720, 4730, 4800, HS 4640.

Kinesiology and Health, B.S. - Pre-Health Professions - Optometry (Pharmacy)

Freshman

Fall	Credits Spring	Credits
BIOL 2110	3 BIOL 2120	3
BIOL 2110L	1 BIOL 2120L	1
CHEM 1770	4 CHEM 1780	3
CHEM 1770L	1 CHEM 1780L	1
ENGL 1500	3 HS 1100	3
KIN 2520	1 MATH 1650	4
KIN 2530	1	
LIB 1600	1	
	15	15

Sophomore

Fall	Credits Spring	Credits
BIOL 2550	3 BIOL 2560	3
BIOL 2550L	1 BIOL 2560L	1
CHEM 3310	3 CHEM 3320	3
CHEM 3310L	1 CHEM 3320L	1
ENGL 2500	3 SOC 1340	3
KIN 2420	0.5 Elective	1
KIN 2580	2 Humanities/U.S. Cultures and Communities (formerly U.S. Diversity)	3
KIN 2850	1-2	
PSYCH 1010 or 2300	3	
	17.5-18.5	15

Junior

Fall	Credits Spring	Credits
BBMB 4040	3 HS 3500	3

KIN 3660 or 3650	3 KIN 3550	3	KIN 2420	0.5 Electives	3
KIN 3720	3 PHYS 1320	4	KIN 2850	1-2 PSYCH Choice	3
PHYS 1310	4 PHYS 1320L	1	Humanities/U.S. Cultures	3	
PHYS 1310L	1 STAT 1010 or 1040	3-4	and Communities (formerly		
SPCM 2120	3 Electives (3000+ Level Courses)	3	U.S. Diversity)		
			16.5-17.5		15

Senior		17	17-18
Fall	Credits Spring		Credits
ENGL 3020, 3140, or SPCM 3120	3 KIN 4000 Level Courses*	9	
KIN 3580	3 MICRO 2010 or 3020	2-3	
KIN 3590	1 MICRO 2010L or 3020L	1	
KIN 3730	1 Electives (3000+ Level Courses)	3	
Humanities/International Perspectives	3		
Social Science Choice	3		
		14	15-16

* KIN 4000 Level Course Choices (9 cr): KIN 4580, 4620, 4660, 4670, 4720, 4730, 4800, HS 4640.

Kinesiology and Health, B.S. - Pre-Health Professions - Physical Therapy

Freshman

Fall	Credits Spring	Credits
BIOL 2110	3 BIOL 2120	3
BIOL 2110L	1 BIOL 2120L	1
ENGL 1500	3 KIN 2580	2
HS 1100	3 MATH 1430, 1450, or 1650	3-4
KIN 2520	1 PSYCH 1010	3
KIN 2530	1 Humanities/International Perspectives	3
LIB 1600	1	
SOC 1340	3	
		16
		15-16

Sophomore

Fall	Credits Spring	Credits
BIOL 2550	3 BIOL 2560	3
BIOL 2550L	1 BIOL 2560L	1
CHEM 1770	4 CHEM 1780	3
CHEM 1770L	1 CHEM 1780L	1
ENGL 2500	3 FSHN 3670	1

Junior

Fall	Credits Spring	Credits
KIN 3660 or 3650	3 HS 3500	3
KIN 3720	3 KIN 3550	3
PHYS 1310	4 PHYS 1320	4
PHYS 1310L	1 PHYS 1320L	1
SPCM 2120	3 PSYCH 4600	3
STAT 1010 or 1040	3-4 Electives (3000+ Level Courses)	3

		17-18	17

Senior

Fall	Credits Spring	Credits
ENGL 3020, 3140, or SPCM 3120	3 KIN 4000 Level Courses*	9
KIN 3580	3 Electives (3000+ Level Courses)	6
KIN 3590	1	
KIN 3730	1	
Electives (3000+ Level Courses)	6	
		14
		15

* KIN 4000 Level Course Choices (9 cr): KIN 4580, 4620, 4660, 4670, 4720, 4730, 4800, HS 4640.

Kinesiology and Health, B.S. - Pre-Health Professions - Physician Associate / Physician Assistant

Freshman

Fall	Credits Spring	Credits
BIOL 2110	3 BIOL 2120	3
BIOL 2110L	1 BIOL 2120L	1
CHEM 1770	4 CHEM 1780	3
CHEM 1770L	1 CHEM 1780L	1
ENGL 1500	3 HS 1100	3
KIN 2520	1 MATH 1400, 1430, 1450, or 1650	3-4
KIN 2530	1 PSYCH 1010	3

LIB 1600	1	
	15	17-18

Sophomore

Fall	Credits Spring	Credits
BIOL 2550	3 BIOL 2560	3
BIOL 2550L	1 BIOL 2560L	1
CHEM 2310 or 3310	3 SOC 1340	3
CHEM 2310L or 3310L	1 SPCM 2120	3
ENGL 2500	3 STAT 1010 or 1040	3-4
KIN 2420	0.5 Humanities/U.S. Cultures and Communities (formerly U.S. Diversity)	3
KIN 2580	2	
KIN 2850	1-2	
PSYCH 2300	3	

17.5-18.5 **16-17**

Junior

Fall	Credits Spring	Credits
BBMB 4040	3 BIOL 3130	3
HS 3500	3 BIOL 3130L	1
KIN 3660 or 3650	3 FSHN 3670	1
KIN 3720	3 PHYS 1150 or 1310 <i>and</i> 1310L	4-5
Humanities/International Perspectives	3 PSYCH 4600	3
	Electives	3

15 **15-16**

Senior

Fall	Credits Spring	Credits
ENGL 3020, 3140, or SPCM 3120	3 KIN 4000 Level Courses *	9
KIN 3550	3 Electives (3000+ Level Courses)	2
KIN 3580	3 Electives	3
KIN 3590	1	
KIN 3730	1	
MICRO 3020	3	
MICRO 3020L	1	
Elective	1	

16 **14**

* KIN 4000 Level Course Choices (9 cr): KIN 4580, 4620, 4660, 4670, 4720, 4730, 4800, HS 4640.

Minors

An undergraduate minor has the following requirements and understandings:

- All minors require at least 15 credits, including
 - at least 9 credits in courses numbered 2000 or above, of which at least 6 credits are in courses numbered 3000 or above.
 - at least 3 credits taken at Iowa State University.
 - at least 3 credits that are not used to meet any other department, college, or university requirement.
- Credits used to meet the minor requirements may also be used to satisfy the credit requirement for graduation and to meet credit requirements in courses numbered 3000 or above.
- Some students may have to exceed the graduation credit requirement set by their college in order to meet the requirements of both the minor and the major.
- Courses taken for a minor may not be taken on a pass-not pass basis.
- A student may not receive both an undergraduate major and a minor of the same name.

Dance

The minor requires a minimum of 15 credits.

At least 3 credits taken at Iowa State University.

At least 3 credits that are not used to meet any other requirements at the University.

Credits used to meet the minor requirements may also be used to satisfy the credit requirement for graduation and to meet credit requirements in courses numbered 3000 or above.

Courses can not be taken pass-not pass to count for the Dance Minor.

Participation in Orchesis I and II is recommended.

The minor may be earned by completing the following:

Pick at least 6 credits:

DANCE 3200	Sound and Movement	3
DANCE 3600	History and Philosophy of Dance	3
DANCE 3700	Advanced Studies in Dance	1
DANCE 3840	Teaching Children's Dance	2
DANCE 3850	Methods of Teaching Dance	2
DANCE 3860	Teaching Dance Technique and Composition	2

DANCE 4900	Independent Study	1
Pick 9 credits (can include courses from the above list):		
DANCE 2200	Modern Dance Composition	2
DANCE 2220	Modern Dance II	1
DANCE 2230	Modern Dance III	1
DANCE 2240	Concert and Theatre Dance	0.5-2
DANCE 2320	Ballet II	1
DANCE 2330	Ballet III	1
DANCE 2420	Jazz II	1
DANCE 2500	Yoga Movement	1
DANCE 2700	Dance Appreciation	3

Exercise Science

The minor requires a minimum of 18 credits and may be earned by completing the following:

KIN 2580	Principles of Physical Fitness and Conditioning	2
KIN 3580	Exercise Physiology	3
KIN 3590	Exercise Physiology Lab	1
KIN 3660	Exercise Psychology	3
KIN 4580	Principles of Fitness Assessment and Exercise Prescription	4
5 cr. from the following		
ATR 2200	Basic Athletic Training	2
KIN 2590	Leadership Techniques for Fitness Programs	3
KIN 2660	Strength Training and Conditioning	2
KIN 3450	Management of Health-Fitness Programs and Facilities	3
KIN 4620	Medical Aspects of Exercise	3
KIN 4670	Exercise and Health: Behavior Change	3

Health Promotion

The minor requires a minimum of 15 credits and may be earned by completing the following:

HS 1100	Personal and Consumer Health	3
HS 3500	Human Diseases	3
HS 3800	Worksite Health Promotion	3
HS 3100	Community and Public Health	3
Choose one from the following:		
HS 3050	Instructor's First Aid and Cardiopulmonary Resuscitation	2
HS 4300	Community Health Program Development	3
HS 4640	Physical Activity Epidemiology	3
KIN 4670	Exercise and Health: Behavior Change	3

Kinesiology

The minor requires a minimum of 16 credits and may be earned by completing the following: (For non-majors only)

KIN 3550	Biomechanics	3
KIN 3580	Exercise Physiology	3
KIN 3590	Exercise Physiology Lab	1
KIN 3600	Sociology of Physical Activity and Health	3
KIN 3720	Motor Control and Learning Across the Lifespan	3
KIN 3650	Sport Psychology	3
or KIN 3660	Exercise Psychology	

Gerontology

The department participates in the interdepartmental minor in gerontology (see Index).

Health Coach Certificate

Students pursuing a bachelor's degree in kinesiology can seek additional credentials through the Health Coach Certificate. More information on the certificate can be found at: [Health Coach Certificate](#).

The Kinesiology Department offers two concurrent undergraduate and graduate programs.

B.S./M.A.T.R. degree in Athletic Training

Certified Athletic Trainers are allied medical health professionals who specialize in the prevention, assessment, treatment and rehabilitation of injuries to athletes and physically active individuals who are engaged in physical and athletic activities. To gain certification, candidates must graduate from a CAATE accredited athletic training education program and successfully pass the Board of Certification (BOC) examination.

In addition to BOC certification, many states also have licensure requirements to practice athletic training. The Athletic Training program at Iowa State University, accredited since 2001 has transitioned to the new M.A.T.R. degree program, which includes various athletic training clinical rotations including high school, physical therapy clinics, surgical observation experiences, and emergency room observation.

More information on the B.S./M.A.T.R. degree in Athletic Training.

B.S./M.S. DEGREE IN DIET AND EXERCISE

A combined Bachelor of Science and Master of Science (B.S./M.S.) degree in Diet and Exercise is available. The program is jointly administered by the Department of Food Science and Human Nutrition (FSHN), and the Department of Kinesiology. Students interested in this program must enroll as freshmen in the Pre-Diet and Exercise program. In the fall of the junior year, students will apply for admission to the B.S./M.S. program. Students not accepted into the program will continue toward completion of a B.S. degree in Dietetics or Kinesiology & Health. Coursework has been designed to facilitate a 4-year graduation date for those students not accepted into the program and electing to complete

a single undergraduate degree. Students accepted into the program will progress toward completion of B.S./M.S. degrees in Diet and Exercise. More information can be found at: <https://fshn.hs.iastate.edu/find-your-major/diet-and-exercise/>. (<https://fshn.hs.iastate.edu/find-your-major/diet-and-exercise/>)

Graduate Study

The Department of Kinesiology graduate program seeks to integrate discovery and learning by preparing graduate students to understand and create basic and applied knowledge in the study of physical activity, exercise and sport. The normal prerequisite to major graduate work is the satisfactory completion of a curriculum essentially equivalent to that required of undergraduate students in kinesiology at this university. However, it is possible for students to qualify for graduate study if undergraduate preparation has been in a related area.

Students in the M.S. and Ph.D. degrees are required to complete original research and write a thesis or dissertation. There is a non-thesis degree option for M.S. students requiring more coursework and an internship experience or other creative component. Specific information about the requirements for these degree options is available from the department office or from the department web site (<http://www.kin.hs.iastate.edu/graduate>).

Nursing OVERVIEW

The Bachelor of Science in Nursing (BSN) program at Iowa State University is a RN-to-BSN program, designed for those who have obtained an associate degree in nursing or are eligible for NCLEX, and desire to further their nursing career and education to the next level. Iowa State's RN-to-BSN program provides interactive learning opportunities where students can apply their real-world experiences and education to inspire innovation in their places of care. RN-to-BSN students will acquire knowledge, skills, and experience in four essential areas: research, leadership, population health, and self-care/health promotion. The program emphasizes providing professional, cultural, and ethically congruent care that respects the dignity and uniqueness of individuals and groups in diverse populations and locations.

The Nursing program of study is not offered as an additional major, it is only offered as a full degree program. Students pursuing the Nursing degree program are allowed to pursue additional majors in other eligible programs of study if desired.

The baccalaureate nursing program at Iowa State University of Science and Technology located in Ames, Iowa is approved by the:

Iowa Board of Nursing (IBON)

6200 Park Ave. #100

Des Moines, IA 50321

The baccalaureate nursing program at Iowa State University of Science and Technology located in Ames, Iowa is accredited by the:

Accreditation Commission for Education in Nursing (ACEN)

3390 Peachtree Road NE, Suite 1400

Atlanta, GA 30326

(404) 975-5000

The most recent accreditation decision made by the ACEN Board of Commissioners for the baccalaureate nursing program is initial accreditation.

View the public information disclosed by the ACEN regarding this program at <http://www.acenursing.com/accreditedprograms/programSearch.htm>

Student Learning Outcomes

Upon graduation, students should be able to:

1. Synthesize theory and concepts from the arts and humanities, natural and social sciences, and nursing as a professional holistic practice and scientific discipline.
2. Engage in professional, culturally sensitive, compassionate, and ethically congruent care that reflects the dignity and uniqueness of individuals and groups in diverse populations and settings that seek to understand their lived experiences and connections to others.
3. Utilize information processes and technology to improve communication, address health literacy, manage knowledge, reduce errors, and support decision-making that assists in delivering optimal care for diverse individuals, families, and communities.
4. Translate research findings to support evidence-based, competent, safe, and effective nursing care to individuals, families, and communities in diverse settings across the lifespan.
5. Demonstrate a commitment to professionalism and professional identity that embodies the values and characteristics of nursing while incorporating the concepts of self-reflection, well-being, and continuous learning.
6. Examine the interconnection amongst the healthcare delivery continuum, including collaborative activities among stakeholders that impact equitable health outcomes through systems thinking, health promotion, and ethical response initiatives.
7. Develop personal, professional, and leadership skills with a commitment to personal growth, expansion of professional knowledge and expertise, and emboldens leadership practice in the healthcare industry.

8. Analyze how social, cultural, and environmental determinants of health and social structure interact to affect access, provision of care, and health outcomes at local, regional, national, and global levels to improve population health while instilling a sense of global citizenship and ethical responsibility.

RN-to-BSN Admissions Criteria

Applications for the RN-to-BSN program are individually reviewed.

Minimum requirements for admission to the BSN program include:

- Licensed as registered nurse or NCLEX eligible
- Meet all Iowa State University admission criteria for transfer students
- Official college transcripts from all colleges and universities attended
- Minimum of 2.5 cumulative GPA for all college coursework
- Achievement of minimum "C" (not C-) for all prerequisite courses listed below

English Composition I and II (ENGL 1500 and ENGL 2500 equivalent)

Introduction to Chemistry (CHEM 1630 or CHEM 1T equivalent)

Statistics (STAT 1010 or STAT 1040 equivalent)

Introduction to Human Nutrition (FSHN 1670 equivalent)

Introduction to Sociology (SOC 1340 equivalent)

RN-to-BSN Progression Criteria

- Must earn a "C" grade or better in all NRS courses and meet the university's academic standards for progress toward a degree

RN-to-BSN Graduation Requirements

- At least 32 credits earned in residence at Iowa State University, and the final 32 credits taken through Iowa State University prior to graduation.
- All general education requirements at Iowa State University must be met.
- The BSN curriculum consists of 24 credits of NRS courses, 5 credits of FSHN courses, and 3 elective credits for a total of 32 credits in addition to prerequisite coursework.
- Electives are selected by students to meet identified career interests, and total elective credits needed will vary based on individual transfer credits.
- Minimum credits for graduation is 120 credits.

International Perspectives: 3 cr.

U.S. Cultures and Communities: 3 cr.

Communications and Library: 10 cr.

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
LIB 1600	Introduction to College Level Research	1
Oral Communication course, select from:		3

COMST 2140 Professional Communication

SPCM 2120 Fundamentals of Public Speaking

Humanities and Social Sciences: 3 cr.

SOC 1340 Introduction to Sociology 3

College of Health and Human Sciences Students Only: Additional Humanities and Social Sciences: 9 cr.

Humanities courses from approve list ¹ 6

Humanities or social science course 3

College of Agriculture & Life Science Students Only: Additional Humanities and Social Sciences: 6 cr.

Humanities course from approved list ¹ 3

Ethics course from approved list ² 3

¹ Approved Humanities course list (<https://www.cals.iastate.edu/student-services/humanities/>)

² Approved Ethics course list (<https://www.cals.iastate.edu/student-services/ethics/>)

Math, Physical, & Biological Sciences: 7-8 cr.

Statistics course, select from: 3-4

STAT 1010	Principles of Statistics	
STAT 1040	Introduction to Statistics	
CHEM 1630	College Chemistry	4

Total Credits 7-8

College of Agriculture & Life Sciences students only: Additional Math, Physical & Biological Sciences: 7-8 crs.

Select math course: MATH 1400, MATH 1430, MATH 1450, 3-4
MATH 1500, MATH 1510, MATH 1600, or MATH 1650

Select biology course: BIOL 1010, BIOL 2110, or BIOL 2120 3

CHEM 1630L Laboratory in College Chemistry 1

Total Credits 7-8

Nursing Courses: 24 cr.

NRS 2500	Introduction to BSN Nursing	1
NRS 3200	Essential Concepts for Professional Nursing Practice	3
NRS 3400	Nursing Research and Evidence-Based Practice	4
NRS 3600	Nursing Leadership and Management	3
NRS 4200	Promoting a Culture of Health and Wellness	3
NRS 4400	Population Health Nursing [†]	3
NRS 4420	Population Health Nursing Practicum	1
NRS 4700	Global Health Nursing [‡]	3
NRS 4800	Advanced Concepts of Professional Nursing	3

Total Credits 24

† May fulfill the U.S. Cultures and Communities requirement - check current list

‡ May fulfill the International Perspectives requirement - check current list

Select at least 3.0 credits of elective: 3 cr.

Nutrition: 5 cr.

FSHN 3650	Obesity and Health	3
FSHN 4300	U.S. Health Systems and Policy	2
Total Credits		5

Electives: Select from any university coursework to earn at least ≥ 120 total credits prior to graduation.

Total credits for Nursing major = 32

Full-Time Enrollment Option

First Year

Fall	Credits Spring	Credits
NRS 2500	1 NRS 4400	3
NRS 3200	3 NRS 4420 (Select from:)*	1
NRS 3400	4 A - Local	
NRS 3600	3 B - Pine Ridge	
NRS 4200	3 C - Norway	
FSHN 4300**	2 D - Cambodia	
	NRS 4700	3
	NRS 4800	3
	FSHN 3650**	3
	Elective as needed**	3
16		16

Total Credits: 32

Part-Time Enrollment Option

First Year

Fall	Credits Spring	Credits
NRS 2500	1 NRS 4700	3
NRS 3400	4 FSHN 3650**	3
NRS 4200	3 Elective as needed	3
8		9

Second Year

Fall	Credits Spring	Credits
NRS 3200	3 NRS 4400	3
NRS 3600	3 NRS 4420 (Select from:)*	1
FSHN 4300	2 A - Local	
	B - Pine Ridge	
	C - Norway	
	D - Cambodia	

NRS 4800	3
8	7

Total Credits: 32

* Denotes Practicum Courses.

** Denotes courses that may be taken before starting the nursing program.

Plan of study does not include any unmet ISU general education requirements.

Nutritional Science (HHSCI)

Nutritional science looks at the connection between diet and health.

Students learn how diet can play a crucial role in the cause, treatment, and prevention of many diseases. The pre-health and research coursework in the degree program prepares students for work in research laboratories, graduate study in nutrition or biological sciences, or entrance into health professional programs, such as medical, dental, physician assistant, and pharmacy schools. Students gain a strong science education along with human nutrition expertise.

The department also offers a nutrition minor.

Student Learning Outcomes

Upon graduation, students should be able to:

- Communicate effectively in their field of study using written, oral, visual and/or electronic forms.
- Demonstrate proficiency in ethical data collection and interpretation, literature review and citation, critical thinking and problem solving.
- Participate effectively in a group or team.
- Integrate creativity, innovation, or entrepreneurship in ways that produce value.
- Explain how human activities impact the natural environment and how societies are affected.
- Meet program specific learning outcomes for the Nutritional Science major.

The department also offers a nutrition minor.

Degree Requirements

Administered by the Department of Food Science and Human Nutrition

Total Degree Requirement: 120 cr.

Students must fulfill International Perspectives and U.S. Cultures and Communities requirements by selecting coursework from approved lists. These courses may also be used to fulfill other area requirements. Only 65 cr. from a two-year institution may apply to the degree which may include up to 16 technical cr.; 9 P-NP cr. of electives; 2.00 minimum GPA.

International Perspectives: 3 cr.**U.S. Cultures and Communities: 3 cr.****Communications and Library: 13 cr.**

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
Select from:		3
ENGL 3020	Business Communication	
ENGL 3090	Proposal and Report Writing	
ENGL 3140	Technical Communication	
LIB 1600	Introduction to College Level Research	1
SPCM 2120	Fundamentals of Public Speaking	3

Total Credits **13**

Humanities and Social Sciences: 6-12 cr.

Select Humanities courses from approved list	3
Select Social Science course from approved list	3
If CHHS student, select:	6
Additional Humanities course	
Additional Humanities or Social Science course	

Ethics: 3 cr.

FSHN 3420	World Food Issues: Past and Present	3

Mathematical Sciences: 6-12 cr.

Select at least 3 credits from:	3-8
MATH 1400	College Algebra
MATH 1430	Preparation for Calculus
MATH 1600	Survey of Calculus
MATH 1650	Calculus I
MATH 1650 & MATH 1660	Calculus I and Calculus II
Select at least 3 credits from:	3-4
STAT 1010	Principles of Statistics
STAT 1040	Introduction to Statistics

Total Credits **6-12**

Physical Sciences: 13 cr.

CHEM 1770	General Chemistry I	4
CHEM 1770L	Laboratory in General Chemistry I	1
CHEM 1780	General Chemistry II	3
CHEM 1780L	Laboratory in College Chemistry II	1
CHEM 2310	Elementary Organic Chemistry	3
or CHEM 3310	Organic Chemistry I	
CHEM 2310L	Laboratory in Elementary Organic Chemistry	1
or CHEM 3310L	Laboratory in Organic Chemistry I	

Total Credits **13**

Biological Sciences: 24-29 cr.

BIOL 2110	Principles of Biology I	3
BIOL 2110L	Principles of Biology Laboratory I	1
BIOL 2120	Principles of Biology II	3
BIOL 2120L	Principles of Biology Laboratory II	1
BIOL 2550	Fundamentals of Human Anatomy	3
BIOL 2550L	Fundamentals of Human Anatomy Laboratory	1
Select at least 3 credits from:		3-4
BIOL 2560 & 2560L	Fundamentals of Human Physiology and Fundamentals of Human Physiology Laboratory	
or BIOL 335C	Principles of Human and Other Animal Physiology	
BIOL 3130	Principles of Genetics	3
Select at least 3 credits from:		3-6
BBMB 3010	Survey of Biochemistry	
BBMB 3160	Principles of Biochemistry	
BBMB 4040 & BBMB 4050	Biochemistry I and Biochemistry II	
MICRO 2010	Introduction to Microbiology	2-3
or MICRO 3020	Biology of Microorganisms	
MICRO 2010L	Introductory Microbiology Laboratory	1
or MICRO 3020L	Microbiology Laboratory	

Total Credits **24-29**

Food Science and Human Nutrition: 31 cr.

FSHN 1100	Professional and Educational Preparation	1
FSHN 1670	Introductory Human Nutrition and Health	3
FSHN 2650	Metabolism, Nutrition and Health	3
FSHN 2670	Clinical Perspectives on Nutrition	1
FSHN 3600	Advanced Nutrition and the Regulation of Metabolism in Health and Disease	3
FSHN 3610	Nutrition and Health Assessment	2
FSHN 3620	Nutrition and Health Throughout the Lifecycle	3
FSHN 4670	Molecular Basis of Nutrition in Disease Etiology and Health Promotion	3
FSHN 4920	Research Concepts in Human Nutrition	2
Select at least 10 additional credits from:		10
FSHN 2030	Contemporary Issues in Food Science and Human Nutrition	
FSHN 2140 & FSHN 2150	Scientific Study of Food and Advanced Food Preparation Laboratory (or FSHN 1150 lab)	
FSHN 2420	The US Food System	
FSHN 3010	Nutrigenomics: From Basic Science to Translational Impact	

FSHN 3640	Nutrition and Prevention of Chronic Disease	
FSHN 3650	Obesity and Health	
FSHN 3670	Medical Terminology for Health Professionals	
FSHN 4300	U.S. Health Systems and Policy	
FSHN 4600	Global Nutrition, Health and Sustainability	
FSHN 4610	Medical Nutrition and Disease I	
FSHN 4630	Community Nutrition and Health	
FSHN 4640	Medical Nutrition and Disease II	
FSHN 4660	Nutrition Counseling and Education Methods	
FSHN 4900C	Independent Study: Nutrition	
FSHN 4990	Undergraduate Research	
NUTRS 5040	Nutrition and Epigenetic Regulation of Gene Expression	
BIOL 3140	Principles of Molecular Cell Biology	
CHEM 3320	Organic Chemistry II	
CHEM 3320L	Laboratory in Organic Chemistry II	
PHYS 1310 & 1310L	General Physics I and General Physics I Laboratory	
	or PHYS 231 Introduction to Classical Physics I and Introduction to Classical Physics I Laboratory	
	& 2310L	
PHYS 1320 & 1320L	General Physics II and General Physics II Laboratory	
	or PHYS 2320 Introduction to Classical Physics II and Introduction to Classical Physics II Laboratory	
	& 2320L	
Total Credits		31

Electives: 2-24 cr. Select from any university coursework to earn at least 120 total credits. Students planning to apply to health professional programs should review entrance requirements and select appropriate courses as electives.

Go to FSHN courses.

Nutritional Science, B.S.

First Year

Fall	Credits Spring	Credits
FSHN 1100	1 FSHN 1670	3
CHEM 1770	4 CHEM 1780	3
CHEM 1770L	1 CHEM 1780L	1
BIOL 2110	3 BIOL 2120	3
BIOL 2110L	1 BIOL 2120L	1
ENGL 1500	3 MATH 1400, 1430, 1600, or 1650	3-4
LIB 1600	1	

Humanities	3	
	17	14-15

Second Year

Fall	Credits Spring	Credits
CHEM 2310 or 3310	3 FSHN 2650	3
CHEM 2310L or 3310L	1 FSHN 2670	1
BIOL 3130	3 BBMB 3010 or 3160, or BBMB 4040 and 4050 the next year	3
STAT 1010 or 1040	3-4 Social Science	3
ENGL 2500	3 Humanities (CHHS) or elective	3
SPCM 2120	3 Elective *	2
	16-17	15

Third Year

Fall	Credits Spring	Credits
BIOL 2550	3 BIOL 2560 and 2560L, or 3350	3-4
BIOL 2550L	1 FSHN 3610	2
FSHN 3600	3 FSHN 3620	3
FSHN 3420	3 Humanities/Social Sci. (CHHS) or elective (CALS) *	3
MICRO 2010 or 3020	2-3 Additional course from approved list **	3
MICRO 2010L or 3020L	1	
Elective *	3	
	16-17	14-15

Fourth Year

Fall	Credits Spring	Credits
FSHN 4920	2 FSHN 4670	3
Additional course from approved list **	3 ENGL 3020, 3090, or 3140	3
Additional course from approved list **	3 U.S. Cultures and Communities (if not already taken) or elective *	3
Additional course from approved list **	1 Elective *	3-4
Elective *	3 Elective *	3
Elective *	3	
	15	15-16

* Choose elective courses to total equal to or greater than 120 credits.

** Select at least 10 additional credits from: BIOL 3140; CHEM 3320, CHEM 3320L; FSHN 2140 with lab (FSHN 1150 or FSHN 2150);

FSHN 2030, FSHN 2420, FSHN 2670X, FSHN 3010, FSHN 3640, FSHN 3650, FSHN 3670, FSHN 4300, FSHN 4600, FSHN 4610, FSHN 4630, FSHN 4640, FSHN 4660, FSHN 4900C, FSHN 4990; NUTRS 5040; PHYS 1310 or PHYS 2310/PHYS 2310L; PHYS 1320 or PHYS 2320/PHYS 2320L.

Note: This sequence is only an example. The number of credits taken each semester should be based on the individual student's situation. Factors that may affect credit hours per semester include student ability, employment, health, activities, and grade point consideration.

More information on the Nutrition minor can be found here: <http://catalog.iastate.edu/collegeofagricultureandlifesciences/foodscienceandhumannutrition/#undergraduateminortext>.

The Department of Food Science and Human Nutrition offers a Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) in Nutritional Sciences. More information can be found here: <https://www.grad-college.iastate.edu/academics/programs/apresults.php?id=84>.

Professional Practice in Dietetics

Master of PROFESSIONAL PRACTICE IN DIETETICS (M.P.P.D)

The Department of Food Science and Human Nutrition offers a 30-credit, non-thesis, online, professional master's degree with two possible tracks. Track 1 (RD2B track) is for individuals who are interested in becoming Registered Dietitian Nutritionists and track 2 (DI track) is for graduates of a dietetic internship (DI) who wish to earn a master's degree. Students interested in further graduate study (PhD) may require additional coursework and/or research beyond the M.P.P.D to gain admission into a doctoral program.

The RD2B track is accredited by the Accreditation Council for Education in Nutrition and Dietetics (ACEND). Admission requirements for this M.P.P.D track include successful completion of at least a Bachelor's degree and a verification statement from any ACEND accredited didactic program in dietetics (DPD). A minimum GPA of 3.0 (on a 4.0 scale) both overall and in the DPD are desired. A professional goal statement (≤ 750 words), three letters of recommendation from faculty, work supervisors or those who can attest to the applicant's ability to succeed in an online program in the field of dietetics are also required. Students in the DI track, must have successfully completed a graduate DI and may be eligible to transfer some of these graduate DI courses towards the M.P.P.D. The Graduate Record Examination (GRE) is not required for either track.

More information on the program can be found here: <https://www.grad-college.iastate.edu/academics/programs/apresults.php?id=140>.

School of Education

Ann Gansemer-Topf, Director of the School of Education

School of Education (<http://www.education.iastate.edu>)

The School of Education at Iowa State University is committed to engaging in rigorous and socially meaningful research. We are preparing leaders and practitioners across the P-20 continuum who support rich, equitable learning opportunities for all students. Supporting public education as a cornerstone of a healthy, vibrant, and just society, the School of Education strives to be a national leader in educational theory, policy, and practice, as we honor the land-grant tradition and the broader mission of the university to serve the people of Iowa.

Undergraduate Study

Early Childhood Education – Unified
 Elementary Education
 K-12 and Secondary Education
 Secondary Major in Education
 Non-Secondary Major Programs
 Education Studies, B.S.
 Learning Technologies Minor

The School of Education provides the professional education coursework to support the completion of the Educator Preparation Program. Program completers can then be recommended for licensure to the Iowa Board of Education Examiners. Majors offered in the School include **Elementary Education (K-6)**, and **Early Childhood Education-Unified (birth through third grade, inclusive)**. The Early Childhood Education-Unified major is an interdepartmental program administered by the School of Education and the Department of Human Development and Family Studies. In addition, the School of Education offers the secondary major in Education. This secondary major is available to candidates pursuing English Education, History/Social Sciences Education, Mathematics Education, Science Education, and World Languages and Cultures Education.

Undergraduate students who are interested in teaching at the secondary level (5-12) or at the K-12 level major in a specific discipline and either pursue the secondary major in Education or complete additional required educational coursework in the School of Education and the department to complete the Educator Preparation Program. K-12 and secondary education programs include: Agriculture Education, English Education, Family and Consumer Sciences Education, Health Education, History-Social Sciences Education, Mathematics Education, Music Education, Physical Education, Science Education (Biology, Chemistry, Earth Science, and Physics), and World Languages and Cultures Education (French, German, and Spanish).

In addition to being admitted to Iowa State University and departmental programs/majors, educator preparation candidates must be admitted to the Educator Preparation Program prior to beginning advanced coursework.

Educator Preparation Program Admission Requirements are provided in Educator Preparation Policy.

- Decision Point 1 - Admission to the Educator Preparation Program (<https://iastate.box.com/s/f2xplqjfa805a9imk8wyr7dem9vjabz4/>)
- Decision Point 1 - Early Admission to the Educator Preparation Program for Transfer Students (<https://iastate.box.com/s/saysyv1to63q0bzwvtwzwtsp3s5kxl2/>)

In order to be eligible for student teaching, candidates must have completed all degree program requirements and specific coursework.

- Decision Point 2 - Requirements Students Must Meet Prior to Student Teaching (<https://iastate.box.com/s/r1301lpd66te2lq53gzsebga3q9jn1c/>)

In order to be recommended for licensure, candidates must have completed all degree program requirements and be considered an educator preparation program completer.

- Decision Point 3 - Recommendation for Licensure (<https://iastate.box.com/s/lxzqk584p9y4e4zgck631cwns111qjq0/>)

All Educator Preparation Program candidates must complete the professional core coursework (information found under each program) and required pedagogy and field experience coursework for their program. In addition, all prospective teachers are required to meet general education requirements as a part of their preparation. They must complete studies in the following general education groups. General education courses may be found in many departments. Credits listed are minimum requirements. Specific departments and/or colleges may require specific coursework to meet these requirements or additional credits. Credits used to satisfy these general education requirements typically satisfy department and college general education requirements:

For Educator Preparation general education requirements, please visit the School of Education website: <https://education.iastate.edu/current-students/educator-preparation-program/resources/curriculum-requirements/>.

Early Childhood Education – Unified

The curriculum in Early Childhood Education – Unified prepares graduates to teach young children and work with their families. This program leads to careers working with young children (both those who are typically developing and those with special needs) from birth through third grade, inclusive. Program completers who apply for licensure are recommended for licensure to the Iowa Board of

Educational Examiners. Individuals who are licensed may be employed by either public or private agencies or schools to teach in early childhood classrooms (preschool through 3rd grade) or in home-based programs. The program is an interdepartmental major administered by the Department of Human Development and Family Studies and the School of Education. For more information about the program, see Early Childhood Education - Unified Curriculum <https://hdfs.hs.iastate.edu/find-your-major/early-childhood-education/>.

Students who enroll in the early childhood education – unified program must apply to and be accepted into the Educator Preparation Program prior to enrolling in advanced courses. Admission requirements can be found at: <https://www.education.iastate.edu/educator-prep-program/admission/>.

Early Childhood Education majors must complete all of the required degree curriculum. This can be found at: http://catalog.iastate.edu/collegeofhumansciences/earlychildhood_education/

Candidates must receive a minimum of a “C” in all education (EDUC), human development and family studies (HDFS), special education (SPED) courses and all content-specific pedagogy/methods courses required for program completion and endorsement completion.

Candidates must receive a minimum of a “C-” in all major department courses/content courses required for teacher program completion and endorsement completion (content coursework).

Candidates can pursue an additional endorsement in K-8 reading. Information about this endorsement can be found at: <https://iastate.app.box.com/s/m4tr3ogr9ouwmiubz5dhv9catyr2jqf> (<https://iastate.app.box.com/s/m4tr3ogr9ouwmiubz5dhv9catyr2jqf/>)

Contact an Early Childhood Education academic advisor for additional information.

Elementary Education

The undergraduate curriculum in elementary education leads to the Bachelor of Science degree. The curriculum in elementary education is designed for candidates preparing to teach at the elementary school level. This program leads to careers in working with school-aged children in kindergarten through sixth grade. Program completers who apply for licensure are recommended for licensure to the Iowa Board of Educational Examiners. Individuals who are licensed will be qualified to teach in elementary classrooms in either public or private schools. Elementary Education majors must complete all of the required degree curriculum. This can be found at: <http://catalog.iastate.edu/collegeofhumansciences/elementaryeducation/>

Candidates must receive a minimum of a “C” in all education (EDUC), human development and family studies (HDFS), special education (SPED)

courses and all content-specific pedagogy/methods courses required for program completion and endorsement completion.

Candidates must receive a minimum of a “C-” in all major department courses/content courses required for teacher program completion and endorsement completion (content coursework).

In addition to pursuing a degree in Elementary Education, candidates are required to pursue an endorsement in at least one additional area. Candidates will be prepared to teach students in grades kindergarten through eighth grade in this area. Endorsements in the following areas are available for elementary education majors:

- K-8 English/Language Arts & Reading
- K-12 English as a Second Language (ESL)
- K-8 Health
- K-8 Mathematics
- K-8 Science
- K-8 Social studies
- K-8 Special education (Instructional Strategist I: Mild/Moderate Disabilities K-8)

Candidates can pursue additional endorsements in any of the above listed areas and in the following areas:

- K-8 Reading
- K-12 Coaching
- 5-8 Algebra for HS Credit

Information about these additional endorsements can be found at: <https://iastate.app.box.com/s/m4tr3ogr9ouwmibz5dhv9catryr2jqf/> (<https://iastate.app.box.com/s/m4tr3ogr9ouwmibz5dhv9catryr2jqf/>) Contact an Elementary Education academic advisor for additional information.

In addition to being admitted to Iowa State University and departmental programs/majors, educator preparation candidates must be admitted to the Educator Preparation Program prior to beginning advanced coursework.

Educator Preparation Program Admission Requirements are provided in Educator Preparation Policy.

- Decision Point 1 - Admission to the Educator Preparation Program (<https://iastate.box.com/s/f2xplqjfa805a9imk8wyr7dem9vjabz4/>)
- Decision Point 1 - Early Admission to the Educator Preparation Program for Transfer Students (<https://iastate.box.com/s/saysyv1to63q0bzwvtwzwtsp3s5kxl2/>)

In order to be recommended for licensure, candidates must have completed all degree program requirements and be considered an educator preparation program completer.

- Decision Point 3 - Recommendation for Licensure (<https://iastate.box.com/s/lxzqk584p9y4e4zgck631cwns111jqj0/>)

K-12 and Secondary Education

Students wanting to pursue K-12 or Secondary Teacher Education major in the content area in which they want to focus. They then pursue one of two options depending upon their program: 1) complete the secondary major in Education or 2) complete additional coursework required to complete the Educator Preparation Program. Program completers who apply for licensure are recommended to the Iowa Board of Educational Examiners.

In addition to being admitted to Iowa State University and departmental programs/majors, educator preparation candidates must be admitted to the Educator Preparation Program prior to beginning advanced coursework.

Educator Preparation Program Admission Requirements are provided in Educator Preparation Policy.

- Decision Point 1 - Admission to the Educator Preparation Program (<https://iastate.box.com/s/f2xplqjfa805a9imk8wyr7dem9vjabz4/>)
- Decision Point 1 - Early Admission to the Educator Preparation Program for Transfer Students (<https://iastate.box.com/s/saysyv1to63q0bzwvtwzwtsp3s5kxl2/>)

Candidates must receive a minimum of a “C” in all education (EDUC), human development and family studies (HDFS), special education (SPED) courses and all content-specific pedagogy/methods courses required for program completion and endorsement completion.

Candidates must receive a minimum of a “C-” in all major department courses/content courses required for teacher program completion and endorsement completion (content coursework).

In order to be eligible for student teaching, candidates must have completed all degree program requirements and specific coursework.

- Decision Point 2 - Requirements Students Must Meet Prior to Student Teaching (<https://iastate.box.com/s/rl301lpd66te2lq53gzsebgza3q9jn1c/>)

In order to be recommended for licensure, candidates must have completed all degree program requirements and be considered an educator preparation program completer.

- Decision Point 3 - Recommendation for Licensure (<https://iastate.box.com/s/lxzqk584p9y4e4zgck631cwns111jqj0/>)

Secondary Major in Education

A secondary major in Education at Iowa State University prepares candidates to teach at the middle school and high school levels. K-12/Secondary Educator Preparation Programs eligible to pursue the secondary major in Education are:

- English Education
- History/Social Sciences Education - History
- History/Social Sciences Education - Political Science
- Mathematics Education
- Science Education – Biology
- Science Education – Chemistry
- Science Education – Earth Science
- Science Education – Physics
- World Languages and Cultures Education – French
- World Languages and Cultures Education – German
- World Languages and Cultures Education – Spanish

Secondary majors in education must complete all of the required degree curriculum. This can be found at: <http://www.catalog.iastate.edu/collegeofhumansciences/educationsecondary/>

Additional Endorsements and Minors

Candidates pursuing the secondary major in Education have the opportunity to pursue additional endorsements and minors:

- K-12 Coaching Endorsement
- K-12 English as a Second Language Endorsement
- 5-12 Reading Endorsement
- Additional Science Endorsements
 - 5-12 Basic Science
- Additional Social Sciences Endorsements
 - 5-12 American Government
 - 5-12 Anthropology
 - 5-12 Social Sciences - Basic
 - 5-12 Economics
 - 5-12 Psychology
 - 5-12 Sociology
- 5-12 Speech and Theatre Endorsement

(See <https://education.iastate.edu> for additional information)

- Learning Technologies Minor

(See <https://education.iastate.edu/find-your-major/learning-technologies-minor/>)

Specific program requirements can be found within each department that houses the endorsement. Information on K-12 Coaching, K-12 English as a Second Language, and 5-12 Reading can be found at: <https://iastate.app.box.com/s/m4tr3ogr9ouwmiubz5dhv9catryr2jqf> (<https://iastate.app.box.com/s/m4tr3ogr9ouwmiubz5dhv9catryr2jqf/>)

Curriculum in secondary major in Education

Educator Preparation Program Admission Requirements

In addition to being admitted to Iowa State University and departmental programs/majors, educator preparation candidates must be admitted to the Educator Preparation Program prior to beginning advanced coursework.

Educator Preparation Program Admission Requirements are provided in Educator Preparation Policy.

- Decision Point 1 - Admission to the Educator Preparation Program (<https://iastate.box.com/s/lxzk584p9y4e4zgck631cwns111jqj0/>)
- Decision Point 1 - Early Admission to the Educator Preparation Program for Transfer Students (<https://iastate.box.com/s/saysyv1to63q0bzwvtwzwtsp3s5kxl2/>)

In order to be eligible to student teach (EDUC 417), candidates must have completed all degree program requirements and content specific coursework.

- Decision Point 2 - Requirements Students Must Meet Prior to Student Teaching (<https://iastate.box.com/s/r1301lpd66te2lq53gzsebgza3q9jn1c/>)

In order to be recommended for licensure, candidates must have completed all degree program requirements and be considered an educator preparation program completer.

- Decision Point 3 - Recommendation for Licensure (<https://iastate.box.com/s/lxzk584p9y4e4zgck631cwns111jqj0/>)

All Educator Preparation Program candidates must complete the professional core coursework (information found under each program) and required pedagogy and field experience coursework for their program. In addition, all prospective teachers are required to meet general education requirements as a part of their preparation. They must complete studies in the following general education groups. General education courses may be found in many departments. Credits listed are minimum requirements. Specific departments and/or colleges may require specific coursework to meet these requirements or additional credits. Credits used to satisfy these general education requirements typically satisfy department and college general education requirements.

Educator Preparation General Education Requirements

- Natural Sciences: 6 credits
- Mathematics or Statistics: 3 credits
- Social Sciences: 9 credits
- Humanities: 6 credits
- Communication Skills: 9 credits that must include ENGL 1500 and 250 or an equivalent
- Library Skills: LIB 1600 for 1 credit
- Other:
 - HDFS 1020* or PSYCH 2300*
 - One course that develops interpersonal or group presentation skills

*Must receive a C or better.

NOTE: Specific majors will provide approved options to meet these requirements.

Secondary major in Education Requirements for English Education Candidates

Educator Preparation Field Experiences:

EDUC 2800L	Pre-Student Teaching Experience I: Secondary Education	0.5
EDUC 3800A	Pre-Student Teaching Experience II: Core Experience	1-2
EDUC 4800E	Pre-Student Teaching Experience III: English	1-2
ENGL 4170E	Student Teaching: English and Literature (*)	1-30

Educator Preparation Professional Core Coursework:

EDUC 2020	Educational Technologies in the 7-12 Classroom (*)	3
EDUC 2040	Social Foundations of Education in the United States: Secondary (*)	3
PSYCH 3330	Educational Psychology (*)	3
EDUC 3950	Teaching Disciplinary Literacy (*)	3
EDUC 4060	Teaching and Learning in a Pluralistic Society: Secondary (*)	3
SPED 4010	Teaching Secondary Students with Exceptionalities in General Education (*)	3

*Must receive a C or better.

Educator Preparation Pedagogy/Methods Coursework:

ENGL 3960	Teaching the Reading of Young Adult Literature	3
ENGL 3970	Practice and Theory of Teaching Writing in the Secondary Schools	3

ENGL 4940	Practice and Theory of Teaching Literature in the Secondary Schools	3
EDUC 4260	Principles of Secondary Education	3

Please check departmental information in regards to specific content coursework requirements.

Secondary major in Education Requirements for History/Social Sciences Education Candidates

Educator Preparation Orientation Course Requirement:

EDUC 2190	Orientation to Teacher Education: English, FCS, History, Math, Science and World Language Majors	1

Educator Preparation Field Experiences:

EDUC 2800L	Pre-Student Teaching Experience I: Secondary Education	0.5
EDUC 3800A	Pre-Student Teaching Experience II: Core Experience	1-2
EDUC 4800A	Pre-Student Teaching Experience III: History/Social Sciences	2
EDUC 4170	Student Teaching*	16

Educator Preparation Professional Core Coursework:

EDUC 2020	Educational Technologies in the 7-12 Classroom (*)	3
EDUC 2040	Social Foundations of Education in the United States: Secondary (*)	3
PSYCH 3330	Educational Psychology (*)	3
EDUC 3950	Teaching Disciplinary Literacy (*)	3
EDUC 4060	Teaching and Learning in a Pluralistic Society: Secondary (*)	3
SPED 4010	Teaching Secondary Students with Exceptionalities in General Education (*)	3

*Must receive a C or better.

Educator Preparation Pedagogy/Methods Coursework:

EDUC 4980	Methods of Teaching History/Social Sciences	3
EDUC 4260	Principles of Secondary Education	3

Please check departmental information in regards to specific content coursework requirements.

Secondary major in Education Requirements for Mathematics Education Candidates

Educator Preparation Orientation Course Requirement:

EDUC 2190	Orientation to Teacher Education: English, FCS, History, Math, Science and World Language Majors	1

Educator Preparation Field Experiences:

EDUC 2800L	Pre-Student Teaching Experience I: Secondary Education	0.5
EDUC 3800A	Pre-Student Teaching Experience II: Core Experience	1-2
EDUC 4800C	Pre-Student Teaching Experience III: Mathematics	0.5-2
EDUC 4170	Student Teaching*	16

Educator Preparation Professional Core Coursework:

EDUC 2020	Educational Technologies in the 7-12 Classroom (*)	3
EDUC 2040	Social Foundations of Education in the United States: Secondary (*)	3
PSYCH 3330	Educational Psychology (*)	3
EDUC 3950	Teaching Disciplinary Literacy (*)	3
EDUC 4060	Teaching and Learning in a Pluralistic Society: Secondary (*)	3
SPED 4010	Teaching Secondary Students with Exceptionalities in General Education (*)	3

*Must receive a C or better.

Educator Preparation Pedagogy/Methods Coursework:

MATH 4970	Teaching Secondary School Mathematics	3

Please check departmental information in regards to specific content coursework requirements.**Secondary major in Education Requirements for Science Education Candidates (Biology, Chemistry, Earth Science, Physics)****Educator Preparation Orientation Course Requirement:**

EDUC 2190	Orientation to Teacher Education: English, FCS, History, Math, Science and World Language Majors	1

Educator Preparation Field Experiences:

EDUC 2800L	Pre-Student Teaching Experience I: Secondary Education	0.5
EDUC 3800A	Pre-Student Teaching Experience II: Core Experience	1-2
EDUC 4800D	Pre-Student Teaching Experience III: Biological Sciences	2
EDUC 4170	Student Teaching*	16

Educator Preparation Professional Core Coursework:

EDUC 2020	Educational Technologies in the 7-12 Classroom (*)	3
EDUC 2040	Social Foundations of Education in the United States: Secondary (*)	3
PSYCH 3330	Educational Psychology (*)	3

EDUC 3950	Teaching Disciplinary Literacy (*)	3
EDUC 4060	Teaching and Learning in a Pluralistic Society: Secondary (*)	3
SPED 4010	Teaching Secondary Students with Exceptionalities in General Education (*)	3

*Must receive a C or better.

Educator Preparation Pedagogy/Methods Coursework:

EDUC 4180	Secondary Science Methods I	3
EDUC 4190	Secondary Science Methods II	3

Please check departmental information in regards to specific content coursework requirements.**Secondary major in Education Requirements for World Languages and Cultures Education Candidates (French, German, Spanish)****Educator Preparation Orientation Course Requirement:**

EDUC 2190	Orientation to Teacher Education: English, FCS, History, Math, Science and World Language Majors	1

Educator Preparation Field Experiences:

EDUC 2800L	Pre-Student Teaching Experience I: Secondary Education	0.5
EDUC 3800A	Pre-Student Teaching Experience II: Core Experience	1-2
EDUC 4800G	Pre-Student Teaching Experience III: World Languages and Cultures	1-2
EDUC 4170	Student Teaching*	16

Educator Preparation Professional Core Coursework:

EDUC 2020	Educational Technologies in the 7-12 Classroom (*)	3
EDUC 2040	Social Foundations of Education in the United States: Secondary (*)	3
PSYCH 3330	Educational Psychology (*)	3
EDUC 3950	Teaching Disciplinary Literacy (*)	3
EDUC 4060	Teaching and Learning in a Pluralistic Society: Secondary (*)	3
SPED 4010	Teaching Secondary Students with Exceptionalities in General Education (*)	3

*Must receive a C or better.

Educator Preparation Pedagogy/Methods Coursework:

ENGL 3180	Introduction to ESL methods and materials	3
EDUC 4260	Principles of Secondary Education	3

Please check departmental information in regards to specific content coursework requirements.

As outlined in Decision Point policies,

Candidates must have a minimum grade requirement of C for all Education (EDUC), Human Development and Family Studies (HDFS), Special Education (SPED) courses, and all other program-specific pedagogy coursework required for licensure.

Candidate must earn a minimum grade of C- for courses in the department of the major specifically required for teacher licensure (content coursework).
History/Social Sciences Educator Preparation candidates must earn a minimum grade requirement of a B- for courses in the department of the major specifically required for teacher licensure (content coursework).

Candidates Pursuing Educator Preparation: Non-secondary major programs

Iowa State offers the following undergraduate K-12/secondary Educator Preparation Programs not associated with this secondary major:
K-12 Music Education
K-12 Physical Education Teacher Education
Agriculture Education
Family and Consumer Sciences Education
For additional information on these programs please see: <https://education.iastate.edu/>

K-12 and secondary education candidates must complete a professional core course sequence. In general, the sequence includes:

EDUC 2020	Educational Technologies in the 7-12 Classroom	3
EDUC 2040	Social Foundations of Education in the United States: Secondary	3
PSYCH 3330	Educational Psychology	3
EDUC 4060	Teaching and Learning in a Pluralistic Society: Secondary	3
EDUC 4260	Principles of Secondary Education	3
SPED 4010	Teaching Secondary Students with Exceptionalities in General Education	3
Total Credits		18

Coursework in content-specific pedagogy and field experience coursework also needs to be successfully completed.

Please check departmental information in regards to specific requirements for each program.

Candidates can choose to pursue additional endorsements.

- K-12 Coaching
- K-12 English as a Second Language
- 5-12 Agriscience/Agribusiness
- 5-12 Multi-occupations
- 5-12 Reading (contact the English Education academic advisor for a list of required courses)
- Science
 - 5-12 Basic Science
- Social Sciences
 - 5-12 American Government
 - 5-12 Anthropology
 - 5-12 Economics
 - 5-12 Psychology
 - 5-12 Sociology
- 5-12 Speech Communications and Theater

Specific program requirements can be found within each department that houses the endorsement. Information on K-12 Coaching, K-12 English as a Second Language, and 5-12 Reading can be found at: <https://iastate.app.box.com/s/m4tr3ogr9ouwmiubz5dhv9catryr2jqf> (<https://iastate.app.box.com/s/m4tr3ogr9ouwmiubz5dhv9catryr2jqf/>)

Education Studies, B.S.

The undergraduate curriculum in education studies leads to a Bachelor of Science degree. This degree program is designed to prepare undergraduate students for professions within the field of education and outside of K-12 classroom teaching. This non-licensure degree seeks to equip educators across the education landscape with the ability to design, implement, and assess educational programming that advances teaching and learning for all.

As part of this proposed degree program, students would take classes that meet ISU general education and college-level requirements along with the SOE professional core and foundations courses for the first two years along with SOE licensure students to provide a grounding in education. In the final two years, students in this new degree program would then pursue a parallel track that would include coursework focused on one of three emphasis areas (Teaching, Learning & Leadership, Innovation, Technology, & Society, or STEM) before participating in a semester-long internship related to their career goals.

LEARNING TECHNOLOGIES MINOR

The School of Education offers a Learning Technologies minor available to all teacher education candidates. In order to earn this minor, candidates must register for the minor and complete the following sequences of courses:

EDUC 2010	Educational Technologies in the PK-6 Classroom	3
or EDUC 2020	Educational Technologies in the 7-12 Classroom	
EDUC 2800B	Pre-Student Teaching Experience I: Educational Technologies	1
EDUC 3020	Principles and Practices of Learning with Technology	3
EDUC 4070	Online Education in Pre-K-12 Classrooms: Hybrid, Virtual, and Blended Approaches	3
EDUC 4540	Emerging Topics in Educational Technologies (take for a total of 3 credits)	3
One of the following:		3
COMS 1070	Windows Application Programming	3
COMS 2070	Fundamentals of Computer Programming	3
EDUC 3700	Toying with Technology	3

Candidates must receive a "C" or above in all courses

Additional information can be found at: <https://www.education.iastate.edu/find-majors/learning-technologies-minor/>

Graduate Study

The School of Education is comprised of two graduate divisions: Higher Education and Teaching, Learning, Leadership, and Policy (TLLP). Within these divisions, the School offers coursework and experiences for the degrees Doctor of Philosophy, Doctor of Education, Master of Science, and Master of Education with a major in education. Students can pursue graduate programs, including a Master of Arts in Teaching degree, leading to completion of a teacher preparation program and recommendation for teacher licensure are offered in secondary science and secondary mathematics. In addition, endorsements in reading and special education can also be pursued by graduate students. Graduate students interested in educational leadership may also participate in our educator preparation programs in educational leadership. Program completers may be recommended for administrative licensure for roles as principals and superintendents. The School of Education offers graduate coursework leading to a minor for masters and doctoral students in other fields of study. Several graduate certificate programs are offered through the School of Education.

Doctoral Degree Programs

The School of Education offers two doctoral degree programs: the Ph.D. and the Ed.D. Students pursuing a Ph.D. in the division of Higher Education may earn an education degree with an emphasis in higher education administration. Students pursuing a Ph.D. in the division of TLLP may earn an education degree with an emphasis in one of the following areas: educational leadership, organizations, and policy; instructional technology; language, literacy, and culture; mathematics education; science education; special education. Specific information

about the requirements of and options available within the Ph.D. degree in education are available from the School office or on the School of Education Graduate Programs (<https://www.education.iastate.edu/graduate-programs/>) website.

Graduates of the Ph.D. program in education are prepared to pursue careers as scholars, leaders, and administrators in various educational settings, including public and private colleges and universities, community colleges, public and private educational agencies, non-profits, and corporate training settings.

Students in the School of Education may complete an Education Doctorate (Ed.D.) with a major in education. Students may earn an education degree with an emphasis in Community College Leadership or in P-12 Systems Level Leadership. Specific information about the requirements of the Ed.D. degree in education are available on the School of Education Graduate Programs website. Graduates of the Ed.D. program in education are prepared to pursue careers as scholar-practitioners in leadership roles in community colleges and K-12 educational systems including school districts, public and private education agencies, and state departments of education. Students who complete the K-12 Systems Level Leadership program can be recommended for Iowa licensure as a school superintendent.

Master's Degree Programs

The School of Education offers two master's degrees: the Master of Science and the Master of Education. In the division of Higher Education, students may earn an M.Ed in education with an emphasis in either student affairs or higher education. In the division of TLLP, students may earn an M.S. or an M.Ed. in education with an emphasis in one of the following areas: educational leadership, organizations and policy; instructional technology; language, literacy, and culture; mathematics education; science education; special education; or social and cultural studies of education. An M.Ed. generalist education degree is also available.

Specific information about the requirements of and options available within M.S. or M.Ed. degrees in education are available from the School office or on the website School of Education Graduate Programs website <https://www.education.iastate.edu/graduate-programs/>

Graduates of the master's degree programs are prepared to pursue careers as educational leaders, higher education professionals, researchers, and advanced practitioners in colleges and universities, community colleges, public and private schools, education agencies, and informal (free-choice) education settings. Students who complete the M.Ed. in Educational Administration can be recommended for Iowa licensure as a P-12 school principal.

Other graduate programs related to education (including Interdisciplinary Graduate Studies) may be planned for students on the basis of previous

education and experiences as well as future plans and needs. For more information, students should refer to Agricultural Education and Studies, Family and Consumer Sciences Education, Kinesiology, and Interdisciplinary Graduate Studies or to graduate level course offerings within other departments.

Graduate minor in education

A minor in Education is available at both the master's and doctoral level. Graduate students in other majors may pursue a graduate minor in Education. A minor for doctoral students requires 15 credits in education courses, while a minor for master's students requires 9 credits. Students should identify a faculty member who will serve as the minor representative on their Program of Study Committee and work with this person to identify an appropriate set of courses to fit the student's interests. The minor is not an appropriate option for students whose primary interests are in research methodology; the graduate certification Applied Research in the Human Sciences should be used instead. Doctoral students are reminded that a minor must be declared before the preliminary oral examination.

Graduate Teacher and Educational Leadership Preparation Programs

The School of Education offers a Masters of Arts in Teaching - Science Education and a Masters of Arts in Teaching - Mathematics Education for candidates who currently have a bachelor's degree in a science area (or a closely related field) or in mathematics (or a closely related field), respectively. In addition, the School of Education offers a Masters of Arts in Teaching - Secondary Education that is currently available for individuals with an English degree or a history/social sciences degree interested in becoming a teacher. In these teacher preparation programs, program completers who apply for licensure are recommended for teacher licensure to the Iowa Board of Educational Examiners.

Teacher preparation programs at the graduate level are also offered in Agricultural Education (College of Agriculture and Life Sciences) and Physical Education (College of Human Sciences). The School of Education provides the professional core education coursework for these programs. Students in a graduate teacher preparation program must complete specific courses. Specific information about these programs can be found by contacting these departments.

Graduate level programs leading to recommendation for teaching endorsements, including Reading endorsements and Instructional Strategist II: Behavior Disorders/Learning Disabilities, are offered through the School of Education.

In addition to being admitted to Iowa State University and departmental programs/majors, educator preparation candidates must be admitted

to the Educator Preparation Program prior to beginning advanced coursework.

Educator Preparation Program Admission Requirements are provided in Educator Preparation Policy:

- Decision Point 1 - Admission to the Educator Preparation Program (<https://iastate.box.com/s/f2xplqjfa805a9imk8wyr7dem9vjabz4/>)

In order to be eligible for student teaching, candidates must have completed all degree program requirements and specific coursework. Decision Point 2 - Requirements Students Must Meet Prior to Student Teaching (<https://iastate.box.com/s/rl301lpd66te2lq53gzsebgza3q9jn1c/>)

In order to be recommended for licensure, candidates must have completed all degree program requirements and be considered an educator preparation program completer. Decision Point 3 - Recommendation for Licensure (<https://iastate.box.com/s/lxzqk584p9y4e4zgck631cwns111jq0/>)

Graduate students who seek a teaching endorsement in reading or special education, but do not wish to pursue a master's degree can incorporate those courses in a professional certificate program. Endorsement programs include Instructional Strategist II: Behavior Disorders/Learning Disabilities, Reading K-8 and Reading 5-12. Information about these endorsements can be found at: <https://iastate.app.box.com/s/m4tr3ogr9ouwmibz5dhv9catryr2jqf> (<https://iastate.app.box.com/s/m4tr3ogr9ouwmibz5dhv9catryr2jqf/>)

The School of Education offers graduate programs for students seeking careers as principals and superintendents. The Transformative School Leader Program (TSLP) is designed for working professionals and includes coursework and field experiences in a principal preparation program.

Candidates must complete the program as a Master of Education degree.

The Ed.D. in Education with an emphasis in P-12 systems-level leadership is designed for working professionals and includes coursework and field experiences in a superintendent preparation program.

Program completers who apply for licensure are recommended for licensure to the Iowa Board of Educational Examiners.

Graduate Certificate Programs

The School of Education offers Graduate Certificate programs to allow students to enhance their skills outside of full degree programs. The Certificate programs currently offered include Applied Research Methods in the Human Sciences, Instructional Design, Literacy Coaching, Education for Social Justice, Postsecondary Teaching and Special

Education. Certificate programs require a minimum of 12 graduate credits (several require more than this) and can be earned in conjunction with a degree program. More information about graduate certificate programs can be found on the School of Education web site.

Courses:

Education (EDUC)
 Educational Administration (EDADM)
 Educational Leadership and Policy Studies (EL PS)
 Higher Education (HG ED)
 Health and Human Sciences (HHSCI) (<http://catalog.iastate.edu/azcourses/hhsci/>)
 Research and Evaluation (RESEV)
 Special Education (SP ED)

Educator Preparation Program at Iowa State University

Educator Preparation (<http://www.education.iastate.edu/educator-prep-program/>): <https://education.iastate.edu/educator-prep-program/>

The Educator Preparation Program at Iowa State University is a shared responsibility that spans three colleges. All candidates who are recommended by Iowa State University for licensure must be considered a program completer by meeting the requirements of the Educator Preparation Program and be recommended by their department, college, and the ISU recommending official. Students who successfully complete the requirements for any of the endorsement areas offered at ISU must demonstrate the skills, knowledge, and dispositions / professional practices required of educators.

Undergraduate Educator Preparation Programs

An undergraduate student seeking a bachelor's degree must be enrolled in the department in which he or she plans to major and must meet the graduation requirements of that department and college.

All Educator Preparation Program candidates must complete the professional core coursework (information found under each program) and required pedagogy and field experience coursework for their program. In addition, all prospective teachers are required to meet general education requirements as a part of their preparation. They must complete studies in the following general education groups. General education courses may be found in many departments. Credits listed are minimum requirements. Specific departments and/or colleges may require specific coursework to meet these requirements or additional credits. Credits used to satisfy these general education requirements typically satisfy department and college general education requirements.

For Educator Preparation general education requirements, please visit the School of Education website: <https://education.iastate.edu/>

[current-students/educator-preparation-program/resources/curriculum-requirements/](https://education.iastate.edu/educator-prep-program/resources/curriculum-requirements/)

Currently, there are fifteen undergraduate Educator Preparation areas offered at Iowa State University. These areas and their corresponding grade levels are listed below:

Agricultural Education (grades 5-12)
 Biology (grades 5-12)
 Chemistry (grades 5-12)
 Early Childhood Education-Unified (birth-grade 3, inclusive)
 Earth Science (grades 5-12)
 Elementary Education (grades K-6)
 English (grades 5-12)
 Family and Consumer Sciences (grades 5-12)
 Health Education (grades 5-12)
 History-Social Sciences (grades 5-12)
 Mathematics (grades 5-12)
 Music (grades K-12)
 Physical Education (grades K-12)
 Physics (grades 5-12)
 World Languages and Cultures (French, German, and Spanish) (grades 5-12)

Endorsements Areas

Early Childhood Education

Candidates can also choose to pursue an endorsement in K-8 reading.

Elementary Education

Candidates pursuing a degree in Elementary Education are required to pursue an endorsement in at least one additional area. Endorsements in the following areas are available for elementary education majors:

- K-8 English/Language Arts & Reading
- K-12 English as a Second Language (ESL)
- K-8 Health
- K-8 Mathematics
- K-8 Science
- K-8 Social studies
- K-8 Special education (Instructional Strategist I: Mild/Moderate Disabilities K-8).

Additional information about these endorsements can be found at: <https://www.education.iastate.edu/find-majors/elementary-education/>

Elementary Education Candidates can pursue additional endorsements in any of the above listed areas and in the following areas:

- K-8 Reading
- K-12 Coaching
- 5-8 Algebra for HS Credit

Information about these additional endorsements can be found at:
<https://iastate.app.box.com/s/m4tr3ogr9ouwmiubz5dhv9catryr2jqf>
(<https://iastate.app.box.com/s/m4tr3ogr9ouwmiubz5dhv9catryr2jqf/>)

Contact an Elementary Education academic advisor for the requirements for these endorsements.

K-12 Education and Secondary Education

Candidates can choose to pursue additional endorsements. These can include any of the above listed endorsement and the following:

- K-12 Coaching
- K-12 English as a Second Language
- 5-12 Agriscience/Agribusiness
- 5-12 Multi-Occupations
- 5-12 Reading (contact the English Education academic advisor for a list of required courses)
- Science
 - 5-12 Basic Science
- Social Sciences
 - 5-12 American Government
 - 5-12 Anthropology
 - 5-12 Economics
 - 5-12 Psychology
 - 5-12 Sociology
- 5-12 Speech Communications and Theater
- World Languages and Cultures
 - 5-12 Chinese
 - 5-12 Russian

Information about endorsements can be found at: <https://education.iastate.edu/future-students/find-your-major/endorsements/>

Minors

Students in the Educator Preparation Program may also choose to pursue a minor in Learning Technologies. Additional information can be found at: <https://www.education.iastate.edu/find-majors/learning-technologies-minor/>

Post-Bachelor's Educator Preparation Programs

Students holding an appropriate bachelor's degree may complete the K-12 or secondary educator preparation program in order to be recommended for teacher licensure.

In addition to being admitted to Iowa State University and departmental programs/majors, educator preparation candidates must be admitted to the Educator Preparation Program prior to beginning advanced coursework.

Educator Preparation Program Admission Requirements are provided in Educator Preparation Policy.

- Decision Point 1 - Admission to the Educator Preparation Program (<https://iastate.box.com/s/f2xplqjfa805a9imk8wyr7dem9vjabz4/>)
- Decision Point 1 - Early Admission to the Educator Preparation Program for Transfer Students (<https://iastate.box.com/s/saysyv1to63q0bzwvtwzwtspq3s5kxl2/>)

In order to be eligible for student teaching, candidates must have completed all degree program requirements and specific coursework. Decision Point 2 - Requirements Students Must Meet Prior to Student Teaching (<https://iastate.box.com/s/rl301lpd66te2lq53gzsebgza3q9jn1c/>)

In order to be recommended for licensure, candidates must have completed all degree program requirements and be considered an educator preparation program completer. Decision Point 3 - Recommendation for Licensure (<https://iastate.box.com/s/lxzqk584p9y4e4zgck631cwns111jq0/>)

Candidates would be required to complete the Professional Core requirements of the program. In general, the sequence includes:

EDUC 2020	Educational Technologies in the 7-12 Classroom	3
EDUC 2040	Social Foundations of Education in the United States: Secondary	3
PSYCH 3330	Educational Psychology	3
EDUC 4060	Teaching and Learning in a Pluralistic Society: Secondary	3
EDUC 4260	Principles of Secondary Education	3
SPED 4010	Teaching Secondary Students with Exceptionalities in General Education	3

Total Credits **18**

Coursework in content-specific pedagogy and field experience coursework also need to be successfully completed. Please check

department information regarding to specific requirements for each program.

Candidates must have at least one course in each of the following five general education groups identified for undergraduate students identified in the previous section: Natural Sciences, Mathematics and Statistics, Social Sciences, Humanities, and Communication Skills. Specific departments and/or colleges may require specific coursework to meet these requirements or additional credits.

Interested students should consult with the program coordinator of the area in which they plan to specialize so that an individualized program of study can be developed.

Educator Preparation Programs for which post-bachelor candidates take undergraduate Educator Preparation courses include;

English (grades 5-12)

Health Education (grades 5-12)

History-Social Sciences (grades 5-12)

World Languages and Cultures (French, German, and Spanish) (grades 5-12)

GRADUATE DEGREE PROGRAMS WITH EDUCATOR PREPARATION PROGRAM COMPLETION

Currently, there are four graduate teacher-educator preparation programs. These programs are designed for students who do not currently hold a teaching license. The programs are listed below:

Agricultural Education (M.S.)

General Education Mathematics Education (M.A.T.)

Physical Education (M.S.)

Secondary Science Education (M.A.T.)

In addition to being admitted to Iowa State University and departmental programs/majors, educator preparation candidates must be admitted to the Educator Preparation Program prior to beginning advanced coursework.

Educator Preparation Program Admission Requirements are provided in Educator Preparation Policy.

- Decision Point 1 - Admission to the Educator Preparation Program (<https://iastate.box.com/s/f2xplqjfa805a9imk8wyr7dem9vjabz4/>)

In order to be eligible for student teaching, candidates must have completed all degree program requirements and specific coursework. Decision Point 2 - Requirements Students Must Meet Prior to Student Teaching (<https://iastate.box.com/s/rl301lpd66te2lq53gzsebgza3q9jn1c/>)

In order to be recommended for licensure, candidates must have completed all degree program requirements and be considered an educator preparation program completer. Decision Point 3 - Recommendation for Licensure (<https://iastate.box.com/s/lxzqk584p9y4e4zgck631cwns111qjq0/>)

Graduate level programs leading to recommendation for additional teaching endorsements are offered through the School of Education. Graduate students who seek a teaching endorsement in reading or special education, but do not wish to pursue a master's degree can incorporate the coursework in a professional certificate program. Endorsement programs include Instructional Strategist II: Behavior Disorders/Learning Disabilities, Reading K-8 and Reading 5-12.

Graduate programs are also available for those who wish to pursue educational leadership as a profession as PK-12 school principals or PK-12 superintendents. (See Educational Leadership and Policy Studies in Courses and Programs section of this catalog.)

Master's Programs with Teacher Preparation AGRICULTURAL EDUCATION

The Agricultural Education and Studies Department offers a Master's of Science program that prepares Agricultural Education teachers for grades 5-12

See coordinator for program requirements.

Secondary MATHEMATICS

The School of Education offers a Master's of Education program that prepares Mathematics teachers for grades 5-12

Physical Education

The Department of Kinesiology offers a Master's of Arts in Teaching program that prepares Physical Education teachers for grades K-12.

Secondary Education

The School of Education offers a Master's of Arts in Teaching program that prepares secondary teachers for grades 5-12. Currently this program is available for English Education candidates and History/Social Sciences Education candidates.

See coordinator for program requirements.

Secondary Sciences

The School of Education offers a Master's of Arts in Teaching program that prepares Secondary Science teachers for grades 5-12

See coordinator for program requirements.

IOWA STATE UNIVERSITY TEACHER EDUCATION STANDARDS (INTASC STANDARDS)

The Learner and Learning

Standard #1: Learner Development. The teacher understands how learners grow and develop, recognizing that patterns of learning and development vary individually within and across the cognitive, linguistic, social, emotional, and physical areas, and designs and implements developmentally appropriate and challenging learning experiences.

Standard #2: Learning Differences. The teacher uses understanding of individual differences and diverse cultures and communities to ensure inclusive learning environments that enable each learner to meet high standards.

Standard #3: Learning Environments. The teacher works with others to create environments that support individual and collaborative learning, and that encourage positive social interaction, active engagement in learning, and self-motivation.

Content

Standard #4: Content Knowledge. The teacher understands the central concepts, tools of inquiry, and structures of the discipline(s) he or she teaches and creates learning experiences that make the discipline accessible and meaningful for learners to assure mastery of the content.

Standard #5: Application of Content. The teacher understands how to connect concepts and use differing perspectives to engage learners in critical thinking, creativity, and collaborative problem solving related to authentic local and global issues.

Instructional Practices

Standard #6: Assessment. The teacher understands and uses multiple methods of assessment to engage learners in their own growth, to monitor learner progress, and to guide the teacher’s and learner’s decision making.

Standard #7: Planning for Instruction. The teacher plans instruction that supports every student in meeting rigorous learning goals by drawing upon knowledge of content areas, curriculum, cross-disciplinary skills, and pedagogy, as well as knowledge of learners and the community context.

Standard #8: Instructional Strategies. The teacher understands and uses a variety of instructional strategies to encourage learners to develop deep understanding of content areas and their connections, and to build skills to apply knowledge in meaningful ways.

Standard #8A: Technology. The teacher integrates current and emerging technology in instruction to encourage student creativity, problem solving, collaboration, and digital literacy. Teachers practice and

advocate safe, legal, and responsible use of information and technology (this standard is unique to the Iowa State University Teacher Preparation Program).

Professional Responsibility

Standard #9: Professional Learning and Ethical Practice. The teacher engages in ongoing professional learning and uses evidence to continually evaluate his/her practice, particularly the effects of his/her choices and actions on others (learners, families, other professionals, and the community), and adapts practice to meet the needs of each learner.

Standard #10: Leadership and Collaboration. The teacher seeks appropriate leadership roles and opportunities to take responsibility for student learning, to collaborate with learners, families, colleagues, other school professionals, and community members to ensure learner growth, and to advance the profession.

EDUCATOR PREPARATION PROGRAM ADMISSION REQUIREMENTS

Educator Preparation Program Candidates must have:

Educator Preparation Program Admission Requirements are provided in Educator Preparation Policy.

- Decision Point 1 - Admission to the Educator Preparation Program (<https://iastate.box.com/s/f2xplqjfa805a9imk8wyr7dem9vjabz4/>)
- Decision Point 1 - Early Admission to the Educator Preparation Program for Transfer Students (<https://iastate.box.com/s/saysyv1to63q0bzwvtwzwtsp3s5kxl2/>)

More information about admission requirements can be found at: <https://www.education.iastate.edu/educator-prep-program/admission/>

THE PROFESSIONAL CORE REQUIREMENT FOR EDUCATOR PREPARATION Undergraduate Students

Educator Preparation Program candidates must complete certain studies related directly to the profession of teaching. All undergraduate candidates in the educator preparation program must take the following courses prior to student teaching, unless the student’s program area has an approved content-area course deemed to be equivalent. Candidates must receive a minimum of a “C” in all education (EDUC), Human Development and Family Studies (HDFS), Special Education (SPED) courses and all content-specific pedagogy/methods courses required for licensure. (See program coordinator for more information).

EARLY CHILDHOOD EDUCATION-Unified

EDUC 2010	Educational Technologies in the PK-6 Classroom	3
EDUC 2050	Social Foundations of Education in the United States: Early Childhood and Elementary Education	3

EDUC 2450	Landscape of Teaching	3
EDUC 3320	Educational Psychology of Early Childhood and Elementary Education	3
EDUC 4050	Teaching and Learning in a Pluralistic Society: Early Childhood and Elementary	3
SPED 2500	Education of the Exceptional Learner	3
Total Credits		18

In addition, Early Childhood Education majors must complete all degree curriculum requirements. These can be found here: http://catalog.iastate.edu/collegeofhumansciences/earlychildhood_education/

ELEMENTARY EDUCATION:

EDUC 2010	Educational Technologies in the PK-6 Classroom	3
EDUC 2050	Social Foundations of Education in the United States: Early Childhood and Elementary Education	3
EDUC 2450	Landscape of Teaching	3
HDFS 1020	Human Development or PSYCH 2300 Developmental Psychology	3
HDFS 2400	Children's Literature	3
SPED 2500	Education of the Exceptional Learner	3
EDUC 3320	Educational Psychology of Early Childhood and Elementary Education	3
Total Credits		21

Elementary Education majors must meet all degree curriculum requirements. These can be found here: <http://www.catalog.iastate.edu/collegeofhumansciences/elementaryeducation/>

K-12 AND SECONDARY EDUCATION:

EDUC 2020	Educational Technologies in the 7-12 Classroom	3
EDUC 2040	Social Foundations of Education in the United States: Secondary	3
PSYCH 3330	Educational Psychology	3
EDUC 4060	Teaching and Learning in a Pluralistic Society: Secondary	3
EDUC 4260	Principles of Secondary Education	3
SPED 4010	Teaching Secondary Students with Exceptionalities in General Education	3

In addition, candidates must complete all degree program discipline-specific pedagogy coursework, field experience coursework, and content-specific coursework. These requirements can be found in the home department of the major.

Post-Bachelor's Students

Students who hold an appropriate bachelor's degree and seek a teaching license must complete an educator preparation program. This includes

the professional education requirements listed above. The requirements can be met through course work or examination.

Master's Students

Prospective teachers must complete certain studies related directly to the profession of teaching. All students enrolled in Master's programs that lead to completion of an educator preparation program must take the following courses prior to student teaching, unless the student's program area has an approved content area course deemed to be equivalent. (See Master's Programs section below for details.)

EDUC 5050	Using Technology in Learning and Teaching	3
EDUC 5060	Social Justice Education and Teaching: Advanced	3
EDUC 5260	Principles of Secondary Education Not all programs require this course. Check with program coordinator	3
EDUC 5290	Educational Psychology and the Secondary Classroom	3
or EDUC 5210	Introduction to the Teaching and Learning of Mathematics and Science	
EDUC 5800	Studies in the Foundations of Education in the United States	3
SPED 5010	Teaching Secondary Students with Exceptionalities in General Education	3

In addition, candidates must complete all degree program discipline-specific pedagogy coursework, field experience coursework, and content-specific coursework. These requirements can be found in the home department of the major.

CLINICAL EXPERIENCES

The Standards for Practitioner and Administrator Preparation Programs 281–79.14(256) Teacher preparation clinical practice standard states, "The unit and its school partners shall provide field experiences and student teaching opportunities that assist candidates in becoming successful teachers in accordance with the following provisions."

This includes:

- **79.14(5)** Teacher candidates admitted to a teacher preparation program must complete a minimum of 80 hours of pre-student teaching field experiences, with at least 10 hours occurring prior to acceptance into the program.
- **79.14(7)** The unit is responsible for ensuring that the student teaching experience for initial licensure:
 - a. Includes a full-time experience for a minimum of 14

consecutive weeks in duration during the teacher candidate's final year of the teacher preparation program. (Iowa State University policy requires a full semester experience.)

For most programs, there are four levels for clinical experiences used to meet these requirements. Level 1 involves observation in local schools and is typically completed prior to admission to the educator preparation program. Level 2 involves actively teaching in the classroom with one-two lessons, at minimum. Level 3 involves actively teaching in the classroom with two lessons, at minimum and being observed by a supervisor during teaching. Level 4 is student teaching and involves actively teaching for a semester-long experience where the student teacher bears primary responsibility for planning and instruction within the classroom for a minimum of four weeks during the semester. Level 2, 3 and 4 field experiences involve a course fee, which ranges from \$75.00 to \$450.00 and are assessed to cover the costs of supervision and placement with a cooperating teacher. Course fees are increased when students teach nationally or internationally. For current course fees, consult the Schedule of Classes. For level 2, 3 and 4 field experiences, the student needs access to transportation because the placement may be within 60 miles of the university. The time commitment for clinical experiences ranges from 1/2 day for level 2 and 3 to the full day for level 4. Students complete a background check before initial placement in schools and other appropriate locations.

Specific field experience course requirements can be found in program/degree requirements.

PROGRAM CURRICULUM

Undergraduate Students

Early Childhood Education – Unified

The curriculum in Early Childhood Education – Unified prepares graduates to teach young children and work with their families. This program leads to careers working with young children (both those who are typically developing and those with special needs) from birth through third grade, inclusive. Program completers can be recommended for licensure to the Iowa Board of Educational Examiners. Individuals who are licensed may be employed by either public or private agencies or schools to teach in early childhood classrooms (preschool through 3rd grade) or in home-based programs. The program is an interdepartmental major administered by the Department of Human Development and Family Studies and the School of Education. For more information about the program, see Early Childhood Education - Unified Curriculum <http://www.education.iastate.edu/undergraduate-studies/early-childhood-education> (<http://www.education.iastate.edu/undergraduate-studies/early-childhood-education/>). (<https://hdfs.hs.iastate.edu/find-your-major/early-childhood-education/>).

In addition to being admitted Iowa State University and departmental programs/majors, educator preparation candidates must be admitted to the Educator Preparation Program prior to beginning advanced coursework.

Educator Preparation Program Admission Requirements are provided in Educator Preparation Policy.

- Decision Point 1 - Admission to the Educator Preparation Program (<https://iastate.box.com/s/f2xplqjfa805a9imk8wyr7dem9vjabz4/>)
- Decision Point 1 - Early Admission to the Educator Preparation Program for Transfer Students (<https://iastate.box.com/s/saysyv1to63q0bwvwtwzwtsp3s5kx12/>)

In order to be recommended for licensure, candidates must have completed all degree program requirements and be considered an educator preparation program completer. Decision Point 3 - Recommendation for Licensure (<https://iastate.box.com/s/tvfae96b3b1y87wbyfna2oonhmfoba7g/>)

All early childhood education – unified candidates must meet general education requirements in order to complete the Educator Preparation Program.

Elementary Education

In addition to pursuing a degree in Elementary Education, candidates are required to pursue an endorsement in at least one additional area. Candidates will be prepared to teach students in grades kindergarten through eighth grade in this area of specialization. Endorsements in the following areas are available for elementary education majors:

- K-8 English/Language Arts & Reading
- K-12 English as a Second Language (ESL)
- K-8 Health
- K-8 Mathematics
- K-8 Science
- K-8 Social studies
- K-8 Special education (Instructional Strategist I: Mild/Moderate Disabilities K-8)

Additional information about these endorsements can be found at: <https://www.education.iastate.edu/find-majors/elementary-education/>

Candidates can pursue additional endorsements in any of the above listed areas and in the following areas:

- K-8 Reading
- K-12 Coaching

Information about these additional endorsements can be found: <https://iastate.app.box.com/s/m4tr3ogr9ouwmibz5dhv9catyr2jqf> (<https://iastate.app.box.com/s/m4tr3ogr9ouwmibz5dhv9catyr2jqf/>)
Contact an Elementary Education academic advisor for additional information.

In addition to being admitted to Iowa State University and departmental programs/majors, educator preparation candidates must be admitted to the Educator Preparation Program prior to beginning advanced coursework.

Educator Preparation Program Admission Requirements are provided in Educator Preparation Policy.

- Decision Point 1 - Admission to the Educator Preparation Program (<https://iastate.box.com/s/f2xplqjfa805a9imk8wyr7dem9vjabz4/>)
- Decision Point 1 - Early Admission to the Educator Preparation Program for Transfer Students (<https://iastate.box.com/s/saysyv1to63q0bzwvtwzwtsp3s5kxl2/>)

In order to be eligible for student teaching, candidates must have completed all degree program requirements and specific coursework. Decision Point 2 - Requirements Students Must Meet Prior to Student Teaching (<https://iastate.box.com/s/rl301lpd66te2lq53gzsebgza3q9jn1c/>)

In order to be recommended for licensure, candidates must have completed all degree program requirements and be considered an educator preparation program completer. Decision Point 3 - Recommendation for Licensure (<https://iastate.box.com/s/lxzqk584p9y4e4zgck631cwns111jqj0/>)

K-12 and Secondary Education

Students wanting to pursue K-12 or Secondary Teacher Education declare a major in the content area in which they want to focus.

They then pursue one of two options depending upon their program: 1) complete the secondary major in Education or 2) complete additional coursework required to complete the Educator Preparation Program.

K-12/Secondary Educator Preparation Programs eligible to pursue the secondary major in Education are:

- English Education
- History/Social Sciences Education
- Mathematics Education
- Science Education – Biology
- Science Education – Chemistry
- Science Education – Earth Science
- Science Education – Physics
- World Languages and Cultures Education – French
- World Languages and Cultures Education – German
- World Languages and Cultures Education – Spanish

Iowa State offers the following undergraduate K-12/secondary Educator Preparation Programs not associated with this secondary major:

- K-12 Music Education
- K-12 Physical Education Teacher Education
- Agriculture Education
- Family and Consumer Sciences Education

In addition to being admitted Iowa State University and departmental programs/majors, educator preparation candidates must be admitted to the Educator Preparation Program prior to beginning advanced coursework.

Educator Preparation Program Admission Requirements are provided in Educator Preparation Policy.

- Decision Point 1 - Admission to the Educator Preparation Program (<https://iastate.box.com/s/f2xplqjfa805a9imk8wyr7dem9vjabz4/>)
- Decision Point 1 - Early Admission to the Educator Preparation Program for Transfer Students (<https://iastate.box.com/s/saysyv1to63q0bzwvtwzwtsp3s5kxl2/>)

In order to be eligible for student teaching, candidates must have completed all degree program requirements and specific coursework. Decision Point 2 - Requirements Students Must Meet Prior to Student Teaching (<https://iastate.box.com/s/rl301lpd66te2lq53gzsebgza3q9jn1c/>)

In order to be recommended for licensure, candidates must have completed all degree program requirements and be considered an educator preparation program completer. Decision Point 3 - Recommendation for Licensure (<https://iastate.box.com/s/lxzqk584p9y4e4zgck631cwns111jqj0/>)

Post-Bachelor's Students

Students holding an appropriate bachelor's degree who wish to complete a teacher preparation program in order to pursue teacher licensure must have at least one course in each of the following five general education groups identified for undergraduate students in the preceding section: Natural Sciences, Mathematics or Statistics, Social Sciences, Humanities, and Communication Skills. Individual departments preparing teachers may require additional credits in general education. (See program coordinator for more information).

In addition to being admitted Iowa State University and departmental programs/majors, educator preparation candidates must be admitted to the Educator Preparation Program prior to beginning advanced coursework.

Educator Preparation Program Admission Requirements are provided in Educator Preparation Policy.

- Decision Point 1 - Admission to the Educator Preparation Program (<https://iastate.box.com/s/f2xplqjfa805a9imk8wyr7dem9vjabz4/>)

In order to be eligible for student teaching, candidates must have completed all degree program requirements and specific coursework. Decision Point 2 - Requirements Students Must Meet Prior to Student Teaching (<https://iastate.box.com/s/rl301lpd66te2lq53gzsebgza3q9jn1c/>)

In order to be recommended for licensure, candidates but have completed all degree program requirements and be considered an educator preparation program completer. Decision Point 3 - Recommendation for Licensure (<https://iastate.box.com/s/lxzqk584p9y4e4zgck631cwns111jq0/>)

Graduate Students

Each Master's program will determine what, if any, general education requirements Master's students must fulfill beyond a bachelor's degree from a regionally accredited institution. (See program coordinator for more information.)

In addition to being admitted Iowa State University and departmental programs/majors, educator preparation candidates must be admitted to the Educator Preparation Program prior to beginning advanced coursework.

Educator Preparation Program Admission Requirements are provided in Educator Preparation Policy.

- Decision Point 1 - Admission to the Educator Preparation Program (<https://iastate.box.com/s/f2xplqjfa805a9imk8wyr7dem9vjabz4/>)

In order to be eligible for student teaching, candidates must have completed all degree program requirements and specific coursework. Decision Point 2 - Requirements Students Must Meet Prior to Student Teaching (<https://iastate.box.com/s/rl301lpd66te2lq53gzsebgza3q9jn1c/>)

In order to be recommended for licensure, candidates but have completed all degree program requirements and be considered an educator preparation program completer. Decision Point 3 - Recommendation for Licensure (<https://iastate.box.com/s/lxzqk584p9y4e4zgck631cwns111jq0/>)

See coordinator for program requirements.

Youth Development Interinstitutional Graduate Program

Iowa State University offers a Master's degree in Family and Consumer Sciences with a specialization in Youth Development. This is an interinstitutional online program offered through the Great Plains Interactive Distance Education Alliance (or GPIDEA). The student selects a home institution (Iowa State), which ultimately grants the degree. After admission to Iowa State, the student takes courses from Iowa State

and the other participating institutions: Michigan State University, North Dakota State University, Texas Tech University, University of Missouri, and University of Nebraska-Lincoln.

The Master of Family and Consumer Sciences with Youth

Development specialization is an online degree available focusing on developing knowledge and skills to serve today's youth. Students become immersed in a strengths-based curriculum and learn a methodology that supports youth, enabling them to grow socially, emotionally, and cognitively. The program has its roots in positive youth development. Rather than focusing solely on corrective measures, a positive youth development approach equips individuals in the second decade of life with the skillset necessary for a successful transition into adulthood.

The masters degree consists of 36 credits, 27 required credits, 6 elective credits, and 3 or more credits of creative component and/or internship (<https://online.hs.iastate.edu/graduate-degrees/youth-development/>). This program does not require a thesis.

Youth Development Certificates

The Youth Development certificates (<https://online.hs.iastate.edu/graduate-degrees/youth-development/>) are offered completely online through the Great Plains Interactive Distance Education Alliance (or GPIDEA). The student selects a home institution (Iowa State), which ultimately grants the certificate. After admission to Iowa State, the student takes courses from Iowa State and the other participating institutions: Michigan State University, North Dakota State University, Texas Tech University, University of Missouri, and University of Nebraska-Lincoln. Both are stand-alone graduate certificates available to any student with a bachelor's degree.

- 12-credit Youth Development Specialist Graduate Certificate
- 12-credit Youth Program Management and Evaluation Graduate Certificate

Courses primarily for graduate students, open to qualified undergraduates:

YTH 5020: Foundations of Positive Youth Development

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Fundamentals of positive youth development, theories, and principles utilized in the youth development profession. Ethical, professional, and historical elements of youth development as it has evolved toward professionalization. (Typically Offered: Fall, Spring, Summer)

YTH 5100: Adolescents and Their Families

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Adolescent development as it is related to and intertwined with family development; reciprocal influences between adolescents and their families are examined. Working with youth vis a vis the family system will be highlighted. (Typically Offered: Fall, Spring)

YTH 5200: Positive Youth Development in Community Settings

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Focus on the national emphasis of a strength-based or asset approach to community youth development, encompassing individual development (i.e., positive youth development) and adolescent interrelationships with environments. Emphasis is placed upon research, theory, and practice applied in communities throughout the U.S. Students will explore existing models, read theoretical and applied literature, and examine current community efforts as a basis for understanding community youth development. (Typically Offered: Fall, Spring)

YTH 5300: Youth in Cultural Contexts

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Examination of the cultural context factors that affect youth from a holistic perspective within and outside the family unit. The course will provide an understanding of the cultural heritage of differing family structures and types. Students will explore the social and educational processes experienced by youth through in-depth reading, writing, discussion, critical listening, viewing of contemporary videos, and informal interviews with youth. Students will be encouraged to think critically about society and culture, gain further knowledge of how ethnic groups fit historically into society, and examine the results of how history has shaped the current cultural climate of the U.S. (Typically Offered: Fall, Spring)

YTH 5400: Youth Professionals as Consumers of Research

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

This course will help youth development professionals understand and evaluate research reports to reduce anxiety about applying research results and theories to practice. Specific emphasis will be on research and theory reports related to youth development. (Typically Offered: Fall, Spring)

YTH 5500: Youth Policy

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Various federal and state policies designed specifically for youth. Students will examine how and why policies for youth are constructed. A guiding question that will be used to evaluate existing state and national policies is whether they contribute to, or act as, barriers to desired developmental outcomes. (Typically Offered: Fall, Spring)

YTH 5600: Youth-Adult Relationships

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

The role of youth-adult relationships in promoting the positive development of youth. Attitudes and activities that support youth engagement and agency. Research and practice of mentorship, youth-adult partnerships, and youth leadership. (Typically Offered: Fall, Spring)

YTH 5700JX: Contemporary Youth Issues: Adolescent Sexuality, Pregnancy, and Parenthood

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

This course explores adolescent sexuality development, sexual behaviors, and pregnancy/parenthood. These topics will be explored with respect to normative development and the reciprocal influences of the youth's ecology (i.e., family, school, community). Implications for professionals working with youth sexuality, pregnancy, and parenthood will be explored and highlighted.

YTH 5700L: Contemporary Youth Issues: Mental Health

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Understand optimal mental health in youth and how it can be promoted. Current theories and research related to optimal mental health and how promoting positive development is both similar to and different from preventing negative outcomes. Learn to assess a given youth development program in terms of its potential to promote positive mental health. Offered odd-numbered years. (Typically Offered: Summer)

YTH 5700M: Contemporary Youth Issues: Working with Adolescents with Difficulties

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Examines cognitive, self, and social transitions during adolescence. Topics include issues of identity, society's understanding of adolescents, and how adolescents and their parents, siblings, peers, teachers, and society interact. Offered odd-numbered years. (Typically Offered: Summer)

YTH 5700N: Contemporary Youth Issues: Understanding Normative Behavior in Immigrant & Minority Youth

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Explores the etiology of adolescent deviance using a positive, cross-national/crosscultural perspective. Includes implications of theory, empirical research, current prevention programs and needs assessments. Offers a look at deviance from different perspectives as well as a comparison of normative and non-normative development of youth. (Typically Offered: Fall)

YTH 5700P: Contemporary Youth Issues: Youth, Families & Technology

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Understand the interconnectedness of technology and youth/family. Formulate constructive and realistic strategies to enrich the life of a family or a youth in a society heavily dependent on technology. Topics of the course include identity formation, privacy, race, class, gender, subculture, risky behavior, policing, education, globalization, health, and policies. Offered odd-numbered years. (Typically Offered: Summer)

YTH 5700R: Contemporary Youth Issues: Sports, Youth and Society

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Examination of how sports and society help us better understand what we value, how we become who we are, and how we may be able to realize social justice in a larger social context. Offered even-numbered years. (Typically Offered: Summer)

YTH 5700TX: Contemporary Youth Issues: Systems of Care for Youth at Risk

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 3 times.

Prereq: Graduate Standing or Permission of Instructor

CYI: Issues faced by youth today and associated risk and resiliency factors. A different topic will be presented each year, with the course rotating among participating universities. Topics have included Adolescent Health and Sexuality, Systems of Care for Youth at Risk, Mental Health, Immigrant and Minority Youth, Sports, Technology, etc. The course may be taken more than once, as long as the content is different each time. Offered odd-numbered years. (Typically Offered: Spring)

YTH 5700UX: Contemporary Youth Issues: Adolescent Health & Sexuality

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

CYI: Issues faced by youth today and associated risk and resiliency factors. A different topic will be presented each year, with the course rotating among participating universities. Topics have included Adolescent Health and Sexuality, Systems of Care for Youth at Risk, Mental Health, Immigrant and Minority Youth, Sports, Technology, etc. The course may be taken more than once, as long as the content is different each time. (Typically Offered: Fall)

YTH 5800: Youth Development Personnel and Program Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to the development, administration and management of youth-serving organizations. (Typically Offered: Fall, Spring)

YTH 5850: Design and Evaluation of Youth Programs

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Theoretical, methodological, and pragmatic issues involved in conducting programs and scholarship. Overview of the program development process and outcome evaluation of children and family programs. Modes of outcome scholarship and their implications for community-based programs are discussed. Students will develop knowledge through participating in a community-based project involving the practical application of program design and evaluation methods. (Typically Offered: Fall, Spring)

YTH 5890: Grant Development and Management.

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Grant-getting process and an overview of what happens after a project is funded. The following topics will be covered: researching funding sources, generating cutting edge ideas, assessing needs, planning a project, establishing credibility, formulating a sustainable budget, designing an evaluation plan, managing the funded project, and disseminating project results. (Typically Offered: Fall)

YTH 5990: Creative Component

Credits: 1-30. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Nonthesis students creative component (e.g., a special report, capstone course, integrated field experience, annotated bibliography, research project, design, or other creative endeavor). A minimum of five credits of independent work is required on the programs of study (POS). Creative component format determined cooperation with the POS committee. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

Courses for graduate students:**YTH 6340: Youth Development**

Credits: 3. Contact Hours: Lecture 3.

Introduction to the developmental period of adolescence. The theory and research of positive youth development will be the lens through which this developmental period is examined. The course will emphasize how the developmental tasks of this life stage are influenced by (and influence) family and home, school, peers, and other contextual forces. The course will help students recognize and become familiar with the major issues and transitions adolescents face as they successfully navigate this developmental stage by critically examining the theoretical and research literature. (Typically Offered: Fall, Spring)

YTH 6900: Advanced Topics

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

Advanced topics. (Typically Offered: Fall, Spring, Summer)

YTH 6910: Internship

Credits: 1-30. Repeatable.

Supervised practice and experience in college teaching, research, professional experience. Offered on a satisfactory-fail basis only.

(Typically Offered: Fall, Spring, Summer)

COLLEGE OF LIBERAL ARTS AND SCIENCES

Benjamin Withers, Dean
 Monic Behnken, Associate Dean
 Arne Hallam, Associate Dean
 Gustavo Macintosh, Interim Associate Dean
 Jo Anne Powell-Coffman, Associate Dean
 Amy Slagell, Associate Dean

www.las.iastate.edu/ (<http://www.las.iastate.edu/>)

The College of Liberal Arts and Sciences (LAS) is a world-class learning and research community. Iowa State's most academically diverse college, LAS educates students to become global citizens, providing rigorous academic programs in the sciences, humanities and social sciences within a supportive, student-centered learning environment that emphasizes career readiness. The college also is home to the Open Option Program that prepares students for any curriculum at the University.

Learning Goals

The primary mission of the college is to promote learning in all its dimensions by providing students with ample opportunities to acquire the requisite knowledge, abilities, and skills to succeed in the world beyond the university. Through coursework within the major and in general education, students will develop skills in reasoning, analysis, and communication; achieve an understanding of the intellectual, historical, and artistic foundations of culture; and work to strengthen their abilities to interact with people, cultures, and the environment in an ethical and sensitive manner. To achieve these learning goals, the college asks students to acquire depth in learning within disciplines of their own choosing, and to acquire breadth through general education courses and electives. The breadth and depth requirements of our liberal arts and sciences degree programs prepare students for a lifetime of evolving career opportunities.

The College of Liberal Arts and Sciences offers over forty majors. Students can earn Bachelor of Arts, Bachelor of Science, Bachelor of Music, or Bachelor of Liberal Studies degrees. In collaboration with the College of Engineering, the College of Liberal Arts and Sciences participates in a program of study leading to the Bachelor of Science in Software Engineering. The College also collaborates with the College of Design to offer a Bachelor of Science in Game Design.

Preparation for Entering the College of Liberal Arts and Sciences

Students entering the college are expected to have high school preparation with at least 4 years of English, 3 years each of Social

Studies, Mathematics and Science. Students are also encouraged to have coursework in computer applications. The study of a world language is highly encouraged; three or more years of a single world language in high school meets the world language graduation requirement in the College of Liberal Arts and Sciences.

Students often enter the College of Liberal Arts and Sciences as transfer students. Prospective transfer students are urged to contact the College of Liberal Arts and Sciences well before arriving on campus so that pre-transfer courses are appropriate to the planned major and transferable toward graduation from ISU. Early planning can improve the transfer process and support a timely graduation. Details regarding the criteria for graduation with distinction and other academic honors are available under Scholastic Recognition.

For information on articulation/transfer agreements that apply to students who have earned Associate of Arts degrees from an Iowa public community college or who have satisfied general education requirements at the University of Northern Iowa or in the College of Liberal Arts at the University of Iowa, see Articulation/Transfer Agreements in the Admission Transfer Information section of the catalog.

Transfer students in the College of Liberal Arts and Sciences may choose to graduate under the catalog in effect at the time of their graduation or under one of the five immediately preceding catalogs, provided that it covers the period of their enrollment either at Iowa State or any other accredited school. Full requirements of the chosen catalog must be met though adjustments will be made in instances where courses are no longer available or where programs have been changed. Transfer students are responsible for reviewing their transfer credit evaluation with the academic advisor during the first semester of enrollment.

Academic Advising

Each student in the College of Liberal Arts and Sciences is assigned an academic advisor in their area of study. This advisor assists the student in developing a program of study designed to meet the degree requirements while also meeting a student's goals outside of and beyond the classroom by incorporating activities such as study abroad, internships, Honors Program and undergraduate research. Advisors are a first point of contact for referral to university and college resources and services and play a crucial role in student success.

Academic advising begins during orientation programming prior to entry and continues through a student's graduation. Through the process of advising, students will develop academic plans that reflect their unique interests and goals as well as learn about the university resources available to assist them academically, professionally, and personally. Advisors help students understand how their interests, skills and goals connect to fields of study and careers, including how a liberal arts education enhances their academic development.

Departments and Programs of the College

Majors, minors and certificates in the College of Liberal Arts and Sciences are administered by the following departments and programs.

Departments

- Air Force Aerospace Studies
- Biochemistry, Biophysics, and Molecular Biology
- Chemistry
- Computer Science
- Earth, Atmosphere, and Climate
- Ecology, Evolution, and Organismal Biology
- Economics
- English
- Genetics, Development, and Cellular Biology
- Greenlee School of Journalism and Communication
- History
- Mathematics
- Military Science (Army Reserve Officers' Training Corps)
- Music and Theatre
- Naval Science
- Philosophy and Religious Studies
- Physics and Astronomy
- Political Science
- Psychology
- Sociology and Criminal Justice
- Statistics
- World Languages and Cultures

Cross-Disciplinary and Interdisciplinary Programs

The College of Liberal Arts and Sciences has a variety of interdisciplinary and cross-disciplinary programs that draw on faculty expertise across multiple departments. Students may enroll in courses offered by these programs, declare majors, certificates or minors where offered, or propose an Interdisciplinary Studies major.

- African and African American Studies Program
- American Indian Studies Program
- Bachelor of Liberal Studies Program
- Communication Studies
- Data Science
- Environmental Science and Environmental Studies
- Interdisciplinary Studies Program
- International Studies Program
- Leadership Studies
- Premedical and Preprofessional Health Programs

- Scientific Illustration and Visualization
- Sustainability Program
- U.S. Latino/a Studies Program
- Women's and Gender Studies Program

Degree Programs and MAJORS

- Advertising, B.A.
- Anthropology, B.A., B.S.
- Biochemistry, B.S.
- Bioinformatics and Computational Biology B.S.
- Biology, B.S.
- Chemistry, B.A., B.S.
- Climate Science, B.S.
- Communication Studies, B.A.
- Computer Science, B.A., B.S.
- Criminal Justice, B.A.
- Data Science, B.S.
- Earth Science, B.A., B.S.
- Economics, B.S.
- English, B.A., B.S.
- Environmental Science, B.S.
- Environmental Studies (secondary major only)
- French (see World Languages and Cultures, below)
- Game Design, B.S. (Managing College for this degree is the College of Design)
- Genetics, B.S.
- Geology, B.S.
- German (see World Languages and Cultures, below)
- History, B.A., B.S.
- Interdisciplinary Studies, B.A., B.S.
- International Studies (secondary major only)
- Journalism and Mass Communication, B.S.
- Liberal Studies, B.L.S. (a general studies degree)
- Linguistics, B.A.
- Mathematics, B.S.
- Meteorology, B.S.
- Music, B.A., B.Mus.
- Performing Arts, B.A.
- Philosophy, B.A.
- Physics, B.S.
- Political Science, B.A.
- Professional Studies, B.L.S. (a general studies degree)
- Psychology, B.A., B.S.

- Public Relations, B.S.
- Religious Studies, B.A.
- Scientific Illustration and Visualization, B.A.
- Sociology, B.A., B.S.
- Software Engineering, B.S. (Managing College for this degree is the College of Engineering)
- Spanish (See World Languages and Cultures, below)
- Sports Media and Communication, B.A.
- Statistics, B.S.
- Technical Communication, B.S.
- Women's and Gender Studies, B.A., B.S.
- World Languages and Cultures B.A.:
 - French
 - German
 - Spanish

A secondary major must be taken in conjunction with a primary major.

MINORS

In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, taken at ISU with a grade of C or higher. Completed minors will be recorded on the transcript.

- Advertising
- African and African American Studies
- American Indian Studies
- Anthropology
- Applied Artificial Intelligence
- Applied Mathematics
- Artificial Intelligence
- Astronomy
- Biochemistry
- Bioinformatics and Computational Biology
- Biology
- Chemistry
- Chinese Studies
- Classical Studies
- Communication Studies
- Computer Science
- Criminal Justice
- Data Science
- Economics
- English
- Entrepreneurship*

- Environmental Studies
- Ethics
- French
- Genetics
- Geology
- German
- Gerontology*
- History
- International Studies
- Journalism and Mass Communication
- Leadership Studies
- Linguistics
- Mathematics
- Meteorology
- Middle Eastern Studies
- Military Studies (Army Reserve Officers' Training Corps)*
- Music
- Music Technology
- Performing Arts
- Philosophy
- Physics
- Political Science
- Psychology
- Public Relations
- Religious Studies
- Russian Studies
- Scientific Illustration and Visualization
- Sociology
- Spanish
- Spanish Translation and Interpretation Studies
- Speech Communication
- Statistics
- Sustainability*
- Teaching English as a Second Language
- Technical Communication
- U.S. Latino/a Studies
- Women's and Gender Studies
- World Film Studies

*The College of Liberal Arts and Sciences participates in these interdepartmental minors.

Certificate Programs

University policies governing Certificate Programs are found in the Degree Planning section of the catalog.

- Actuarial Science Certificate
- Computing Applications Certificate
- Data Science Certificate
- Latin American Studies Certificate
- Leadership Studies Certificate
- Science Communication Certificate

LAS College Requirements

To obtain a bachelor's degree in any program offered by the College of Liberal Arts and Sciences, an undergraduate student must meet all university graduation requirements including:

- minimum of 120 credits
- minimum of 32 semester credits earned in residence at Iowa State University
- last 32 credits in residence
- GPA of 2.0 or better on courses taken at Iowa State University
- Information Literacy Requirement (credit for LIB 1600 Introduction to College Level Research)
- Communication Proficiency Requirement (credit for ENGL 1500, ENGL 2500*, and upper-level coursework)
- U.S. cultures and communities and international perspectives requirements

**The College of Liberal Arts and Sciences aligns with the University Communication Proficiency Grade Requirement. At a minimum, students must demonstrate their communication proficiency by earning a grade of C or better in ENGL 2500; some majors set higher requirements for communication proficiency. For other university policies governing ISU degree programs, see Academics.*

Students with majors leading to Bachelor of Science or Bachelor of Arts degrees, must also meet all college and program specific requirements including:

- General Education
- World Language
- Advanced Credits
- Career Proficiency
- Completion of the Major

General Education

Requirements in a major are designed to develop depth, or mastery of a specific field or discipline, while courses in general education are designed to establish breadth, or a strong, intellectual foundation to support learning for all majors.

General Education Requirements and Learning Goals

The general education areas with their minimum credit requirements for the College of Liberal Arts and Sciences are:

- Arts and Humanities— (Minimum 12 credits). The student should develop an understanding of human cultural heritage and history, and an appreciation of reasoning and the aesthetic value of human creativity.
- Mathematical Disciplines and Natural Sciences — (Minimum 11 credits, including 3 in the mathematical disciplines and 8 in the natural sciences). The student should appreciate mathematics as a valuable tool of the sciences and as an intrinsically important way of thinking and should experience science as a rational search for understanding the structure and behavior of the natural world.
- Social Sciences— (Minimum 9 credits). The student should develop an appreciation of the principal methods of studying human behavior and an understanding of the structure and functioning of institutions.

Lists of courses approved for the three general education areas are available on the LAS College website (<http://www.las.iastate.edu/students/academics/general-education/>). Students may not apply the same course in more than one general education area.

Because students fulfill, in part, the learning goals of the area of their first major by taking courses in their programs of study, the minimum number of general education credits required in the area of the first major is reduced from that listed above by 3 credits. Students in Liberal Studies or Interdisciplinary Studies majors must complete the minimum requirements in all three areas.

Consistent with its breadth goal, courses with the subject/designator of a student's primary major may not be applied to general education requirements. Courses cross-listed with a course in the student's primary major may be used to satisfy either major requirements or general education requirements but may not be used more than once. Courses taken to meet the requirements of an additional major, secondary major, minor or certificate may be counted in the general education groups.

Seminars and experimental courses may be acceptable as general education; advisors should consult with the LAS college office. Orientation courses, independent study courses (usually numbered 2900 or 4900), cooperative courses, courses numbered 5000 and above, and

courses taken on a satisfactory-fail (S-F) or pass-not pass (P-NP) basis cannot be applied to a general education group.

World Language Requirement

The faculty of the College of Liberal Arts and Sciences believes that undergraduate students should acquire elementary practical experience in a second language, should be introduced to the theoretical study of language structure, and should begin to develop an understanding of a second culture through study of that culture's language. Students meet this expectation by satisfying a graduation requirement equivalent to the first year of university-level study in one world language.

Students may meet this requirement through several pathways:

- Completing three or more years of high-school world language study in a single language.
- Passing the exam for credit at the 1020 level.
- Receiving a passing grade in an ISU 1020 world language or American Sign Language (ASL) course, an approved ISU intensive or accelerated world language course, or equivalent transfer course.
- Receiving a passing grade in a world language course taught in a language other than English at the 2000-level or higher.
- Being a native speaker of a language other than English.
- Completing a major in any world language.

Questions about the World Language Requirement and how to meet it should be directed to the College Academic Services office in 102 Catt Hall. Credits applied toward the World Language Requirement cannot be used to satisfy the general education requirements, but students who have fulfilled the World Language Requirement may apply approved courses in world languages toward the appropriate general education areas.

Advanced Credit Requirements

To obtain a bachelor's degree from the College of Liberal Arts and Sciences, curriculum in liberal arts and sciences, a student must earn at least 45 credits at the 3000 level or above taken at a four-year college. All such credits, including courses taken on a pass/not pass basis, may be used to meet this requirement.

Career Proficiency Requirement

Students will demonstrate knowledge of foundational career preparation topics such as internship and job search resources and processes, identifying and developing personal strengths and experiences, preparing application materials, interviewing, negotiating offers, and understanding ISU career services resources.

The minimum expectations of this career-readiness requirement will be met by successful completion of LAS 2030 Professional Career Preparation.

Students are expected to complete the minimum requirement before their third year (before their third semester at ISU for transfer students) and are encouraged to continue developing their career proficiency beyond the minimum through internships, co-ops, research, entrepreneurial activities and other professional development experiences and coursework during their Junior and Senior years.

The Major

Students must show they have achieved depth in a specialized area by completing successfully the requirements and learning goals of a major. A major comprises 24 to 50 credits in a program of study as determined by the faculty. Tracks within a major must have a common core that supports learning outcomes of the major. Some courses outside the major discipline may also be required as supporting work for the major. (See Majors, Minors and Certificates to find individual department and program requirements.)

The average grade of all courses in the major (those courses listed under major on the degree audit) must be 2.0 or higher. The major must contain at least 8 credits in courses taken at Iowa State University that are numbered 3000 or above and in which the student's grade is C or higher. Some majors have specific GPA requirements for key courses or groups of courses.

Courses with the subject/designator of the primary major listed on the degree program may not be counted in the general education groups.

The major in Interdisciplinary Studies (B.A., B.S.) is available for undergraduate students who have unique interdisciplinary educational goals. Such a major is designed by the faculty and the student and is approved only when the educational goals cannot be met by a reasonable combination of existing majors, minors, and certificates.

Additional Majors

Students may elect an additional major from the departments and program areas in the College of Liberal Arts and Sciences, or from a different major field offered for the bachelor's degree in another college of the university.

When choosing an additional major, students must confirm that the additional major is allowable; currently the following combinations of majors are not allowed, as multiple majors or multiple degrees:

- Economics with Business Economics
- Any combination of Journalism and Mass Communication, Advertising, and Public Relations.

Students interested in pursuing multiple majors should talk to their advisor about the process. If one major leads to the B.A. degree and the other to the B.S. degree, the degree awarded will be the one offered by the department of the primary major. In all cases, the student must satisfy the requirements of each major and the general education and

other degree requirements for the primary major. Students with a primary major in another college who wish to take a second major in the College of Liberal Arts and Sciences must meet all requirements of the second major, but are exempt from the LAS College General Education, World Language, Career Proficiency and Advanced Credits requirements.

University policies for students wishing to double major or earn two bachelor's degrees are found in the Degree Planning section of the catalog.

Minors and Certificates

In addition to earning a major a student may want to complete minors or certificates to develop specific knowledge and skills beyond their major. University policies related to minors and certificates and lists of all minors and certificates are available in the catalog. See the Degrees, Majors, Minors and Certificates tab in the LAS section of the catalog for all minors and certificates offered by the college. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher. Completed minors and certificates will be recorded on the transcript.

Bachelor of Music Curriculum

In addition to the major in music leading to a Bachelor of Arts degree, the LAS College offers a Bachelor of Music degree (B.Mus.). In order to pursue teacher certification and recommendation for licensure in music, students must earn the Bachelor of Music degree. Bachelor of Music students select one of the following options: music education [vocal or instrumental], performance [voice, piano, organ, string instruments, wind or percussion instrument], or composition. For details about both degrees, see Music, Degree Requirements.

Bachelor of Liberal Studies Curriculum

The LAS College also administers the Bachelor of Liberal Studies (B.L.S.) degree, a bachelor's degree program established by Iowa Board of Regents and offered by all three Regents institutions. The B.L.S. is a general studies degree. While the B.L.S. does not have traditional majors focused on a specific discipline, students may choose to pursue the Liberal Studies Major, taking coursework in three areas of distribution, or the Professional Studies Major, taking coursework aimed to develop broad professional competencies in critical thinking, communication, leadership/teamwork, and technology. With the assistance of a B.L.S. advisor, students can structure a program that meets their individual educational, vocational or personal goals. Students in the B.L.S. program are not eligible for additional majors, but they may earn a Certificate or minor by completing all of the requirements of those programs. Criteria for graduating with distinction and other academic honors with a B.L.S. degree are available under Scholastic Recognition.

For specific degree requirements, see Bachelor of Liberal Studies.

Software Engineering Curriculum

A Bachelor of Science degree in software engineering is jointly administered by the College of Liberal Arts and Sciences and the College of Engineering; the College of Engineering is the managing college for this program. The program is aimed at creating high-quality software in a systematic, controlled, and efficient manner. The specific objective of the program is to educate students on principles, processes, techniques, and tools for producing, analyzing, specifying, designing and evolving software. A broader objective is to cultivate among students' intellectual curiosity, problem-solving skills, good learning habits, effective communication skills, leadership, and teamwork.

This cross-college program enables students to take a range of Software Engineering courses, as well as elective courses from both Computer Science and Computer Engineering as part of their degree program.

For specific degree requirements, see Software Engineering.

Additional Curricular Policies

In addition to the policies outlined in the above discussion of the curricula of the LAS College:

- Elective courses as well as general education courses may be used to meet the requirements of a minor, certificate or additional major, provided that they are taken on a graded basis.
- Courses taken on a pass/not pass basis may be counted toward the required total of 120 credits and may be used to meet the advanced credit requirement, if appropriate, but may not be used to satisfy any other graduation requirement.
- No more than 9 credits of 4900 (Independent Study) courses may be counted toward graduation.
- Criteria for graduating with distinction and other academic honors are available under [Scholastic Recognition](#).
- Students whose high school study of world languages meets the College World Language Requirement may not enroll in or receive credit for 1010 or 1020 in that language.
- Students are ultimately responsible for their academic decisions and are expected to use multiple resources such as their academic advisors, the Academic Progress Report/degree audit, Navigate, University policies, and this catalog, to understand their progress toward graduation and to operate within University policy. See the Academics section of the catalog.

Open Option

Students who enter Iowa State University and want time to explore the best match between their academic interests, abilities, and career goals may do so as Open Option students. The Open Option experience is designed to help students explore majors and careers, become

acquainted with the entire university, and make successful adjustments to the academic expectations of Iowa State.

Open Option students are assigned academic advisors who specialize in working with students who have not declared a major. First-year Open Option students take LAS 1010 and participate in the HOME learning community. This orientation experience introduces students to campus resources as well as to all of the colleges and majors on campus.

Aided by their advisor, Open Option students select courses that allow them to explore their academic interests before committing to a specific university major. Open Option students typically declare a major no later than their third semester. In addition, students who may have started in a specific field and have discovered it is not meeting their needs may transfer into Open Option for a semester or two while they decide on a new major.

For more information, visit the Open Option webpage (<https://openoption.iastate.edu/>).

Opportunities for Students

The College of Liberal Arts and Sciences provides many opportunities for students to enhance their knowledge, skills and credentials beyond traditional academic work in their majors, minors or certificate programs.

Honors Program

Students enrolled in the College of Liberal Arts and Sciences are encouraged to participate in the University Honors Program.

Liberal Arts and Sciences Honors is designed to add depth, breadth and challenge to enrich students' programs of study and intellectual development. Students in Liberal Arts and Sciences Honors benefit from the resources and capabilities of a large and dynamic research university along with the intellectual community that characterizes smaller, selective liberal arts colleges. Membership in LAS Honors offers specific benefits to students such as collaborations with individual faculty members on Honors projects, extended library loan privileges, 24-hour use of the Jischke Honors Building and priority registration for classes.

LAS Honors encourages freshmen as well as more advanced students to apply. Upon graduation, students who fulfill all of the requirements of the Honors Program are recognized by a special notation on their diploma and permanent record.

Learning Communities

Students in the LAS College can participate in a variety of learning community options that support student success by supporting the transition to college life. There are various kinds of learning communities both within and across majors. Most learning communities involve small groups of students who take one or more classes in common and have

a staff person or peer mentor who supports students as they make connections and get engaged at ISU.

See <http://www.lc.iastate.edu/> for more information.

Teacher Preparation

Teaching licenses are issued by the Iowa Board of Educational Examiners not by Iowa State. The Recommending Officer for the ISU University Teacher Education Program submits each candidate file after that candidate is determined to be eligible for recommendation. Recommendations for teaching licensure are issued for a specific teaching level, e.g., grades 5-12. Subject area endorsements are listed on the candidate's license. The College of Liberal Arts and Sciences collaborates with the School of Education to prepare students for recommendations for licensure in approved programs. Students who plan to teach in secondary schools (grades 5-12) may work toward completing an approved teacher preparation program focus in one of the following majors:

- Biology
- Chemistry
- Earth Science
- English
- History
- Mathematics
- Music (through the Bachelor of Music curriculum) *
- Physics
- Political Science
- World Languages and Cultures (Endorsements are available in French, German, and Spanish.)

Students may also prepare for recommendation for additional endorsements. For further information, see Educator Preparation.

*Students in the College of Liberal Arts and Sciences who complete the approved teacher preparation program in music education (B.Mus. degree with Vocal K-12 option or Instrumental K-12 option) and meet all other requirements may be recommended for a teaching license that allows them to teach music in grades K-12.

Preprofessional Programs

Any major in the College of Liberal Arts and Sciences provides excellent preparation for entry to professional schools. Students may enter the college with a designation of Pre-Med, Pre-Law or Preprofessional Health. Most students will earn a bachelor's degree in the major of their choosing while also completing the courses required for admission to professional schools. Some students will spend one to three years as students in the

college before transferring to a professional school where they have been accepted to complete their studies.

Preprofessional students are encouraged to pursue a major that interests them and where they excel. Advisors work with students to develop a program of study within their major that meets admission requirements to professional school and develops a student's credentials for the competitive application process to professional schools. For further information, see Opportunities for Preprofessional Study.

The College of Liberal Arts and Sciences participates in a 3+3 program with the Law Schools at Drake University and at the University of Iowa which allows qualified students to complete three years at Iowa State and transfer coursework from the first year of law school to complete their bachelor's degree requirements. Visit the Liberal Arts and Sciences Student Services office for details.

Reserve Officers' Training Corps Programs (ROTC)

The College of Liberal Arts and Sciences also offers students the opportunity to combine their academic programs with ROTC programs in Military Science (Army), Naval Science (Navy, Marine Corps), and Air Force Aerospace Studies (Air Force, Space Force). See Officer Education Programs for more information.

Study Abroad and National Student Exchange

The LAS College offers many study abroad and domestic exchange program options to enhance the undergraduate experience. Every year hundreds of students expand their horizons through these programs while they stay on track for graduation.

LAS Study Abroad provides international study, work, and service opportunities for all Iowa State students. LAS supports faculty and staff to facilitate learning opportunities abroad, and partners with organizations to offer a breadth of program options.

International learning opportunities for LAS students come in varied formats, from semester-long experiences focused on language immersion to three-week long global seminars that focus on interdisciplinary subjects. Faculty-led programs are among the most sought-after by our undergraduates, as they pair faculty expertise and ISU credit with the opportunity to explore other lands and cultures. Other program types available to students are exchanges, direct-enroll and affiliate programs.

LAS students can also work with the ISU National Student Exchange program to explore options to study out-of-state at one of more than 200 universities within the United States, US Territories, and Canada.

Visit LAS Study Abroad (<https://abroad.las.iastate.edu/>) or the National Student Exchange website (<https://www.nse.dso.iastate.edu/>) for more information.

Undergraduate Research

The LAS College has hundreds of faculty members actively engaged in research and most majors have designated independent study and/or research courses. Students are encouraged to talk to faculty about how they can be involved in the process of discovery. Visit LAS Undergraduate Research (<https://las.iastate.edu/research/las-undergraduate-research/>) for more information.

LAS Innovation and Entrepreneurship Academy

The College of Liberal Arts and Sciences I+E Academy (<https://las.iastate.edu/students/lasinnovates/>) offers a two-year program open to all LAS majors, where students engage in online, face-to-face, and interactive activities to experience and develop an innovative and entrepreneurial mindset. The program matches students with a mentor in the second year and connects students with other on campus opportunities such as ISU's Pappajohn Center for Entrepreneurship (<https://www.isupjcenter.org/>) and Student Innovation Center offerings (<https://sictl.iastate.edu/>) where students can further develop their innovative ideas.

Career Services and Internships

LAS Career Services supports students' career exploration, career development, and professional career search assistance. The career development process requires students to proactively plan and engage with applied learning experiences, such as internships, research, and leadership positions, throughout their time on campus. LAS Career Services strongly recommends students have one or more internships before entering the workforce.

LAS Career Services offers career advising, internship and job search resources, and organizes events such as career fairs that connect students with employers. Services are available to undergraduates, graduate students, and alumni. Academic credit may be available for internships/co-op through departments and LAS Career Services.

For additional information, explore the LAS Career Services website (<https://careers.las.iastate.edu/>) or visit their office on the first floor of Carver Hall.

Advertising ADVERTISING

<http://www.greenlee.iastate.edu> (<http://www.greenlee.iastate.edu/>)

The advertising major prepares students for careers in business and industry or for graduate education. Students majoring in advertising find career opportunities in professions requiring applied communication expertise. Graduates are qualified for positions in the creative and account sides of advertising within businesses, agencies and media. Coursework in this major focuses on writing, research, digital and emerging media, and professional abilities. Students are required to complete a capstone internship experience to practice and refine their skills.

The Greenlee School of Journalism and Communication prepares students for communication fields. The school offers four majors:

- Advertising Bachelor of Arts (ADVRT)
- Journalism and Mass Communication Bachelor of Science (JLMC)
- Public Relations Bachelor of Science (PR)
- Sports Media and Communication Bachelor of Arts (SMC)

In addition, the Greenlee School offers a 4+1 program allowing students to complete their B.A. or B.S. and earn an M.S. in journalism and mass communication in fewer semesters.

Professional skills are taught and practiced alongside academic requirements using the latest technology and leading-edge communication trends and methods.

Founded in 1905, the unit was one of the first journalism programs to be accredited in 1948 and continues to be one of the longest continuously accredited programs in the country. Accreditation is based on the principle that students need a broad-based, liberal arts education and solid core courses within the discipline. Students taking one major at the school may not seek an additional major or a minor in the school. All students are required to take an additional major or a minor outside the school as an area of expertise.

Student Learning Outcomes

Students who major in programs of the Greenlee School of Journalism and Communication are expected to develop competencies in 10 key areas:

- Apply the principles and laws of freedom of speech and press, in a global context, and for the country in which the institution that invites ACEJMC is located;
- Demonstrate an understanding of the multicultural history and role of professionals and institutions in shaping communications;
- Demonstrate culturally proficient communication that empowers those traditionally disenfranchised in society, especially as grounded in race, ethnicity, gender, sexual orientation and ability, domestically and globally, across communication and media contexts;

- Present images and information effectively and creatively, using appropriate tools and technologies;
- Write correctly and clearly in forms and styles appropriate for the communications professions, audiences and purposes they serve;
- Demonstrate an understanding of professional ethical principles and work ethically in pursuit of truth, accuracy, fairness and diversity;
- Apply critical thinking skills in conducting research and evaluating information by methods appropriate to the communications professions in which they work;
- Effectively and correctly apply basic numerical and statistical concepts;
- Critically evaluate their own work and that of others for accuracy and fairness, clarity, appropriate style and grammatical correctness;
- Apply tools and technologies appropriate for the communications professions in which they work.

The Advertising Major

To receive a Bachelor of Arts degree in advertising, a student must earn at least 120 credits. A minimum of 72 credits must come from courses other than ADVRT, JLMC, PR or SMC. At least 50 of these credits must come from the liberal arts and sciences. Overall, at least 45 credits must be from 3000-level courses or above.

The degree requirements allow for a minimum of 34 credits and a maximum of 48 credits to be taken in ADVRT, JLMC, PR or SMC. These include:

JLMC 1100	Orientation to Journalism and Communication	1
JLMC 2010	Reporting and Writing for the Mass Media (C+ or better)	3
ADVRT 2300	Advertising Principles	3
ADVRT 3010	Research and Strategic Planning for Advertising and Public Relations	3
One of the following two courses with C+ or better		
ADVRT 3340	Advertising Creativity	3
or ADVRT 3360 Advertising Account Management		
3000-level ADVRT, JLMC, PR or SMC Electives		6
One of the following two courses:		
ADVRT 4340	Advertising Campaigns	3
or ADVRT 4360 Advertising Creative Portfolio		
JLMC 4600	Law of Mass Communication	3
JLMC 4620	Media Ethics, Freedom, Responsibility	3
4000-level ADVRT, JLMC, PR or SMC Electives		3
ADVRT 4990A	Professional Media Internship: Required	3
Total Credits		34

Advertising majors are also required to take:

MKT 3400	Principles of Marketing	3
STAT 1010	Principles of Statistics (or another approved statistics course)	4

As majors in the College of Liberal Arts and Sciences, advertising students must meet College of Liberal Arts and Sciences and University-wide requirements for graduation in addition to those stated above for the major.

University Requirement: Students in all ISU majors must complete a three-credit course in U.S. Cultures and Communities, as well as a three-credit course in International Perspectives. The approved course lists are found at the following web addresses: (U.S. Cultures and Communities) <http://www.registrar.iastate.edu/students/div-ip-guide/usdiversity-courses> (<http://www.registrar.iastate.edu/students/div-ip-guide/usdiversity-courses/>) and (International Perspectives) <http://www.registrar.iastate.edu/students/div-ip-guide/IntlPerspectives-current> (<http://www.registrar.iastate.edu/students/div-ip-guide/IntlPerspectives-current/>). Students must also demonstrate their communication proficiency by earning a grade of C or better in ENGL 2500.

College of LAS Requirement: Minimum of 120 credits, including a minimum of 45 credits at the 3000-level and above. You must also complete the LAS world language requirement, LAS career proficiency requirement, and any unmet ISU admission requirements.

Greenlee majors and minors cannot take ADVRT, JLMC, PR or SMC courses pass/not pass.

Minor or Additional Major: Students are required to fulfill a secondary area of expertise. This requirement can be met by declaring a minor or an additional major outside of the Greenlee School of Journalism and Communication. Students taking one major at the school may not seek an additional major or minor in the school.

Juniors can apply to a concurrent degree program and earn a B.A. in advertising and an M.S. in journalism and mass communication in fewer semesters. Contact the Director of Graduate Education for more information on the Greenlee School's 4+1 Program.

Advertising, B.A.

Freshman

Fall	Credits	Spring	Credits
ENGL 1500		3 ECON 1010	3
JLMC 1100		1 LIB 1600	1
Arts and Humanities		3 ADVRT 2300	3
Natural Science		3 JLMC 2010	3

Social Science	3 Arts and Humanities	3
	Natural Science	3
13		16

Sophomore

Fall	Credits	Spring	Credits
ADVRT 3010		3 ADVRT 3340 or 3360	3
ENGL 2500		3 Arts and Humanities	3
STAT 1010		4 Social Science	3
Natural Science		2 U.S. Cultures and Communities	3
World Languages and Cultures or Elective		3-4 World Languages and Cultures or Elective	3-4
LAS 2030		1	
16-17		15-16	

Junior

Fall	Credits	Spring	Credits	Summer	Credits
ADVRT/JLMC/PR/SMC-3000 level choice		3 ADVRT/JLMC/PR/SMC choice-3000 level		3 ADVRT 4990A	3
MKT 3400		3 ADVRT/JLMC/PR/SMC choice-4000 level	3		
Arts & Humanities		3 International Perspective	3		
Minor/additional major choice		3 Minor/additional major choice-3000 level	3		

Minor/ additional major choice	3 Minor/ additional major choice-3000 level	3
15		15
		3

Senior

Fall	Credits	Spring	Credits
JLMC 4600	3	JLMC 4620	3
One of the following:	3	Elective or Minor/ additional major choice-3000 level or above	3
ADVRT 4340		Elective or Minor/ additional major choice-3000 level or above	3
ADVRT 4360		Elective or Minor/ additional major choice-3000 level or above	3
ADVRT/ JLMC/ PR/SMC 4000-level choice*	3		
Minor/ additional major choice-3000 level or above	3		

Elective or Minor/ additional major choice-3000 level or above	3
15	
12	

Total Credits: 120-122

Minor in Advertising

Students cannot select more than one minor in the Greenlee School of Journalism and Communication. Minors in the Greenlee School are not available to Greenlee majors.

For a minor in advertising, students complete 15 credits. The minor must include at least 3 credits that are not used to meet any other department, college, or university requirement.

JLMC 1010	Mass Media and Society	3
ADVRT 2300	Advertising Principles	3
9 credits from the following:		9
SMC 2500	Principles of Sports Media and Communication	
ADVRT 3010	Research and Strategic Planning for Advertising and Public Relations	
ADVRT 4730	Social Media Strategy	
SMC 4230	Sports and the Media in a 24/7 Digital World	
ADVRT 3350	Advertising Media Planning	
JLMC 3070	Fundamentals of Digital Video Production	
JLMC 4010	Mass Communication Theory	
JLMC 4060	Media Management	
ADVRT 4970	Special Topics in Communication	
JLMC 4740	Communication Technology and Social Change	
JLMC 4760	World Communication Systems	
JLMC 4770	Diversity and the Media	

Total Credits 15

Greenlee majors and minors cannot take ADVRT, JLMC, PR or SMC courses pass/not pass.

The Advertising Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

Concurrent Undergraduate and Graduate Programs

The Greenlee School offers three concurrent degree programs:

- B.A. Advertising/M.S. Journalism and Mass Communication
- B.S. Journalism/M.S. Journalism and Mass Communication
- B.S. Public Relations/M.S. Journalism and Mass Communication

Enrollment in the Greenlee School's concurrent degree programs enables students to complete coursework for the undergraduate and graduate programs on a five-year accelerated timeline – rather than the typical six-year timeline for the two degrees. See Journalism and Mass Communication Concurrent Undergraduate and Graduate Programs for more information on combining the B.A. in Advertising and the M.S. in Journalism and Mass Communication.

GRADUATE PROGRAMS

Master of Science

The Greenlee School of Journalism and Communication offers work for a Master of Science degree in journalism and mass communication.

Concurrent Programs

The Greenlee School's concurrent degree programs enable interested students the opportunity to complete coursework for the undergraduate and graduate programs on a five-year accelerated timeline – rather than the typical six-year timeline for the two degrees.

Graduate Minor

The Greenlee School graduate program offers minor work for students majoring in other departments.

See Journalism and Mass Communication Graduate Programs for more information on the M.S. in Journalism and Mass Communication.

African and African American Studies

Interdepartmental Undergraduate Program

African and African American Studies, a cross-disciplinary program in the College of Liberal Arts and Sciences, offers students the opportunity to explore the experiences of African Americans and African American contributions to American culture. Students in the program analyze and learn about African and African American experiences through the study of history, literature, art, religion, and society. They gain knowledge and develop skills and sensitivities to help them function effectively in today's diverse society.

African and African American Studies at Iowa State University is an expanding program. Many of the courses in the program satisfy general education requirements in the College of Liberal Arts and Sciences, the human relations requirement for teachers, and the university's U.S.

Cultures and Communities or International Perspectives requirements; please consult official lists. Students can minor or even design their own Interdisciplinary Studies major with an emphasis in African and African American Studies. Relevant courses are offered through various departments.

Undergraduate Minor

African and African American Studies is offered as an undergraduate minor.

A minor in African and African American Studies requires 15 credits.

AFAM 2010	Introduction to African American Studies	3
Plus 12 additional credits in AFAM from the following:		12
AFAM 3100	Africa to 1880	
AFAM 3110	Africa under Colonial Rule	
AFAM 3270	Strategies of Resistance: From Slavery to Hip-Hop & Black Lives Matter	
AFAM 3300	Ethnic and Race Relations	
AFAM 3340	Africana Religions	
AFAM 3350	Race, Ethnicity, and the US Criminal Justice System	
AFAM 3470	African American Literature	
AFAM 3500	Women of Color in the U.S	
AFAM 3530	History of African Americans I	
AFAM 3540	History of African Americans II	
AFAM 3550	Understanding Sub-Saharan Africa	
AFAM 4600	Seminar in African American Culture	
AFAM 4730	Civil Rights and Ethnic Power	
AFAM 4900	Independent Study	
Total Credits		15

African and African American Studies is an LAS minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

Air Force Aerospace Studies Program

The Department of Air Force Aerospace Studies (AFAS) is set within the College of Liberal Arts and Science as an interdisciplinary program but does not offer an academic degree. The courses offered in the program are developed by the Air Force Air Education and Training Command and approved by the Department of the Air Force. The Department of Air Force Aerospace Studies aims to provide qualified student leaders the opportunity to earn a commission as active-duty officers in the United States Air Force (USAF) or United States Space Force (USSF). All AFAS courses are open to any ISU student who has met the course prerequisites. Entry into the Air Force Reserve Officer Training Corps

(AFROTC) program is not dependent on a departmental major or year in the university. It is open to all qualified students but is intended for students with at least three years of coursework remaining.

For further information on AFAS and AFROTC, please get in touch with afrotc@iastate.edu or call 515-294-1716.

Undergraduate Study

The curriculum is divided into two basic phases: the General Military Course (GMC) and the Professional Officer Course (POC). The GMC is introductory and open to all ISU students. It consists of four consecutive one-hour courses normally taken during the freshman and sophomore years.

Selection for entry into the POC is on a competitive basis. Cadets enrolling in this course must meet certain academic, mental, and physical requirements as well as having high moral standards. If selected, cadets who have completed the GMC will attend Field Training, a two-week intensive summer program aimed at evaluating a cadet's leadership, followership, and problem solving skills. Field Training includes officer training, physical training, career orientation, expeditionary training, and an introduction to military base functions. Successful completion of Field Training is a requirement to enter the POC.

Upon enrollment and acceptance into the POC, all cadets complete a contractual agreement with the Air Force, committing them to serve at least four years on active duty as a U.S. Air Force (USAF) or U.S. Space Force (USSF) officer after graduation. Cadets interested in an aviation career are able to compete for positions as a pilot, combat systems operator (CSO), remotely-piloted aircraft (RPA) operator, or air battle manager (ABM).

Example schedules for GMC and POC cadets: GMC

- 1 hour per week in the AFAS academic course
- 3 hours per week of physical training which is typically held at 6 am on Monday, Wednesday and Thursday
- 2 hours per week of Leadership Laboratory (LLAB) held Tuesday mornings at 6 am

POC

- 3 hours per week in the AFAS academic course
- 3 hours per week of physical training which is typically held at 6 am on Monday, Wednesday and Thursday
- 2 hours per week of Leadership Laboratory (LLAB) held Tuesday mornings at 6 am

AFROTC scholarships are available and provide payment for up to full tuition and fees. In addition, scholarship cadets receive a \$300-\$500 monthly subsistence allowance and \$900 per year book allowance. Scholarships can be awarded for periods from two to five years,

depending on academic major. Upon acceptance of a scholarship, students complete a contractual agreement with the Air Force, which commits them to serve at least four years on active duty as a USAF or USSF officer after graduation. To determine eligibility and initiate application procedures for the scholarship program, interested students should contact the AFAS department.

Military Studies Minor

The College of Liberal Arts and Sciences offers a minor in Military Studies. Requirements for the minor include taking a minimum of 15 credits of ROTC instruction, which may be taken from one or more of the ROTC programs.

American Indian Studies Minor

American Indian Studies Minor

American Indian Studies is a cross-disciplinary minor in the College of Liberal Arts and Sciences that allows students to learn more about the contemporary and historical realities of native communities in North America, to appreciate the variety of native cultures and experiences, and to be prepared for an attentive lifelong learning experience in a diverse world.

Courses focus on critical thinking and the application of knowledge in complex, diverse situations. Courses in American Indian Studies thus not only provide knowledge on specific native issues, but also prepare students for careers and further studies in fields such as community development and planning, social work, law, sociology, education, history, anthropology, agriculture, resource extraction, literature, policy, engineering, or environmental issues.

Today, 80% of American Indians live outside of reservation communities. American Indian Studies students will gain the knowledge and skills they need for living and working with, in, and around native communities and people who live everywhere in North America, and, increasingly, the world.

For students who are interested in deeper knowledge on the issues, a major can be pursued through the Interdisciplinary Studies major in the College of Liberal Arts and Sciences. Faculty members also are available to provide expertise to graduate students working on specific issues that involve American Indian themes.

Minor in American Indian Studies (AMIN)

The minor in American Indian Studies is 15 credits and includes:

AMIN 2100	Introduction to American Indian Studies	3

And 12 additional credits of AMIN coursework, of which at least 6 credits need to be 3000-level courses or above. The minor must include at least 3 credits that are not used to meet any other department, college, or university requirement.

Contact the Program Director with any questions about the minor or about upcoming course offerings in American Indian Studies.

The American Indian Studies Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

Anthropology Overview

The ISU program in Anthropology is housed in the Department of World Languages and Cultures.

Anthropology students develop a well-rounded professional education in cultural anthropology, archaeology, and biological anthropology. An undergraduate major in Anthropology can serve as the nucleus for a general liberal education, or as the prerequisite for graduate training qualifying a person for positions in (1) college and university teaching, (2) research, and (3) administrative and applied positions in government, development organizations, museums, and private businesses or corporations.

Anthropology majors may choose either a Bachelor of Arts or a Bachelor of Science degree, both of which require 36 credits in anthropology. A Bachelor of Arts degree is obtained by fulfilling the college general education requirements plus 6 additional credits in Area I (Arts and Humanities) or III (Social Sciences) or a combination of both. A Bachelor of Science degree is obtained by fulfilling the college general education requirements plus 6 additional credits in Area IIA (Mathematics) or IIB (Natural Sciences) or a combination of both. All students must also complete a minor or a second major as part of their degree requirements.

Student Learning Outcomes

Upon completion of the major in anthropology, students will be able to:

1. Explain what it means to be human through the study of culture and society, the biology and evolution of humans and other primates, and through the study of past human communities and material culture.
2. Demonstrate knowledge of the important historical and contemporary issues in the subdisciplines of archaeological, biological, and cultural anthropology.
3. Describe and evaluate local and global issues from an anthropological perspective.
4. Demonstrate an understanding of the value of cultural diversity.

Degree Requirements

Undergraduate students with majors in anthropology are required to take the following anthropology core courses:

ANTHR 2010	Introduction to Cultural Anthropology	3
ANTHR 2020	Human Origins	3
ANTHR 3060	Culture and Interpretation	3
ANTHR 3070	Biological Anthropology	3
ANTHR 3080	Archaeology	3
ANTHR 4500	Approaches in Anthropology	3
One of the following methods courses is required:		3

ANTHR 3190 Skeletal Biology
or ANTHR 32 Archaeological Discovery and Analysis
or ANTHR 43 Ethnographic Methods

In addition to the above, 15 ANTHR choice credits are required. 15

Communication Proficiency requirement: According to the university-wide Communication Proficiency Grade Requirement, students must demonstrate their communication proficiency by earning a grade of a C or better in ENGL 2500.

ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
or ENGL 2500H Written, Oral, Visual, and Electronic Composition: Honors		

Additionally, the Anthropology Program requires a grade of C or better in one of the following courses:

ENGL 3020	Business Communication
ENGL 3090	Proposal and Report Writing
ENGL 3140	Technical Communication

The principal sub-disciplines of anthropology are represented by the following:

1. Cultural anthropology:

ANTHR 2010	Introduction to Cultural Anthropology	3
ANTHR 2300	Globalization and the Human Condition	3
ANTHR 3060	Culture and Interpretation	3
ANTHR 3090	Introduction to Culture and Language	3
ANTHR 3100	Environmental Anthropology	3
ANTHR 3130	Kinship and Marriage in a Global Perspective	3
ANTHR 3220	Peoples and Cultures of Native North America	3
ANTHR 3230A	Latin American Anthropology: Violence and Memory	3
ANTHR 3230B	Latin American Anthropology: Social movements and Democracy	3
ANTHR 3230C	Latin American Anthropology: Race, Class and Gender	3
ANTHR 3230D	Latin American Anthropology: Regional Focus	3
ANTHR 3230E	Latin American Anthropology: Culture and Sport	3

ANTHR 3320A	Current Issues in Native North America: Gender and Family	3
ANTHR 3320B	Current Issues in Native North America: Indigenous Ecologies and Geographies	3
ANTHR 3320C	Current Issues in Native North America: Cultural and Political Movements	3
ANTHR 3320D	Current Issues in Native North America: Regional Focus	3
ANTHR 3360	Culture and Capitalism	3
ANTHR 3400	Magic, Witchcraft, and Religion	3
ANTHR 3420	Culture, Sex, and Gender	3
ANTHR 3540	War and the Politics of Humanitarianism	3
ANTHR 3550	Understanding Sub-Saharan Africa	3
ANTHR 4110	Anthropology in Professional Applications	3
ANTHR 4310	Ethnographic Methods	3
ANTHR 4340B	Internship: Cultural Anthropology	2-6
ANTHR 4340D	Internship: Linguistic Anthropology	2-6
ANTHR 4500	Approaches in Anthropology	3
ANTHR 4510B	Practicum in Anthropology: Cultural Anthropology	1-3
ANTHR 4510D	Practicum in Anthropology: Linguistic Anthropology	1-3
ANTHR 4900B	Independent Study: Cultural Anthropology	1-5
ANTHR 4900D	Independent Study: Linguistic Anthropology	1-5

2. Archaeology:

ANTHR 2020	Human Origins	3
ANTHR 3080	Archaeology	3
ANTHR 3150	Archaeology of North America	3
ANTHR 3200	Great Plains Archaeology	3
ANTHR 3210	World Prehistory	3
ANTHR 3280	Archaeological Discovery and Analysis	3
ANTHR 4290	Topics in Archaeological Laboratory Methods and Techniques: Archaeological Field School	4-6
ANTHR 4340A	Internship: Archaeology	1-6
ANTHR 4500	Approaches in Anthropology	3
ANTHR 4510A	Practicum in Anthropology: Archaeology	1-3
ANTHR 4900A	Independent Study: Archaeology	1-5

3. Biological Anthropology:

ANTHR 2020	Human Origins	3
ANTHR 3070	Biological Anthropology	3
ANTHR 3170	Primate Behavior, Ecology, and Evolution	3
ANTHR 3190	Skeletal Biology	3

ANTHR 4240	Forensic Anthropology	3
ANTHR 4340C	Internship: Biological Anthropology	1-6
ANTHR 4450	Biological Field School	4-6
ANTHR 4510C	Practicum in Anthropology: Biological Anthropology	1-3
ANTHR 4900C	Independent Study: Biological Anthropology	1-5

As majors in the College of Liberal Arts and Sciences, Anthropology students must meet College of Liberal Arts and Sciences and University-wide requirements for graduation in addition to those stated above for the major.

LAS majors require a minimum of 120 credits, including a minimum of 45 credits at the 3000/4000 level. You must also complete the LAS world language requirement and career proficiency requirement.

Students in all ISU majors must complete a three-credit course in U.S. Cultures and Communities and a three-credit course in International Perspectives. Check (<http://www.registrar.iastate.edu/courses/div-ip-guide.html>) for a list of approved courses.

Students in Anthropology have the option of pursuing a B.S. or a B.A. A B.S. requires six additional group requirement credits in natural science or mathematics disciplines. A B.A. requires six additional group requirement credits in social or humanities disciplines.

Anthropology B.S., B.A.

Freshman

Fall	Credits Spring	Credits
ENGL 1500	3 ANTHR 2020	3
LIB 1600	1 Minor choice	3
ANTHR 2010	3 Social science choice	3
Elective	3 Natural science choice	3
Arts & Humanities choice	3 Arts & Humanities choice	3
Social science choice	3	
16		15

Sophomore

Fall	Credits Spring	Credits
ANTHR 3080	3 ANTHR 3060	3
World Languages and Cultures/International Perspective	4 World Languages and Cultures/International Perspective	4
Humanities choice	3 ANTHR 3000 choice	3
ENGL 2500	3 Minor choice	3
ANTHR 3000 choice	3 Natural science choice	3
LAS 2030	1	
17		16

Junior

Fall	Credits Spring	Credits
ANTHR 4250	1 ANTHR 3070	3
STAT 1010	4 ENGL 3000-level	3
Arts & Humanities choice	3 ANTHR 3000	3
ANTHR 3000 choice	3 Minor choice	3
Natural science choice	3 Additional Area requirement	3
Summer: It is highly recommended that students complete a field school, internship, or study abroad experience during the summer between their junior and senior years however, this is not required for graduation.		
14		15

Senior

Fall	Credits Spring	Credits
ANTHR 4500	3 ANTHR 3000 choice	3
Minor choice	3 Minor choice	3
ANTHR 3000 choice	3 Elective	3
Additional Area requirement	3 Elective	3
Electives	3	
15		12

Minor

A minor in anthropology consists of at least 15 credits. The minor must include at least 3 credits that are not used to meet any other department, college, or university requirement.

ANTHR 2010	Introduction to Cultural Anthropology	3
ANTHR 2020	Human Origins	3
One of the following in cultural anthropology:		3
ANTHR 3060 Culture and Interpretation		
or ANTHR 30 Introduction to Culture and Language		
or ANTHR 32 Peoples and Cultures of Native North America		
or ANTHR 34 Magic, Witchcraft, and Religion		
ANTHR 3230A	Latin American Anthropology: Violence and Memory	3
or ANTHR 3230B Latin American Anthropology: Social movements and Democracy		
or ANTHR 3230C Latin American Anthropology: Race, Class and Gender		
or ANTHR 3230D Latin American Anthropology: Regional Focus		
One of the following in archaeology or biological anthropology:		3

ANTHR 3070 Biological Anthropology

or ANTHR 3080 Archaeology

or ANTHR 3150 Archaeology of North America

or ANTHR 3190 Skeletal Biology

or ANTHR 3200 World Prehistory

Or ANTHR 4820A, ANTHR 4820B, ANTHR 4820C, ANTHR 4820D

Three additional credits in ANTHR at the 3000+ level 3

The Anthropology Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

Graduate Programs

The department offers a master of arts degree with a major in anthropology. Graduate courses are offered in the areas of archaeology, biological anthropology, and cultural anthropology. Competence in statistics or a methodology relevant to the student's program of study must be demonstrated. Students are required to do original field, archival, or laboratory research that will result in a scholarly thesis.

**Applied Artificial Intelligence
Minor in Applied Artificial Intelligence**

Applications of Artificial Intelligence (AI) are permeating nearly every aspect of society, from healthcare diagnostics, financial analysis, and transportation optimization to enhancing educational methodologies, driving innovations in entertainment, and shaping more efficient and personalized customer experiences. The Applied AI minor is available to all undergraduate students at Iowa State University. It provides foundational knowledge on the use of AI using low-code or no-code tools available to a wide range of users. A useful analogy is that of being able to drive a car versus produce it or perform work under the hood. The minor also helps students understand the ethical, social, cultural, and economic implications of increased AI use.

The minor in Applied Artificial Intelligence requires the completion of 15 credit hours, including a 6 credit core plus 9 additional credits selected from the approved list.

Students with strong backgrounds in logical or quantitative reasoning who are interested in learning basic AI and machine learning techniques and applying AI methods to solve practical problems may be interested in the Artificial Intelligence Undergraduate Minor.

MINOR

The minor in Applied Artificial Intelligence requires the completion of 15 credit hours, including a 6 credit core plus 9 additional credits selected from the approved list.

AI 2010	Introduction to Applied AI	3
AI 2020	Ethical Design, Use, and Impact of AI	3
Choose 9 additional credits from the list below		9
ABE 5160	Data Science and Analytics for Agricultural and Biosystem Engineers	
ANTHR 3160X	Anthropology and Artificial Intelligence (AI)	
COMS 4720	Principles of Artificial Intelligence	
COMS 4740	Introduction to Machine Learning	
COMS 4760	Motion Planning for Robotics and Autonomous Systems	
COMST 3300	Communication in a Digital World	
DES 2500 Specified Section	Design Intersections - Only topic of AI in Art and Design	
DS 2010	Introduction to Data Science	
DS 3010	Applied Data Modeling and Predictive Analysis	
ECON 3830X	Economics of Innovation	
EDUC 4540 Specified Section	Emerging Topics in Educational Technology - Only topic of Introduction to AI in Education	
EE 4250	Machine learning: A Signal Processing Perspective	
EE 4280	Image Analysis using Machine Learning	
ENGL 2220	Artificial Intelligence and Writing	
IE 4830	Data Mining	
IE 4870	Big Data Analytics and Optimization	
JLMC 4740	Communication Technology and Social Change	
MATH 4220X	Mathematical Principles of Data Science	
ME 2800	Design and Analysis of Cyber-Physical Systems	
MIS 4360	Introduction to Business Analytics	
MIS 4460	Advanced Business Analytics	
MKT 4560X	Digital Marketing Analytics	
PHIL 3430	Philosophy of Technology	
PSYCH 3500	Human Factors in Technology	

At least 6 credits must be in courses numbered 3000 or above. At least 3 credits must be taken at Iowa State University.

At least 3 credits used for the minor cannot be used to meet any other department, college or university requirement.

Courses taken for a minor may not be taken on a pass-not pass basis.

The Applied Artificial Intelligence Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

Artificial Intelligence Minor Overview

The Artificial Intelligence Minor is designed to equip students with foundational knowledge in artificial intelligence and machine learning principles. The coursework is structured to provide students with the essential knowledge and core skills needed to apply AI and machine learning techniques to address a wide range of practical problems. Students completing the minor will gain a comprehensive understanding of AI and machine learning principles, methodologies and algorithms, equipping them with the ability to create AI-driven solutions for real-world challenges. This minor is ideal for undergraduates with strong quantitative backgrounds who are eager to learn and apply the fundamentals of AI and machine learning.

The Artificial Intelligence minor is available to majors in all disciplines. Students majoring in one of the computing disciplines, specifically, computer science, computer engineering, software engineering and data science, will find that their primary coursework matches well with the prerequisites and courses required for the minor.

Students (from any major) who want to learn how to use low-code or no-code AI tools effectively and ethically may be interested in the Applied Artificial Intelligence Minor.

Undergraduate Minor

The Artificial Intelligence Undergraduate Minor is a 15 credit minor. Please note these courses require significant prerequisite coursework.

Artificial Intelligence Core Courses

PHIL 3430	Philosophy of Technology	3
COMS 4720	Principles of Artificial Intelligence	3
COMS 4740	Introduction to Machine Learning	3

AI-related Course Electives

COMS 4350	Algorithms for Large Data Sets: Theory and Practice	
COMS 4760	Motion Planning for Robotics and Autonomous Systems	
COMS 4770	Foundations of Robotics and Computer Vision	
CPRE 4190	Software Tools for Large Scale Data Analysis	
EE 4240	Introduction to Digital Signal Processing	
EE 4250	Machine learning: A Signal Processing Perspective	
ME 4250	Optimization Methods for Complex Designs	
ME 4560	Machine Vision	
ME 4750	Modeling and Simulation	
STAT 4219	Bayesian Data Analysis	

Total Credits

15

The Artificial Intelligence Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

Biochemistry (LAS)

Overview

The Roy J. Carver Department of Biochemistry, Biophysics and Molecular Biology (<https://www.bbmb.iastate.edu>) offers majors in biochemistry in the College of Liberal Arts and Sciences and in the College of Agriculture and Life Sciences. Biochemists seek to understand life processes in terms of chemical and physical principles. Students in the biochemistry majors develop foundational analytical skills while exploring frontiers in biotechnology and medicine. Graduates in biochemistry will have a rigorous background in chemistry, biology, and physics. Biochemistry coursework focuses on the development of problem-solving skills, critical thinking, communication, and research design. The Biochemistry degree includes focused specializations towards professional goals, including three prescribed options: **Research & Biotechnology**, **Pre-Medicine**, and **Biophysics**.

Graduates with a Biochemistry B.S. degree will be prepared for postgraduate studies in the chemical or biological sciences, medical and health professional training, or immediate laboratory research in biochemistry, biotechnology, or pharmacy. Graduates are also equipped to pursue careers in teaching, technical writing, science communication and policy, intellectual property law, and biotechnology entrepreneurship. The biochemistry major is accredited by the American Society for Biochemistry and Molecular Biology (ASBMB). As such our learning objectives align with ASBMB core concepts.

Student Learning Outcomes

Upon graduation, students should be able to:

- Explain and provide examples to illustrate the biochemical principles underlying the following:
 - a. How energy is required and transformed in biological systems.
 - b. How macromolecular structure determines function and regulation.
 - c. How information storage and flow are dynamic and interactive.
 - d. How biochemistry and biology are driven by evolution and homeostasis
- Apply and justify appropriate techniques to characterize and quantify biomolecules in biological systems.
- Execute effective multimodal communication of the research process and results.

- Implement and justify best practices for laboratory safety and research ethics.

Biochemistry Major in the College of Liberal Arts and Sciences

The Bachelor of Science (B.S.) degree in Biochemistry requires the Biochemistry Core and one of the following three prescribed options. The options represent focused specializations for professional goals, including *Research & Biotechnology*, *Pre-Medicine*, and *Biophysics*. As majors in the College of Liberal Arts and Sciences, Biochemistry students must meet College of Liberal Arts and Sciences and University-wide requirements for graduation in addition to those stated below. Focus option-approved science course lists can be found on the Biochemistry website (<https://www.bbmb.iastate.edu/approved-course-lists/>).

Biochemistry Core

The major in biochemistry requires completion of the Biochemistry Core and one of three focus options. Each defined option includes specific supporting coursework in Biology; Chemistry; Mathematics and/or Statistics.

BBMB 1010	Introduction to Biochemistry	2
BBMB 1020	Introduction to Biochemistry Laboratory	1
BBMB 2010	Chemical Principles in Biological Systems	2
BBMB 3110	Writing Scientific Reports in Biochemistry ¹	1
BBMB 3120	Experimental Research Skills in Biochemistry	2
BBMB 4040	Biochemistry I	3-4
or BBMB 5040 & BBMB 5050	Amino Acids and Proteins and Bioenergetics and Metabolism	
BBMB 4050	Biochemistry II	3-4
or BBMB 5060 & BBMB 5070	Membrane Biochemistry and Biochemistry of Nucleic Acids	
BBMB 4100	Analysis of Scientific Literature	2
BBMB 4110	Techniques in Biochemical Research	4
BBMB 4610	Molecular Biophysics	2
BBMB 5610L	Laboratory in Molecular Biophysics	2-3
or CHEM 3220L	Laboratory in Physical Chemistry	
PHYS 2310 & 2310L	Introduction to Classical Physics I and Introduction to Classical Physics I Laboratory	5
PHYS 2320 & 2320L	Introduction to Classical Physics II and Introduction to Classical Physics II Laboratory	5

BBMB 4990	Undergraduate Research (highly encouraged elective)	arr †
Total Credits		34-37 †

† Arranged with instructor.

¹ BBMB 3110 fulfills the ISU upper-level Communication Proficiency requirement.

* Prior to graduation all students take the spring semester ASBMB Annual Exam as a measure of program outcomes assessment.

Biochemistry Program of Study: Research & Biotechnology

Students interested in careers in biotechnology research and/or graduate studies in biochemistry, chemistry, or bioscience fields may opt for the Research & Biotechnology Option.

In addition to the Biochemistry Core (above):

CHEM 2010	Advanced General Chemistry	5-7
or CHEM 1770 & CHEM 1780	General Chemistry I and General Chemistry II	
CHEM 2010L	Laboratory in Advanced General Chemistry	1
or CHEM 1770L or CHEM 1770LL	Laboratory in General Chemistry I and Laboratory in General Chemistry II	
CHEM 3250	Chemical Thermodynamics	3
CHEM 3310	Organic Chemistry I	3
CHEM 3320	Organic Chemistry II	3
CHEM 3330L	Laboratory in Organic Chemistry I (for Chemistry and Biochemistry Majors)	1-2
or CHEM 3310L	Laboratory in Organic Chemistry I	
CHEM 3340L	Laboratory in Organic Chemistry II (for Chemistry and Biochemistry Majors)	1-2
or CHEM 3320L	Laboratory in Organic Chemistry II	
MATH 1650 & MATH 1660	Calculus I and Calculus II	8
MATH 2650	Calculus III	3-4
or MATH 2660 or MATH 2670	Elementary Differential Equations and Elementary Differential Equations and Laplace Transforms	
or STAT 2010 or STAT 3050	Introduction to Statistical Concepts and Methods and Engineering Statistics	
BIOL 2110	Principles of Biology I	3
BIOL 2120	Principles of Biology II	3

BIOL 3130 & 3130L	Principles of Genetics and Genetics Laboratory	4
BIOL 3140	Principles of Molecular Cell Biology	3
	Molecular Sciences from approved list	3
Total Credits		44-49

Biochemistry Program of Study: Pre-Medicine

Students interested in qualifying for medical school training for careers as a Doctor of Medicine (MD) or Doctor of Osteopathic Medicine (DO) may opt for the Pre-Medicine Option. Allied health professions (e.g., Physician Assistant, Dentistry, and Ophthalmology) may also consider the Pre-Medicine Option.

In addition to the Biochemistry Core (above):

CHEM 1770 & 1770L & CHEM 1780 & CHEM 1780L or CHEM 2010 & 2010L	General Chemistry I and Laboratory in General Chemistry I and General Chemistry II and Laboratory in College Chemistry II and Advanced General Chemistry and Laboratory in Advanced General Chemistry	6-9
CHEM 3250	Chemical Thermodynamics	3
CHEM 3310 & 3310L	Organic Chemistry I and Laboratory in Organic Chemistry I	4
CHEM 3320 & 3320L	Organic Chemistry II and Laboratory in Organic Chemistry II	4
MATH 1650 & MATH 1660	Calculus I and Calculus II	8
STAT 2010 or STAT 3050	Introduction to Statistical Concepts and Methods and Engineering Statistics	3-4
PSYCH 1010 or PSYCH 2300	Introduction to Psychology and Developmental Psychology	3
SOC 1340	Introduction to Sociology	3
BIOL 2110	Principles of Biology I	3
BIOL 2110L	Principles of Biology Laboratory I	1
BIOL 2120	Principles of Biology II	3
BIOL 2120L	Principles of Biology Laboratory II	1
BIOL 3130	Principles of Genetics	3
BIOL 3140	Principles of Molecular Cell Biology	3
	Health & Biosciences from approved list	3
Total Credits		51-55

Biochemistry Program of Study: Biophysics

Students interested in research careers focused on the biophysical basis of life processes may opt for the Biophysics Option.

In addition to the Biochemistry Core (above):

CHEM 2010	Advanced General Chemistry	5-7
or CHEM 1770	General Chemistry I	
& CHEM 1780	and General Chemistry II	
CHEM 2010L	Laboratory in Advanced General Chemistry	1
or CHEM 1770N	Laboratory in General Chemistry I	
or CHEM 1770L	Laboratory in General Chemistry II	
CHEM 3240	Introductory Quantum Mechanics	3
CHEM 3250	Chemical Thermodynamics	3
CHEM 3310	Organic Chemistry I	3
CHEM 3320	Organic Chemistry II	3
MATH 1650	Calculus I	8
& MATH 1660	and Calculus II	
MATH 2650	Calculus III	4
MATH 2660	Elementary Differential Equations	3
MATH 3170	Theory of Linear Algebra	4
COMS 2070	Fundamentals of Computer Programming	3
BIOL 2110	Principles of Biology I	3
BIOL 2120	Principles of Biology II	3
Physical Sciences from approved list		3
Total Credits		49-51

As majors in the College of Liberal Arts and Sciences, Biochemistry students must meet College of Liberal Arts and Sciences and University-wide requirements for graduation in addition to the requirements for the major.

LAS majors require a minimum of 120 credits, including a minimum of 45 credits at the 3000/4000 level. You must also complete the LAS world language requirement and LAS career proficiency requirement.

Communication Proficiency requirement: According to the university-wide Communication Proficiency Grade Requirement, students must demonstrate their communication proficiency by earning a grade of C or better in ENGL 2500.

Students in all ISU majors must complete a three-credit course in U.S. Cultures and Communities and a three-credit course in International Perspectives. Check (<http://www.registrar.iastate.edu/courses/div-ip-guide.html>) for a list of approved courses. Discuss with your advisor how the two courses that you select can be applied to your graduation plan.

Four Year Plans

Biochemistry B.S. Program of Study, College of Liberal Arts and Sciences

Research & Biotechnology Option

Sample Four-Year Plan

First Year

Fall	Credits	Spring	Credits
BBMB 1010	2	BBMB 1020	1
BBMB 1100	1	BBMB 1110	1
MATH 1650	4	MATH 1660	4
CHEM 1770	4	CHEM 1780	3
CHEM 1770N	1	BIOL 2110	3
LIB 1600	1	General Education Elective	3
ENGL 1500	3		
		16	15

Second Year

Fall	Credits	Spring	Credits
MATH 2650, 2660, 2670, STAT 2010, or STAT 3050	3-4	BBMB 2010	2
CHEM 3310	3	CHEM 3320	3
CHEM 3310L	1	CHEM 3320L	1
PHYS 2310	4	PHYS 2320	4
PHYS 2310L	1	PHYS 2320L	1
BIOL 2120	3	ENGL 2500	3
		BBMB 4990	1
		LAS 2030	1
		15-16	16

Third Year

Fall	Credits	Spring	Credits
BBMB 4040	3	BBMB 4050	3
BBMB 3110*	1	BIOL 3140	3
BBMB 3120	2	BBMB 4100	2
BIOL 3130	3	BBMB 4990	1
BIOL 3130L	1	International Perspectives Elective	3
BBMB 4990	1	General Education Elective	3
U.S. Cultures and Communities Elective	3		
General Education Elective	3		
		17	15

Fourth Year

Fall	Credits	Spring	Credits
BBMB 4110	4	CHEM 3250	3

BBMB 4990	2 CHEM 3220L or BBMB 4610 <i>and</i> BBMB 5610L	3-4
Upper-level Mol. Sciences Elective	3 BBMB 4990	3
General Education Elective	3 General Education Elective	3
General Education Elective	3 General Education Elective	3
15		15-16

"General Education Electives" include credits in LAS-approved courses in *Arts & Humanities* and *Social Sciences*

* BBMB 3110 fulfills the upper-level communication proficiency requirement.

Biochemistry B.S. Program of Study, College of Liberal Arts and Sciences
Pre-Medicine Option
Sample Four-Year Plan

First Year

Fall	Credits	Spring	Credits
BBMB 1010	2	BBMB 1020	1
BBMB 1100	1	BBMB 1110	1
MATH 1650	4	MATH 1660	4
CHEM 1770	4	CHEM 1780	3
CHEM 1770N	1	CHEM 1780L	1
LIB 1600	1	BIOL 2110	3
ENGL 1500	3	BIOL 2110L	1
16		14	

Second Year

Fall	Credits	Spring	Credits
CHEM 3310	3	BBMB 2010	2
CHEM 3310L	1	CHEM 3320	3
PHYS 2310	4	CHEM 3320L	1
PHYS 2310L	1	PHYS 2320	4
BIOL 2120	3	PHYS 2320L	1
BIOL 2120L	1	ENGL 2500	3
PSYCH 1010	3	LAS 2030	1
16		15	

Third Year

Fall	Credits	Spring	Credits
BBMB 4040	3	BBMB 4050	3
BBMB 3110*	1	BIOL 3140	3
BBMB 3120	2	BBMB 4100	2

BIOL 3130	3	BBMB 4990	1
STAT 2010	4	SOC 1340	3
PHIL 2350 ¹	3	International Perspectives Elective	3
16		15	

Fourth Year

Fall	Credits	Spring	Credits
BBMB 4110	4	CHEM 3250	3
BBMB 4990	2	CHEM 3220L or BBMB 4610 <i>and</i> BBMB 5610L	3-4
Upper-level Health or Mol. Biosci. Elective	3	BBMB 4990	3
General Education Elective	3	General Education Elective	3
General Education Elective	3	General Education Elective	3
15		15-16	

"General Education Electives" include credits in LAS-approved courses in *Arts & Humanities* and *Social Sciences*. MCAT-recommended SOC 1340 and PSYCH 1010 apply towards *Social Sciences* requirement.

* BBMB 3110 fulfills the upper-level communication proficiency requirement.

¹ Fulfills university U.S. Cultures and Communities requirement

Biochemistry B.S. Program of Study, College of Liberal Arts and Sciences
Biophysics Option
Sample Four-Year Plan

First Year

Fall	Credits	Spring	Credits
BBMB 1010	2	BBMB 1020	1
BBMB 1100	1	BBMB 1110	1
MATH 1650	4	MATH 1660	4
CHEM 1770	4	CHEM 1780	3
CHEM 1770N	1	BIOL 2110	3
LIB 1600	1	General Education Elective	3
ENGL 1500	3		
16		15	

Second Year

Fall	Credits	Spring	Credits
MATH 2650	4	BBMB 2010	2
CHEM 3310	3	CHEM 3320	3
PHYS 2310	4	PHYS 2320	4
PHYS 2310L	1	PHYS 2320L	1

BIOL 2120	3 ENGL 2500	3
	MATH 2660	3
	LAS 2030	1
15		17

Third Year

Fall	Credits Spring	Credits
BBMB 4040	3 BBMB 4050	3
BBMB 3110*	1 CHEM 3250	3
BBMB 3120	2 BBMB 4100	2
COMS 2070	3 MATH 3170	4
U.S. Cultures and Communities Elective	3 BBMB 4990	1
General Education Elective	3 General Education Elective	3
15		16

Fourth Year

Fall	Credits Spring	Credits
BBMB 4110	4 CHEM 3240	3
STAT 3050	3 CHEM 3220L or BBMB 4610 and BBMB 5610L	3-4
BBMB 4990	1 Upper-level Physical Sci. Elective	3
International Perspectives Elective	3 BBMB 4990	1
General Education Elective	3 General Education Elective	3
General Education Elective	3 General Education Elective	3
17		16-17

"General Education Electives" include credits in LAS-approved courses in *Arts & Humanities* and *Social Sciences*.

* BBMB 3110 fulfills the upper-level communication proficiency requirement.

Minor

The Roy J. Carver Department of Biochemistry, Biophysics, and Molecular Biology offers a minor in Biochemistry, administered by the College of Liberal Arts and Sciences.

BBMB 4040	Biochemistry I	3
BBMB 4050	Biochemistry II	3
BBMB 3120	Experimental Research Skills in Biochemistry	2
One course from the following:		2-3
BBMB 4610	Molecular Biophysics (2 cr)	
BBMB 5610	Molecular Biophysics (2 cr)	
CHEM 3250	Chemical Thermodynamics (3 cr)	

3000+ level courses in BBMB or CHEM to 15 cr total	5-6
Total Credits	15-17

All minors require at least 15 credits. At least 9 credits of the minor must be in courses numbered 2000 or above, of which at least 6 credits number 3000 or above. At least 3 credits applied to the minor must be taken at Iowa State University. The minor must include at least 3 credits that are not used to meet any other department, college, or university requirement.

The Biochemistry Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

Concurrent Programs**Concurrent Bachelor of Science (B.S.)/ Master of Science (M.S.) Degrees**

The department offers a concurrent enrollment degree program in either Biochemistry or Biophysics that allows ISU undergraduate students to obtain both the B.S. and M.S. degrees in about five years. The program is open to undergraduate students in the College of Liberal Arts and Sciences and in the College of Agriculture and Life Sciences. The concurrent degrees can be useful to students entering various career tracks. For those considering careers as research specialists, entry positions with higher-level responsibilities, and a higher-level salary, are made possible with the M.S. degree. For those considering careers as research directors, which require advanced study, the M.S. degree provides an advantage for admission into Ph.D. programs at the most competitive and prestigious graduate schools. Similarly, the M.S. degree can be a competitive advantage for admission in to medical, dental, law, veterinary medicine, or other professional schools.

Application to the program is made near the end of the junior undergraduate (third) year. Concurrent B.S./M.S. degree students begin research for the M.S. thesis during the summer semester after their junior year and are eligible for research assistantships, which are renewable based on academic standing and satisfactory research performance. The M.S. thesis requires intensive experience in original, independent laboratory research under the close supervision of a faculty mentor. To apply, see the concurrent B.S./M.S. application instructions found on the department's Graduate Study web page.

Concurrent Bachelor of Science/Graduate Certificate

The Bachelor of Science /Graduate Certificate program is intended for exceptional undergraduate students majoring in Biochemistry. In this program, the student completes all of the requirements for the B.S. degree and the graduate certificate in a four-year period by combining the requirements of the two programs. The student enters the Graduate College after he/she achieves junior status and develops a plan of coursework (graduate and undergraduate) subject to the approval of

the Director of Certificate (DOC). Required graduate courses are BBMB 5040, 5050, 5060, 5070, 5610 and 5610L. The student must satisfy the requirements of the B.S. in Biochemistry (121 credits) and the Graduate Certificate in Biochemistry (12 credits). Six credits of graduate coursework can satisfy some requirements of the B.S. degree. To apply for the B.S./Graduate Certificate, submit the application form found on the Graduate College Forms web page.

Graduate Programs

Introduction

Biochemistry and Biophysics are the science and technology used to understand the mechanisms underlying biological processes at the molecular level, with an emphasis on the fundamental relationships among the chemical, physical, and biological sciences. The Roy J. Carver Department of Biochemistry, Biophysics, and Molecular Biology (BBMB) administers Doctor of Philosophy (Ph.D.), Master's (M.S.), and Graduate Certificate programs that lead to an advanced degree or certificate in these disciplines. The prerequisite to graduate study is a sound undergraduate background in biology, chemistry, mathematics, and physics.

BBMB offers Doctor of Philosophy and Master's degrees in Biochemistry and in Biophysics that are designed to train students to independently conceive and carry out original research. BBMB also offers two graduate certificate programs in Biochemistry that provide a mechanism for formal recognition of focused graduate study in a specialized area that is less comprehensive than that required for a master's degree. BBMB participates in the Interdepartmental majors of Bioinformatics and Computational Biology; Genetics and Genomics; Immunobiology; Molecular, Cellular, and Developmental Biology; Neuroscience; Plant Biology; and Toxicology. All graduate degree students in BBMB are required to teach as part of their training.

Master of Science (M.S.) Degree

The M.S. degree programs in Biochemistry and in Biophysics are useful for students who prefer to undertake research training without the longer-term commitment required for the Ph.D. degree. It is also useful for students interested more in the technical aspects of research rather than in careers as research directors. The program requires about 3 years on average to complete and the successful defense of an independent research dissertation is required. About half the time required to earn the degree is spent on advanced coursework and professional seminars, and the other half is devoted to research undertaken in the laboratory under the close supervision of a faculty mentor. Financial support is available. To apply, applicants first submit the free BBMB online application found on the department website, which is used as a screening tool.

NOTE: Students interested in a research career are encouraged to consider the Ph.D. track. Students may enter the Biochemistry or

Biophysics M.S. degree program as a direct admit to a faculty research group at any time during the year.

Doctor of Philosophy (Ph.D.) Degree

The Ph.D. programs in Biochemistry and in Biophysics are designed to train students in the ability to independently conceive and carry out original research in the general area of the chemistry or physics of the processes of life. The programs require about 5-6 years on average to complete and the successful defense of an independent research dissertation. The majority of the time required to earn the degree is spent doing research on the dissertation project in the laboratory under the close supervision of a faculty mentor. Considerable time also is devoted to advanced coursework and professional seminars. Financial support is available. To apply, applicants first submit the free BBMB online application found on the department website, which is used as a screening tool. Students may enter the Biochemistry or Biophysics Ph.D. degree programs either as a rotation student in the fall semester or as a direct admit to a faculty research group at any time during the year.

Graduate Minor in Biochemistry

Graduate students in other M.S. and/or Ph.D. programs at ISU can earn a graduate minor in Biochemistry by completing 12 credits of the following courses with a grade point average of 3.0 or above: at least 6 credits from BBMB 5040, BBMB 5050, BBMB 5060 and BBMB 5070 and at least 6 credits of other BBMB 5000- and 6000-level courses. A student wishing to declare a minor in Biochemistry should arrange for a member of the graduate faculty in Biochemistry to serve on the POS Committee and submit the required form found on the Graduate College Forms page.

Graduate Certificate Programs

The graduate certificate program is designed for students who wish to continue or expand their knowledge in Biochemistry at the graduate level without the time commitment or lab experience required for a formal Master's or Ph.D. program. A certificate program can be an attractive option for individuals who have a bachelor's degree and are interested in broadening their expertise, or who are working in the sciences or industry and want to continue their education at the graduate level. BBMB offers two graduate certificate programs in Biochemistry: a concurrent B.S. / Graduate Certificate and a Graduate Certificate. The standards of admission and the course standards to which a certificate student is held are equivalent to those expected of a master's student. Each graduate certificate requires at least 12 graduate credits, all of which are available either on campus or online. A graduate supervisor will be appointed to oversee the certification for each student.

If a person who completes a graduate certificate program decides to continue for a graduate degree in Biochemistry or Biophysics, program approval is required. Credits earned for the graduate certificate may be used to meet course requirements for the graduate degree program.

Graduate Certificate in Biochemistry

The graduate certificate in Biochemistry is designed for students who have a B.S. degree in Biochemistry or a related field and wish to advance their knowledge by taking additional coursework at the graduate level.

The graduate certificate courses may be taken either on-line or on campus. Candidates for a graduate certificate in Biochemistry are admitted in the Graduate College. A total of 12 credits is required that includes: BBMB 5040, BBMB 5050, BBMB 5060 and BBMB 5070, plus four additional credits of BBMB coursework at the 5000-level. The 12 credits earned in the graduate certificate program may be applied to meet the course requirements of a M.S. or Ph.D. program in Biochemistry at Iowa State University (ISU) if the student is accepted into one of these programs. To apply for the graduate certificate in Biochemistry, submit the ISU online application.

Bioinformatics and Computational Biology

Undergraduate study in BCBIO is jointly administered by the Department of Computer Science, the Department of Genetics, Development, and Cell Biology, and the Department of Mathematics. The undergraduate B.S. degree is offered through the College of Liberal Arts and Sciences.

Bioinformatics and Computational Biology is an interdisciplinary science at the interfaces of the biological, informational and computational sciences. The science focuses on a variety of topics. These include gene identification, expression, and evolution; RNA, protein, and genome structure; and molecular and cellular systems and networks. The large group of participating faculty provides students with a multidimensional perspective on bioinformatics and computational biology and presents them with broad range of possibilities to get involved in research.

This major will prepare students for careers at the interfaces of biological, informational and computational sciences. BCBIO graduates with a B.S. seeking direct employment will find ready markets for their talents in agricultural and medical biotechnology industries, as well as in academia, national laboratories, and clinics. Although some students find employment directly after their baccalaureate training, many students will continue their education in one of the many excellent graduate programs in bioinformatics and computational biology that now exist.

Participation in this field requires that students achieve a high level of competence not only in biology, but also in mathematics, computer science, and statistics. As a result, the program includes required courses from many different disciplines. Graduates demonstrate an above-average ability to synthesize methods from these different disciplines to solve problems.

Student Learning Outcomes

By completing their studies, students earning the BS degree in BCBIO are expected to:

1. Develop critical thinking skills by implementing the scientific method through bioinformatics data analysis.
2. Explain and complete simple applications of the common bioinformatics and computational biology methods used for DNA, RNA, and protein analysis.
3. Understand the central dogma of biology and how bioinformatic analyses of high throughput biological next-generation sequencing proteomics datasets can help answer fundamental questions about the biology of DNA, RNA, and proteins.
4. Define systems biology and explain its importance in understanding biology; undertake basic data analyses in systems biology.
5. Identify common formats for biological data and be able to convert among different formats.
6. Summarize fundamental bioinformatics software tools, know when to apply them, and be able to use them.
7. Combine existing software tools into bioinformatic data processing pipelines.
8. Evaluate the limits of traditional algorithms and data analysis techniques as they apply to big data in biology.
9. Identify and appraise noise in high throughput biological datasets and uncertainty in the conclusions of data analysis.
10. Interpret bioinformatics and computational biology analyses individually and in collaborative learning environments.

As majors in the College of Liberal Arts and Sciences, Bioinformatics and Computational Biology students must meet College of Liberal Arts and Sciences and University-wide requirements for graduation in addition to those stated below for the major.

LAS majors require a minimum of 120 credits, including a minimum of 45 credits at the 3000/4000 level. You must also complete the LAS world language requirement and career proficiency requirement.

Students in all ISU majors must complete a three-credit course in U.S. Cultures and Communities and a three-credit course in International Perspectives. Check (<http://www.registrar.iastate.edu/courses/div-ip-guide.html>) for a list of approved courses. Discuss with your advisor how the two courses that you select can be applied to your graduation plan.

A. Complementary Courses for the BCBIO Major

A minimum of 5 credits from the following:

5-8

CHEM 1630 & 1630L	College Chemistry and Laboratory in College Chemistry

or

CHEM 1770 & 1770L & CHEM 1780	General Chemistry I and Laboratory in General Chemistry I and General Chemistry II

or

CHEM 2010 & 2010L	Advanced General Chemistry and Laboratory in Advanced General Chemistry

A minimum of 4 credits from the following:

4-8

CHEM 2310 & 2310L	Elementary Organic Chemistry and Laboratory in Elementary Organic Chemistry

or

CHEM 3310 & 3310L	Organic Chemistry I and Laboratory in Organic Chemistry I

and

CHEM 3320 & 3320L	Organic Chemistry II and Laboratory in Organic Chemistry II

5 credits from the following:

5

PHYS 1150 & 1150L	Physics for the Life Sciences and Laboratory in Physics for the Life Sciences

or

PHYS 1310 & 1310L	General Physics I and General Physics I Laboratory

or

PHYS 2310 & 2310L	Introduction to Classical Physics I and Introduction to Classical Physics I Laboratory

STAT 3300	Probability and Statistics for Computer Science	3

STAT 4830	Empirical Methods for the Computational Sciences	3

BIOL 2110 & 2110L	Principles of Biology I and Principles of Biology Laboratory I	4

BIOL 2120 & 2120L	Principles of Biology II and Principles of Biology Laboratory II	4

BIOL 3140	Principles of Molecular Cell Biology	3

or

BIOL 3150	Biological Evolution

or

GEN 4090	Molecular Genetics

Total Credits 31-38

Complementary courses note: The following other STAT courses may be substituted for STAT 3300 and STAT 4830, with permission of the BCBIO Major.

STAT 3300: STAT 1010, 1040, 2010, 2310, 3050, 3410, or 3470

STAT 4830: STAT 3010, 3420, or 4320

B. Core Courses Within the BCBIO Major

GEN 3130 & 3130L	Principles of Genetics and Genetics Laboratory	4

COMS 2270 & COMS 2280	Object-oriented Programming and Introduction to Data Structures (recommended when developing course plan)	7

COMS 2300	Discrete Computational Structures	3

COMS 3110	Introduction to the Design and Analysis of Algorithms	3

MATH 1650 & MATH 1660	Calculus I and Calculus II (recommended when developing course plan)	8

BCBIO 1100	BCBIO Orientation	0.5

BCBIO 3220	Introduction to Bioinformatics and Computational Biology	3

BCBIO 4010	Bioinformatics of Sequences	3

BCBIO 4060	Bioinformatics of OMICS	3

BCBIO 4900	Independent Study or BCBIO 4910 Team Research Projects	1-5

Total Credits 35.5-39.5

Core courses note: The COMS 2270/2280 and MATH 1650/1660 core course series is required for BCBIO majors. However, students transferring into the major who have already earned credit for COMS 2070/2080 and/or the Math 1810/1820 can substitute those courses for the respective COMS 2270/2280 and/or MATH 1650/1660 series. Students will need permission of the instructors to enroll in any upper-level course that requires a pre-req in COMS 2270/2280 and/or MATH 1650/1660.

C. Support Electives

3-9 credits to be chosen from the following list:

BBMB 4040	Biochemistry I	3

BBMB 4050	Biochemistry II	3

BBMB 4610	Molecular Biophysics	2

BIOL 3280	Molecular and Cellular Biology of Human Diseases	3

BIOL 4230	Developmental Biology	3

BIOL 4510	Plant Evolution and Phylogeny	4

BIOL 4620	Evolutionary Genetics	3

BIOL 4870	Microbial Ecology	3

COMS 2520	Linux Operating System Essentials	3

COMS 3090	Software Development Practices	3

COMS 3190	Construction of User Interfaces	3

COMS 3270	Advanced Programming Techniques	3
COMS 3630	Introduction to Database Management Systems	3
COMS 4250	High Performance Computing for Scientific and Engineering Applications	3
COMS 4260	Introduction to Parallel Algorithms and Programming	4
GEN 3400	Human Genetics	3
GEN 4100	Analytical Genetics	3
MATH 2070	Matrices and Linear Algebra	3
or MATH 3170	Theory of Linear Algebra	
MATH 2650	Calculus III	4
MATH 2660	Elementary Differential Equations	3
or MATH 2670	Elementary Differential Equations and Laplace Transforms	
MATH 3040	Combinatorics	3
MATH 3140	Graph Theory	3
MATH 3730	Introduction to Scientific Computing	3
MICRO 4020	Microbial Genetics and Genomics	3
STAT 3420	Introduction to the Theory of Probability and Statistics II	4
STAT 4219	Bayesian Data Analysis	3
STAT 4750	Introduction to Multivariate Data Analysis	3
STAT 4279	Statistical Computing for Data Analysis	3
STAT 5810	Analysis of Gene Expression Data for the Biological Sciences	3
STAT 4212	Experimental Design and Data Analysis	3

D. The communications and English proficiency requirements of the LAS college are met by:

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
or ENGL 2500H	Written, Oral, Visual, and Electronic Composition: Honors	

And one of the following:

ENGL 3090	Proposal and Report Writing	3
or		
ENGL 3120	Communicating Science and Public Engagement	
or		
ENGL 3140	Technical Communication	

BCBIO majors must earn a minimum grade of C in ENGL 2500 Written, Oral, Visual, and Electronic Composition or ENGL 2500H Written, Oral, Visual, and Electronic Composition: Honors.

Bioinformatics and Computational Biology, B.S.

Freshman

Fall	Credits	Spring	Credits
BCBIO 1100	0.5	BIOL 2120	3
BIOL 2110	3	BIOL 2120L	1
BIOL 2110L	1	CHEM 2310	3
CHEM 1630	4	CHEM 2310L	1
CHEM 1630L	1	MATH 1660	4
MATH 1650	4	LIB 1600	1
ENGL 1500	3	Humanities choice	3
16.5		16	

Sophomore

Fall	Credits	Spring	Credits
BIOL 3130	3	COMS 2280	3
BIOL 3130L	1	BIOL 3140	3
BCBIO 3220	3	PHYS 1150	4
COMS 2270	4	PHYS 1150L	1
ENGL 2500	3	Social Science choice	3
International Perspectives or U.S. Cultures and Communities	3	LAS 2030	1
17		15	

Junior

Fall	Credits	Spring	Credits
COMS 2300 (or CPRE 3100)	3	COMS 3110	3
STAT 3300	3	STAT 4830	3
ENGL 3090 (or ENGL 3120 or ENGL 3140)	3	Bioinformatics Support Elective	3-9
Humanities Choice	3	Humanities choice	3
BCBIO 4010	3	Social Science choice	3
15		15-21	

Senior

Fall	Credits	Spring	Credits
Humanities choice	3	BCBIO 4900 or 4910	1-5
BCBIO 4060	3	World Language if needed or elective	4
World Language, if needed / Elective	3-4	MATH 2650 (or other Support Elective)	4
COMS 3630 (Recommended or other support elective)	3	International Perspectives or U.S. Cultures and Communities	3

Social Science choice	3
15-16	12-16

Total Credits: 121.5-132.5

Minor in Bioinformatics and Computational Biology

The administering departments offer a minor in Bioinformatics and Computational Biology, which requires the following courses.

BIOL 2110	Principles of Biology I	3
BIOL 2120	Principles of Biology II	3
GEN 3130	Principles of Genetics	3
COMS 2270 & COMS 2280	Object-oriented Programming and Introduction to Data Structures	7
STAT 3300	Probability and Statistics for Computer Science	3
BCBIO 3220	Introduction to Bioinformatics and Computational Biology	3
BCBIO 4010	Bioinformatics of Sequences	3
BCBIO 4060	Bioinformatics of OMICS	3
Total Credits		28

Note: The following other STAT courses may be substituted for STAT 3300, with permission of the BCBIO Major: STAT 1010, 1040, 2010, 2310, 3050, 3410, or 3470.

2. The COMS 2270/2280 course series is required for the BCBIO minor. However, students transferring into the minor who have already earned credit for COMS 2070/2080 can substitute those courses for the COMS 2270/2280 series. Students will need permission of the instructors to enroll in any upper-level course that requires a pre-req in COMS 2270/2280.

Most students pursuing a minor in Bioinformatics and Computational Biology will be biology, genetics, computer science, computer engineering, statistics, data science or mathematics students who have already taken some of these courses for their major. The minor must include at least 3 credits that are not used to meet any other department, college, or university requirement.

The Bioinformatics and Computational Biology Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

Graduate Study

Work is offered for the Master of Science and Doctor of Philosophy degrees with a major in Bioinformatics and Computational Biology (BCB). Faculty are drawn from several departments: Agronomy; Animal Science; Astronomy and Physics; Biochemistry, Biophysics and Molecular Biology; Biomedical Sciences; Chemical and Biological Engineering; Chemistry;

Computer Science; Ecology, Evolution, and Organismal Biology; Electrical and Computer Engineering; Entomology, Genetics, Development and Cell Biology; Materials Science and Engineering; Mathematics; Plant Pathology; Statistics; Veterinary Microbiology and Preventive Medicine; and Veterinary Pathology.

The BCB program emphasizes interdisciplinary training in nine related areas of focus: Bioinformatics, Computational Molecular Biology, Structural and Functional Genomics, Macromolecular Structure and Function, Metabolic and Developmental Networks, Integrative Systems Biology, information Integration and Data Mining, Biological Statistics, and Mathematical Biology. Additional information about research areas and individual faculty members is available at: www.bcb.iastate.edu (<http://www.bcb.iastate.edu>).

BCB students are trained to develop an independent and creative approach to science through an integrative curriculum and thesis research projects that include both computational and biological components. First year students are appointed as research assistants and participate in BCB 6970 Graduate Research Rotation, working with three or more different research groups to gain experience in both “wet” (biological) and “dry” (computer) laboratory environments. In the second year, students initiate a thesis research project under the joint mentorship of two BCB faculty mentors, one from the biological sciences and one from the quantitative/computational sciences. The M.S. and Ph.D. degrees are usually completed in two and five years, respectively.

Before entering the graduate BCB program, prospective BCB students should have taken courses in mathematics, statistics, computer science, biology, and chemistry. A course load similar to the following list would be considered acceptable:

MATH 2650	Calculus III	4
STAT 3410	Introduction to the Theory of Probability and Statistics I	4
COMS 2270	Object-oriented Programming	4
COMS 2280	Introduction to Data Structures	3
COMS 2300	Discrete Computational Structures	3
CPRE 3100	Theoretical Foundations of Computer Engineering	3
CHEM 1630	College Chemistry	4
CHEM 2310	Elementary Organic Chemistry	3
BBMB 3010	Survey of Biochemistry	3
BIOL 3130	Principles of Genetics	3
BIOL 3150	Biological Evolution	3

During the first year, BCB students are required to address any background deficiencies in calculus, molecular genetics, computer science, statistics and discrete structures, with specific courses determined by prior training. Among the total course requirements for

Ph.D. students are four core courses in Bioinformatics, three of which are mandatory in the BCB program:

BCB 5670	Bioinformatics Algorithms	3
BCB 5680	Statistical Bioinformatics	3
BCB 5690	Structural Bioinformatics	3
BCB 5700	Systems Biology	3

And also should include

GDCB 5110	Advanced Molecular Genetics	3
BCB 6900	Student Seminar in Bioinformatics and Computational Biology	
BCB 6910	Faculty Seminar in Bioinformatics and Computational Biology	
BCB 5920	Workshop in Bioinformatics and Computational Biology	

M.S. students take the above background and core courses, take at least 6 credits of advanced coursework, and may elect to participate in fewer seminars and workshops. Additional coursework may be selected to satisfy individual interests or recommendations of the Program of Study Committee. All graduate students are encouraged to teach as part of their training for an advanced degree. (For curriculum details and sample programs of study, see: www.bcb.iastate.edu (<http://www.bcb.iastate.edu>)).

Biology

Interdepartmental Undergraduate Program

Iowa State University is a major center for research and education in the biological sciences. With over 200 faculty in the life sciences, students have the opportunity to learn from some of the nation's leaders in biological research and teaching and to participate in innovative, meaningful research projects that explore frontiers of biology. Few other universities have such a wealth of faculty expertise available to undergraduate students, making Iowa State's Biology Program the logical choice for those who want to participate in a thriving academic community.

The faculties of the Department of Ecology, Evolution, and Organismal Biology and the Department of Genetics, Development, and Cell Biology jointly offer the undergraduate biology major. This high-quality academic program has the flexibility to accommodate a range of career goals while taking advantage of the university's strengths in science and technology. A bachelor's degree in biology provides excellent preparation for graduate study in biological disciplines ranging from the molecular to the ecological levels, and for entrance into various professional schools, such as human medicine, physical therapy, or veterinary medicine. The

major is well suited for those who plan to teach biology, who wish to enter government or industrial employment in health or environmental professions, or who prefer educational breadth as an end in itself. By working with our professional advisors, it is possible to design a unique program of study that will meet student needs and objectives.

Students with special interests and aptitudes should consider combining biology with a minor or a second major in another subject, such as chemistry, environmental studies, journalism, mathematics, music, statistics, or many other subjects offered by the university.

Customizing a Degree

Biology encompasses an amazing diversity of disciplines and scales of study ranging from molecules to the biosphere. The biology major offers a rich variety of coursework addressing most of the areas of biology. The major's curriculum requirements offer tremendous flexibility in creating an individualized program of study to facilitate achievement of a student's career goals, while simultaneously assuring some exposure to all areas of biology and providing complementary knowledge from supporting courses in chemistry, physics, and math/statistics.

While flexibility is the hallmark of the biology major, the breadth of the field can also be challenging. Thus, in an effort to provide more guidance to students who desire such, the major also provides six advising tracks, or areas of specialization, for students who wish to focus on subfields of biology or who have specific career goals in mind. Course plans for each area of specialization are listed on the biology web site. The areas are:

Pre-medical and Human Health Professions—This area emphasizes preparation for further study in medical school or allied human health professions such as dentistry, optometry, genetic counseling, physical therapy, occupational therapy, physician assistant, nursing, chiropractic, and others. It also will prepare students for a broad range of careers in the biological sciences. Students are urged to determine the specific entrance requirements for the professional schools where they might study and to plan a program of study accordingly, in addition to following the basic plan.

Pre-veterinary—An eventual degree in Veterinary Medicine can lead to a wide variety of careers, including private clinical practice in small animal medicine or agricultural animal production. But pre-veterinary students can also prepare themselves for careers in animal research, public health, laboratory animal medicine, food safety, regulatory medicine, and education. Specific requirements for entrance to the Iowa State Veterinary College or other schools should be consulted as programs of study are planned, in addition to following the basic plan.

Molecular and Cellular Biology—Students specializing in this field will explore the structure, function, and interactions of the molecules and sub-cellular features that make up living cells. This area is particularly designed for those who plan to pursue a career in research in molecular

or cell biology or in related areas such as biochemistry, genetics, microbiology, developmental biology, human medicine, or veterinary medicine. Many students in this area will choose to go on to graduate school.

Ecology and Conservation Biology—Ecologists examine the interactions and relationships that living organisms have with each other and their environment. Conservation biologists study the nature and status of Earth's biodiversity with the aim of protecting species, their habitats, and ecosystems from excessive rates of extinction and loss. Students who choose this specialization may go on to work for a non-profit environmental group; an environmental consulting firm; a local, state, or federal agency; or other related organizations. Many students in this area will choose to go on to graduate school.

Evolution and Biodiversity—This area provides students with a sound understanding of evolutionary principles and the biological patterns that result from evolutionary change. Students have the opportunity to explore, in depth, the biodiversity found within a wide range of groups of organisms. Students who choose this specialization may go on to work for a non-profit environmental group; an environmental consulting firm; a local, state, or federal agency; or other related organizations. Many students in this area will choose to go on to graduate school.

Teacher licensure—Biology majors seeking recommendation for licensure to teach biology in secondary schools must meet requirements of the Teacher Education Program as well as those of the Biology Program. In addition, they must apply formally for admission to the teacher education program. See the section on Teacher Education for a list of licensure areas, degree requirements, and other information about this program.

Other Opportunities

Undergraduate research—Students who have interests in biological research are encouraged to become involved in the research projects of faculty members on campus. Those doing so may receive credit for the experience in BIOL 4990 Undergraduate Research Experience. Making the effort to find a suitable research mentor and engaging in research work can be one of the most valuable experiences of an undergraduate education. Internship experiences are often available at other universities, zoos, museums, governmental and non-governmental entities focused on environmental issues, and industrial or government laboratories. Students participating in such projects may receive internship credit in BIOL 4940 Biology Internship.

Field trip courses – The Biology Program offers two field trip courses: BIOL 3930 (North American Field Trips in Biology) and BIOL 3940 (International Field Trips in Biology). In recent years field trip opportunities to Honduras and Spain have been available. These courses involve a pre-trip seminar followed by one-week to one-month long field trip at a time when academic year classes are not in session. The classes

are low enrollment and allow extensive interaction between instructors and students in locations of biological interest.

International experience—Because major discoveries in science often result from global efforts, biology majors are encouraged to include an international or study abroad component in their degree programs. This can be done by participating in international field trips originating from the ISU campus in BIOL 3940 International Field Trips in Biology. In addition, many students choose to study abroad, attending a university in another country for up to a year as an exchange student. Minors in a foreign language can also add an international emphasis to a degree in biology.

Courses Offered at Other Locations

In addition to biological science courses taught on campus, students may take courses at various remote locations and arrange to have the credits count toward the advanced courses required in the biology major. Attending a summer field station adds an important component to an undergraduate program of study.

Gulf Coast Research Laboratory—The Gulf Coast Research Laboratory is affiliated with the University of Southern Mississippi. Iowa State students may register for marine biology courses and transfer credit to their degree programs under the number BIOL 4800 Studies in Marine Biology. Written permission of the Biology Program Director is required for this arrangement.

Summer Biological Field Stations—Courses taken at summer field stations may be transferred to Iowa State University as credit in BIOL 4810 Summer Field Studies. Such stations are found throughout the country and often offer courses that emphasize the adaptation of plants and animals to unique environments. See www.biology.iastate.edu (<http://www.biology.iastate.edu/>) for links to Iowa Lakeside Laboratory and other field stations in different biomes, e.g., marine/coastal, Great Lakes, taiga, deciduous forests, deserts, Rocky Mts., etc.

Organization for Tropical Studies—Iowa State students may register for courses in tropical biology taught in Costa Rica by the Organization for Tropical Studies. Credit is transferred to Iowa State as BIOL 4820 Tropical Biology. For further information, contact the Biology Student Services Office in 103 Bessey Hall.

Student Learning Outcomes

Upon graduation, students should be able to:

- Explain and apply the core biological concepts of:
 - Evolution
 - Structure and function
 - Information flow, exchange, and storage
 - Pathways and transformations of energy and matter
 - How systems are interconnected and interact:

- Apply the process of science.
- Use quantitative reasoning.
- Use modeling and simulation.
- Utilize, communicate with, and collaborate with other disciplines.
- Understand the relationship between science and society.

Undergraduate Study

Biology majors start their studies in the biological sciences by taking a two-semester long Principles of Biology course sequence:

BIOL 2110	Principles of Biology I	3
BIOL 2110L	Principles of Biology Laboratory I	1
BIOL 2120	Principles of Biology II	3
BIOL 2120L	Principles of Biology Laboratory II	1

During the first year, students also take BIOL 1100 Introduction to Biology and BIOL 1110 Opportunities in Biology, which are half-semester courses designed to introduce the student to the discipline of biology and opportunities for careers in biology. Students transferring into the biology major take BIOL 1120 in place of BIOL 1100 and BIOL 1110.

Students then explore, in any order depending on their interests, four upper-level core courses including: concepts of ecology in BIOL 3120; the principles of genetics in BIOL 3130 and BIOL 3130L; cell and molecular biology in BIOL 3140; and evolutionary biology in BIOL 3150. Biology majors must take an additional 21 credits of advanced biological science courses at the 3000 level, or above, from an approved list of courses. Many of these courses have as prerequisites BIOL 2110/L and BIOL 2120/L, so students do not need to complete the four upper-level core courses before taking advanced courses. Of these advanced courses, at least 9 credits must be taken as BIOL courses, and a minimum of two laboratory or field courses must also be included from an approved list.

Biology majors should carefully consider their selection of upper-level courses to allow them to emphasize one, or more, of the sub-disciplines of Biology relevant to their post-baccalaureate objectives. Most biology courses numbered 3000 or above can be used to satisfy the additional credit requirement. Some courses taught in other departments can also be applied to the biology major. Advanced students should consider including 5000 level courses in their programs. The Biology Program's web site has a complete listing of acceptable upper-level life science courses.

Biology majors must demonstrate competency in their understanding of the biological sciences. A 2.0 cumulative average is required in biology and advanced biology coursework. In order to graduate, a student must have a cumulative average in the major of at least 2.00.

General requirements

Students may earn the B.S. degree in Biology from either the College of Liberal Arts and Sciences or from the College of Agriculture and Life Sciences. Students in the College of Liberal Arts and Sciences must fulfill the College of Liberal Arts and Sciences and University-wide requirements for graduation in addition to those stated for the major. Students in the College of Agriculture and Life Sciences must meet University-wide requirements for graduation and requirements for that college. Contact the Student Services Office for details regarding differences in general education and course requirements that are specific to these colleges.

Supporting course requirements – Understanding biology requires a basic understanding of the physical sciences and mathematics. Consequently, a minimum number of credits in general chemistry, organic chemistry, biochemistry, and physics is required. See the Biology Program Web Site for specific supporting science requirements.

The Math requirement is competency based. After demonstrating competency in algebra and trigonometry, biology majors must take two semesters of calculus; or two semesters of Statistics; or one semester of calculus and one semester of Statistics chosen from a list of approved courses available on the Biology Program Web Site and in the Biology Program Office.

Given the important role of communications in the modern sciences, biology majors must demonstrate communication competency by earning a minimum of C in ENGL 2500 Written, Oral, Visual, and Electronic Composition or equivalent composition courses and in one advanced writing course numbered ENGL 3020 through ENGL 3160, or JLMC 3470, or SPCM 2120. (Students in the College of Agriculture and Life Sciences are required to earn a C or better in ENGL 1500, as well.)

Curriculum in Biology

Administered by the Departments of Ecology, Evolution, and Organismal Biology; and Genetics, Development and Cell Biology. Students should consult the Biology Student Services Office, 103 Bessey (or biology@iastate.edu) for the appropriate course selections for professional or graduate school preparation.

Total Degree Requirement: 120 cr.

Only 65 cr. from a two-year institution may apply which may include up to 16 technical cr.; 9 P-NP cr. of free electives; 2.00 minimum GPA.

Biology: 23.5 cr.

2.00 GPA average required.

BIOL 1100	Biology Major Orientation	1
BIOL 1110	Opportunities in Biology	0.5
BIOL 2110	Principles of Biology I	3

BIOL 2110L	Principles of Biology Laboratory I	1
BIOL 2120	Principles of Biology II	3
BIOL 2120L	Principles of Biology Laboratory II	1
BIOL 3120	Ecology	4
BIOL 3130	Principles of Genetics	3
BIOL 3130L	Genetics Laboratory	1
BIOL 3140	Principles of Molecular Cell Biology	3
BIOL 3150	Biological Evolution	3
Total Credits		23.5

Advanced Biology: 21 cr.

2.00 GPA average required. Must include two approved Advanced Biology labs. See the Biology Program website for list of approved Advanced Biology courses, or consult an advisor in the Biology Student Services office, 103 Bessey Hall.

Biology advanced courses (from approved list)	9
Additional approved biology advanced courses	12
Total Credits	21

Mathematical Sciences 7 cr.

Students in College of Agriculture and Life Sciences must have a Math and Statistics.

MATH 1600 or MATH 1650 and STAT 1010 or STAT 1040	
Or	
MATH 1650	Calculus I
& MATH 1660	and Calculus II
Or	
STAT 1010 or STAT 1040 and STAT 3010	4-7

Physical Sciences

General Chemistry: 5 cr. minimum

CHEM 1630	College Chemistry	5
& 1630L	and Laboratory in College Chemistry	
Or		
CHEM 1770	General Chemistry I	5
& 1770L	and Laboratory in General Chemistry I	
CHEM 1780	General Chemistry II	4
& 1780L	and Laboratory in College Chemistry II	
Organic Chemistry: 4 cr. minimum		
CHEM 2310	Elementary Organic Chemistry	4
& 2310L	and Laboratory in Elementary Organic Chemistry	
Or		
CHEM 3310	Organic Chemistry I	4
& 3310L	and Laboratory in Organic Chemistry I	

CHEM 3320	Organic Chemistry II	4
& 3320L	and Laboratory in Organic Chemistry II	
Biochemistry: 3 cr.		
BBMB 3160	Principles of Biochemistry	3
Or		
BBMB 4040	Biochemistry I	3
Or		
BBMB 4200	Mammalian Biochemistry	3
Physics: 5 cr. minimum		
PHYS 1150	Physics for the Life Sciences	5
& 1150L	and Laboratory in Physics for the Life Sciences	
Or		
PHYS 1310	General Physics I	5
& 1310L	and General Physics I Laboratory	
PHYS 1320	General Physics II	5
& 1320L	and General Physics II Laboratory	

International Perspectives: 3 cr.**U.S. Cultures and Communities: 3 cr.**
Communication/Information Literacy

Students must earn a C or better in ENGL 2500 and the advanced communication course. Additionally, students in the College of Agriculture and Life Sciences must earn a C or better in ENGL 1500. Students should consult their advisor to discuss advanced communication course options other than SPCM 2120.

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
LIB 1600	Introduction to College Level Research	1
SPCM 2120	Fundamentals of Public Speaking	3
Total Credits		10

Humanities and Social Sciences

Chosen from approved lists.

LAS - Biology		
Note: Students must have completed 3 years of a single world language or take 4-8 credits of university level world language.		
Humanities		12
Social Sciences		9
Career Preparation (LAS 2030)		1
Total Credits		22

Humanities and Social Sciences

Chosen from approved lists.

CALS - Biology

Note: Students in CALS - Biology must take an approved speech course and an approved Math and Statistics course.

Humanities	3
Social Sciences	3
Ethics	3
Total Credits	9

Biology Teacher Preparation Focus

Biology majors seeking certification to teach Biology in secondary schools follow the requirements of the B.S. degree in Biology. In addition, they must take the complementary coursework listed below and meet all of the requirements of the Secondary Major in Education including student teaching.

Complementary Coursework for Biology Teacher Preparation Focus

PSYCH 2300	Developmental Psychology	3
EDUC 4180	Secondary Science Methods I	3
EDUC 4190	Secondary Science Methods II	3
One course in American History or Government		3

Some students decide to complete the biology major and continue their studies as graduate students in Iowa State's Science Education, Masters of Teaching (M.A.T.) program (<https://education.iastate.edu/graduate-students/graduate-programs/division-of-teaching-learning-leadership-and-policy/educator-prep-programs-for-licensure-recommendation/science-education-m-a-t/>).

Note: Teacher license requirements are established by the Iowa Department of Education and the Iowa Board of Educational Examiners and are subject to change. Recent changes may not be reflected in this catalog, but advisers and faculty will be aware.

Biology, B.S. (College of Liberal Arts and Sciences)**General Sample Plan****Freshman**

Fall	Credits	Spring	Credits	Summer	Credits
BIOL 1100		1 BIOL 2120		3 All	
				Summers:	
				Consider	
				internship,	
				study	
				abroad,	
				field	
				stations,	
				research,	
				clinical	
				observation	
BIOL 1110		0.5 BIOL 2120L		1	
BIOL 2110		3 Chemistry *		4	
BIOL 2110L		1 Social		3	
		Science			
CHEM 1630		4 Math/Stat		4	
or 1770 *		Choice *			
CHEM 1630L		1			
or 1770L *					
ENGL 1500		3			
or 2500					
LIB 1600		1			
		14.5		15	0

Sophomore

Fall	Credits	Spring	Credits
ENGL 2500		3 BIOL 3130	3
(or Elective			
or World			
Language)			
BIOL 3140		3 BIOL 3130L	1
Chemistry		3-4 Biochemistry *	3
or Elective *			
Advanced		3 World	4
Biology		Language/	
		Elective	
LAS 2030		1 Math/Stat	4
		Choice *	
Humanities		3 Elective	1
Choice			
		16-17	16

Junior

Fall	Credits	Spring	Credits
BIOL 3120		4 BIOL 3150	3
Advanced Biology		3 Advanced Biology with Lab	4
PHYS 1150 or 1310		4 PHYS 1320 (or Elective)	4
PHYS 1150L or 1310L		1 PHYS 1320L (or Elective)	1
International Perspectives + Humanities Choice		3 U.S. Cultures and Communities + Social Science Choice	3
15		15	

Senior

Fall	Credits	Spring	Credits
Advanced Biology		3 Advanced Biology with Lab	4
Written Communication/ Speech		3 Advanced Biology	4
Social Science		3 Humanities Choice	3
Humanities Choice		3 Elective or Minor	3
Elective or Minor		3	
15		14	

Total Credits: 120.5-121.5

This is only a suggested outline plan. Students may choose or be forced to deviate from this plan to satisfy unmet requirements, for scheduling reasons, or to add a minor or double major. We strongly suggest student involvement in internships, study abroad, summer field stations, Iowa Lakeside Lab, Field Trips in Biology or research opportunities at ISU. These will enhance your program of study but may add credits or time to your degree plan.

* Students should meet with a Biology Program advisor to determine the proper plans for chemistry, math and physics before selecting those options above.

Biology, B.S. (College of Liberal Arts and Sciences)**Pre-Medical Sample Plan**

Please note that professional school requirements vary by program.

Freshman

Fall	Credits	Spring	Credits	Summer	Credits
BIOL 1100		1 BIOL 2120		3 All Summers: Consider internship, study abroad, field stations, research, clinical observation	
BIOL 1110		0.5 BIOL 2120L		1	
BIOL 2110		3 CHEM 1780		3	
BIOL 2110L		1 CHEM 1780L		1	
CHEM 1770		4 MATH 1600 or 1650		4	
CHEM 1770L		1 PSYCH 1010		3	
ENGL 1500 or 2500		3			
LIB 1600		1			
14.5		15		0	

Sophomore

Fall	Credits	Spring	Credits
BIOL 3140		3 Advanced Biology Choice	3
CHEM 3310		3 BIOL 3130	3
CHEM 3310L		1 BIOL 3130L	1
ENGL 2500 (or Elective)		3 CHEM 3320	3
STAT 1040 or 1010		3-4 CHEM 3320L	1

LAS 2030	1 USCC + Arts and Humanities Choice	3
FSHN 3670	1 Social Science Choice	3

15-16 **17**

Junior

Fall	Credits	Spring	Credits
BBMB 3160 or 4040	3	BBMB 4050 (Or Advanced Biology Choice)	3
BIOL 3500	4	BIOL 3350	3
SOC 1340	3	BIOL 3350L	1
PHYS 1310	4	Elective	1
PHYS 1310L	1	PHYS 1320	4
		PHYS 1320L	1
		Take MCAT in May or June Submit application in June or July	

15 **13**

Senior

Fall	Credits	Spring	Credits
Advanced Biology Choice	3	Advanced Biology Choice	3
BIOL 3120 (with lab)	4	BIOL 3150	3
Written Communication/ Speech	3	Arts & Humanities Choice	6
Arts & Humanities + IP Choice	3	World Lang or Elective	3-4

World Lang 3-4
or Elective
Choice

16-17 **15-16**

Total Credits: 120.5-123.5**Biology, B.S. (College of Liberal Arts and Sciences)****Pre-Physician Assistant Sample Plan**

Please note that professional school requirements vary by program.

Freshman

Fall	Credits	Spring	Credits	Summer	Credits
BIOL 1100	1	BIOL 2120	3	All Summers: Consider internship, study abroad, field stations, research, clinical observation	
BIOL 1110	0.5	BIOL 2120L	1		
BIOL 2110	3	CHEM 1780	3		
BIOL 2110L	1	CHEM 1780L	1		
CHEM 1770	4	MATH 1600 or 1650	4		
CHEM 1770L	1	PSYCH 1010	3		
ENGL 1500 or 2500	3				
LIB 1600	1				
	14.5		15		0

Sophomore

Fall	Credits	Spring	Credits
BIOL 3140	3	Advanced Biology Choice	3
CHEM 2310	3	BIOL 3130	3
CHEM 2310L	1	BIOL 3130L	1
Or CHEM 3310 & CHEM 3310L		Elective	3

ENGL 2500 (or Elective)	3 Humanities Choice	3
STAT 1040 or 1010	3-4 PSYCH 2300	3
LAS 2030	1	
FSHN 3670	1	
15-16		16

Junior

Fall	Credits	Spring	Credits
BBMB 3160		3 Advanced Biology	3
BIOL 3120		4 BIOL 3350	3
BIOL 3500		4 BIOL 3350L	1
Elective		1 U.S. Cultures and Communities + Humanities	3
PSYCH 4600		3 PHYS 1150/L or PHYS 1310/L	5
15		15	

Senior

Fall	Credits	Spring	Credits
Advanced Biology Choice		3 Advanced Biology Choice	3
Written Communication/ Speech		3 Elective Choice	3
BIOL 3150		3 Arts & Humanities Choice	3
IP + Humanities Choice		3 Social Science	3
World Lang or Elective Choice		3-4 World Lang or Elective	3-4
15-16		15-16	

Total Credits: 120.5-123.5

Biology, B.S. (College of Liberal Arts and Sciences)

Pre-Physical Therapy Sample Plan

Please note that professional school requirements vary by program.

Freshman

Fall	Credits	Spring	Credits	Summer	Credits
BIOL 1100		1 BIOL 2120		3 All Summers: Consider internship, study abroad, field stations, research, clinical observation	
BIOL 1110		0.5 BIOL 2120L		1	
BIOL 2110		3 CHEM 1780		3	
BIOL 2110L		1 CHEM 1780L		1	
CHEM 1770		4 MATH 1600 or 1650		4	
CHEM 1770L		1 PSYCH 1010		3	
ENGL 1500 or 2500		3			
LIB 1600		1			
14.5		15		0	

Sophomore

Fall	Credits	Spring	Credits
BIOL 3140		3 Advanced Biology	3
CHEM 2310		3 BIOL 3130	3
CHEM 2310L		1 BIOL 3130L	1
ENGL 2500 (or Elective)		3 Elective	2
STAT 1010 or 1040		3-4 Humanities Choice	3
LAS 2030		1 Social Science (Psych course recommended)	3
FSHN 3670		1	
15-16		15	

Junior

Fall	Credits	Spring	Credits
BBMB 3160		3 Advanced Biology	3
Humanities Choice		3 BIOL 3350	3
BIOL 3500		4 BIOL 3350L	1
PHYS 1310		4 Arts & Humanities + USCC Choice	3
PHYS 1310L		1 PHYS 1320	4
		PHYS 1320L	1
15		15	

Senior

Fall	Credits	Spring	Credits
Advanced Biology Choice		3 Advanced Biology Choice	3
Written Communication/ Speech		3 Elective	3
BIOL 3120 (with lab)		4 BIOL 3150	3
Arts & Humanities + IP Choice		3 Social Science	3
World Lang or Elective Choice		3-4 World Lang or Elective	3-4
16-17		15-16	

Total Credits: 120.5-123.5**Minor**

A minor in Biology is offered by the Biology Program and administered by the College of Liberal Arts and Sciences. The minor requires 15 credits in Biology and includes the completion of the specific courses listed below and 7 credits in biology courses numbered 3000 or above. Three (3) credits of the required courses must apply only to the minor. For more information, see the Biology Program web site or contact the Student Services Office in 103 Bessey Hall.

BIOL 2110	Principles of Biology I	3
BIOL 2110L	Principles of Biology Laboratory I	1
BIOL 2120	Principles of Biology II	3
BIOL 2120L	Principles of Biology Laboratory II	1

Additional BIOL courses 3000-level and above	7
Total Credits	15

The Biology Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

Graduate Programs

Biology is an undergraduate major only. Persons interested in graduate study in the biological sciences should apply directly to one of the life science graduate programs at Iowa State University.

Programs

- Bioinformatics and Computational Biology
- Ecology and Evolutionary Biology
- Genetics
- Molecular Cellular and Developmental Biology
- Neuroscience
- Plant Biology
- Toxicology
- Immunobiology
- Environmental Science

Interdisciplinary Graduate Studies

A non-thesis master's degree in Interdisciplinary Graduate Studies (biological sciences) has been established particularly for those who wish to have a more diversified program of advanced study than that generally permitted by specific departments and programs.

Chemistry OVERVIEW

The department of Chemistry offers Bachelor of Science and Bachelor of Arts degrees in Chemistry in the College of Liberal Arts and Sciences.

Graduates holding the B.S. degree in Chemistry qualify in many fields as teachers of Chemistry, supervisors in industry, technical sales personnel, and research chemists in federal, state, municipal, academic, or industrial laboratories. Students with high scholastic standing often continue with graduate work, where they may explore more thoroughly the specialized areas of chemistry in which they are interested. The B.S. degree is recommended for students who wish to pursue graduate studies or a research career in Chemistry.

The B.A. degree is useful for students who intend to pursue studies in parallel areas, such as secondary school teaching, to obtain additional majors, minors, or for pursuing professional school (such as medical, dental, or pharmacy school) outside of Chemistry.

Student Learning Outcomes

Upon graduation students should:

- Have firm foundations in the fundamentals and application of current chemical theories.
- Be able to design, carry out, record, and analyze the results of chemical experiments.
- Use modern instrumentation and classical techniques to identify and solve chemical problems as well as explore new areas of research.
- Communicate the results of their work to chemists, as well as non-chemists.
- Understand the ethical and environmental dimensions of problems and issues facing chemists.
- Follow the proper procedures and regulations for safe storage, labeling, use of chemicals, and disposal of chemicals.
- Be able to use chemical literature (perform searches for, read, evaluate, and appropriately cite publications).
- Be skilled in problem solving, critical thinking, and analytical reasoning.

These skills may be applied to careers in education and industry; in professions such as law, medicine, environmental sciences, and forensic sciences. The curricula in Chemistry are approved by the American Chemical Society (ACS). Students who complete the program obtain an ACS certified baccalaureate degree provided they also take one Biochemistry course, typically BBMB 3010 Survey of Biochemistry, BBMB 3160 Principles of Biochemistry, or BBMB 4040 Biochemistry I and BBMB 4050 Biochemistry II.

Liberal arts majors who wish to transfer into Chemistry at the end of their second year may still complete all degree requirements and graduate within five years.

DEGREE REQUIREMENTS

All Chemistry students complete required classes in Chemistry, Physics, and Math, and additional credits of Advanced Coursework depending on the degree type. Students choose a pathway based on their career goals: Chemistry (B.S. or B.A.), Teacher Preparation (with B.A. or B.S.), or chemistry applications (via advanced course choices in the B.S.).

Chemistry, B.S.

Undergraduate students seeking the Bachelor of Science (B.S.) degree in Chemistry complete 67-78 credits in required chemistry, math, and physics classes, and have the following courses in their degree programs as minimum requirements.

Chemistry Core Courses (B.S.)

CHEM 1770	General Chemistry I	4
CHEM 1770L	Laboratory in General Chemistry I	1
CHEM 1780	General Chemistry II	3
CHEM 2110	Quantitative and Environmental Analysis	2
CHEM 2110L	Quantitative and Environmental Analysis Laboratory	2
CHEM 3010	Inorganic Chemistry ^S	2
CHEM 3160	Instrumental Methods of Chemical Analysis ^F	2
CHEM 3160L	Instrumental Analysis Laboratory ^F	2
CHEM 3220L	Laboratory in Physical Chemistry ^S	3
CHEM 3240	Introductory Quantum Mechanics	3
CHEM 3250	Chemical Thermodynamics	3
CHEM 3310	Organic Chemistry I	3
CHEM 3320	Organic Chemistry II	3
CHEM 3330L	Laboratory in Organic Chemistry I (for Chemistry and Biochemistry Majors) ^F	2
CHEM 3340L	Laboratory in Organic Chemistry II (for Chemistry and Biochemistry Majors) ^S	2
CHEM 4020	Advanced Inorganic Chemistry	3
CHEM 4010L	Inorganic Chemistry Laboratory	1
Advanced Chemistry Choice 1 ²		2-3
Advanced Chemistry Choice 2 ²		2-3

[CHEM 1670/CHEM 1670L (5 cr.)] may be substituted for [CHEM 1770/CHEM 1770L (5 cr.)] only if the Chemistry major has been declared after receiving credit for [CHEM 1670/CHEM 1670L

[CHEM 2010/CHEM 2010L (6 cr.)] may be substituted for [CHEM 1770/CHEM 1770N/CHEM 178 (8 cr.)] ^{1,F}

[CHEM 3310L/CHEM 3320L] may be substituted for [CHEM 3330L/CHEM 3340L]. However, this substitution may result in a program which is deficient in the laboratory experience recommended by the American Chemical Society.

Total Credits **45-47**

¹ Advanced high school chemistry and strong algebra skills are necessary for success in CHEM 2010. Math ACT of 24 or greater is strongly recommended.

² The completion of two courses (minimum of 2 credits each) is mandatory to meet this requirement. See below for details on this requirement and for a list of accepted courses.

^F Offered only in Fall

^S Offered only in Spring

Additional Chemistry Courses (B.S.)

CHEM 1010A	Chemistry Learning Community Orientation: On-Campus Orientation ^F	1

CHEM 1010B	Chemistry Learning Community Orientation: Professional Development Opportunities ^S	1
CHEM 1100	Cutting-Edge Chemistry: Research and Career Opportunities ^F	1
CHEM 1010A and CHEM 1010B are required for students in the Chemistry Learning Community		
All students majoring in Chemistry are strongly encouraged to take CHEM 1100		

^F Offered only in Fall

^S Offered only in Spring

Math and Physics Core Courses (B.S.)

MATH 1650	Calculus I	4
MATH 1660	Calculus II	4
MATH 2650	Calculus III	4
PHYS 2310	Introduction to Classical Physics I	4
PHYS 2310L	Introduction to Classical Physics I Laboratory	1
PHYS 2320	Introduction to Classical Physics II ^S	4
PHYS 2320L	Introduction to Classical Physics II Laboratory ^S	1
Total Credits		22

Advanced Chemistry Choices (B.S.)

The completion of two courses (minimum of 2 credits each) is mandatory within the Chemistry BS degree. In addition to Advanced Chemistry Courses (4000 and 5000 level), certain courses in Biochemistry-Biophysics, Chemical Engineering, Computer Science, Mathematics, and Materials Science and Engineering are acceptable.

Students may assume courses in this list will be accepted without petition but should petition through their adviser for the acceptance of any other course outside this list offered by a department other than chemistry. Lab courses associated with lectures (e.g., FS HN 3110L) are not considered as advanced chemistry courses.

Up to three credits in undergraduate research (CHEM 3990/4990/4900) can be counted as one of the two advanced chemistry courses. CHEM 5500 and CHEM 5550 may not be used to satisfy the Advanced Chemistry requirement.

List of Approved Advanced Chemistry Credits

CHEM 3260	Chemical Kinetics	1
CHEM 3990	Undergraduate Research	1-30
CHEM 3980	Cooperative Education	R
CHEM 4900	Independent Study	1-30
CHEM 4990	Senior Research	2-3
CHEM 5010L	Inorganic Preparations	1
CHEM 5020	Advanced Inorganic Chemistry	3

CHEM 5050	Physical Inorganic Chemistry	3
CHEM 5110	Advanced Analytical Chemistry	3
CHEM 5120	Electrochemical Methods of Analysis	3
CHEM 5130	Analytical Molecular and Atomic Spectroscopy	3
CHEM 5160	Analytical Separations	3
CHEM 5310	Organic Synthesis I	3
CHEM 5320	Organic Synthesis II	2
CHEM 5370	Physical Organic Chemistry I	3
CHEM 5380	Physical Organic Chemistry II	3
CHEM 5490	Nuclear Magnetic Resonance Spectroscopy	3
CHEM 5610	Fundamentals of Quantum Mechanics	4
CHEM 5620	Fundamentals of Atomic and Molecular Quantum Mechanics	3
CHEM 5630	Statistical Mechanics	3
CHEM 5640	Molecular Spectroscopy and Structure	3
CHEM 5710	Solid-State Chemistry	2
CHEM 5720	Spectrometric Identification of Organic Compounds	3
CHEM 5730	Nanochemistry	2
CHEM 5740	Organometallic Chemistry of the Transition Metals	2
CHEM 5750	Diffraction and Crystal Structure	3
CHEM 5760	Surface Chemistry	3
CHEM 5770	Mass Spectrometry	3
CHEM 5780	Chemical Kinetics and Mechanisms	2
CHEM 5800	Introduction to Computational Quantum Chemistry	3
CHEM 5830	Chemical Group Theory	1
BBMB 3010	Survey of Biochemistry	3
BBMB 3030	General Biochemistry	3
BBMB 3160	Principles of Biochemistry	3
BBMB 4040	Biochemistry I	3
BBMB 4050	Biochemistry II	3
BBMB 4110	Techniques in Biochemical Research	4
BBMB 4200	Mammalian Biochemistry	3
BBMB 4610	Molecular Biophysics	2
BBMB 4900	Independent Study	1-3
BBMB 5040	Amino Acids and Proteins	2
FSHN 3110	Food Chemistry	3
FSHN 4100	Food Analysis	3
GEOL 4190	Aqueous and Environmental Geochemistry	3
GEOL 3150	Mineralogy and Earth Materials	3
GEOL 5190	Aqueous and Environmental Geochemistry	3
ENSCI 4190	Aqueous and Environmental Geochemistry	3
ENSCI 5190	Aqueous and Environmental Geochemistry	3

LAS 4990	Internship	1-4
ANS 3190	Animal Nutrition	3

All students majoring in Chemistry are strongly encouraged to take CHEM 3990 and CHEM 5500

LAS 4990 counts only if the internship occurred in a chemistry related workplace.

Chemistry, B.A.

Undergraduate students seeking the Bachelor of Arts (B.A.) degree in Chemistry must complete 51-54 credits in required chemistry, math, and physics classes and have the following courses in their degree programs as minimum requirements.

Chemistry Core Courses (B.A.)

CHEM 1770	General Chemistry I	4
CHEM 1770L	Laboratory in General Chemistry I	1
CHEM 1780	General Chemistry II	3
CHEM 2110	Quantitative and Environmental Analysis	2
CHEM 2110L	Quantitative and Environmental Analysis Laboratory	2
CHEM 3010	Inorganic Chemistry	2
CHEM 3160	Instrumental Methods of Chemical Analysis	2
CHEM 3160L	Instrumental Analysis Laboratory	2
CHEM 3210L	Laboratory in Physical Chemistry	2
CHEM 3240	Introductory Quantum Mechanics	3
CHEM 3250	Chemical Thermodynamics	3
CHEM 3310	Organic Chemistry I	3
CHEM 3330L	Laboratory in Organic Chemistry I (for Chemistry and Biochemistry Majors)	2
CHEM 3320	Organic Chemistry II	3
CHEM 3340L	Laboratory in Organic Chemistry II (for Chemistry and Biochemistry Majors)	2

[CHEM 1670/CHEM 1670L (5 cr.)] may be substituted for CHEM 1770/CHEM 1770L (5 cr.) only if the Chemistry major has been declared after receiving credit for [CHEM 1670/CHEM 1670L]

[CHEM 2010/CHEM 2010L (6 cr.)] may be substituted for [CHEM 1770/CHEM 1770N/CHEM 178 (8 cr.)] ^{1,F}

[CHEM 3310L/CHEM 3320L] may be substituted for [CHEM 3330L/CHEM 3340L]. However, this substitution may result in a program which is deficient in the laboratory experience recommended by the American Chemical Society.

Total Credits 36

¹ Advanced high school chemistry and strong algebra skills are necessary for success in CHEM 2010. Math ACT of 24 or greater is strongly recommended.

^F Offered only in Fall

^S Offered only in Spring

Additional Chemistry Courses (B.A.)

CHEM 1010A	Chemistry Learning Community Orientation: On-Campus Orientation ^F	1
CHEM 1010B	Chemistry Learning Community Orientation: Professional Development Opportunities ^S	1
CHEM 1100	Cutting-Edge Chemistry: Research and Career Opportunities ^F	1

CHEM 1010A and CHEM 1010B are required for students in the Chemistry Learning Community

All students majoring in Chemistry are strongly encouraged to take CHEM 1100

^F Offered only in Fall

^S Offered only in Spring

Math and Physics Core Courses (B.A.)

MATH 1650	Calculus I	4
MATH 1660	Calculus II	4
PHYS 2310	Introduction to Classical Physics I	4
PHYS 2310L	Introduction to Classical Physics I Laboratory	1
PHYS 2320	Introduction to Classical Physics II	4
PHYS 2320L	Introduction to Classical Physics II Laboratory	1

[PHYS 1310/1310L and PHYS 1320/1320L] may be substituted for [PHYS 2310/2310L and 2320/2320L]; however, [PHYS 2310/2310L and PHYS 2320/2320L] are highly recommended

Total Credits 18

Teacher Preparation Focus

Chemistry majors seeking certification to teach Chemistry in secondary schools can follow the requirements of either the B.S. or the B.A. degree in Chemistry. In addition, they must take the complementary coursework listed below and all of the requirements of the Secondary Major in Education.

Complementary Coursework

EDUC 4180	Secondary Science Methods I	3
EDUC 4190	Secondary Science Methods II	3
PSYCH 2300	Developmental Psychology	3

One course in Biology (BIOL 2110 & BIOL 2110L recommended)

One course in American History or Government

Chemistry Career Pathways

Students who are not planning to attend graduate school in Chemistry or become teachers, can meet the advanced coursework requirements of the Chemistry major by completing one of several approved completion pathways for the Chemistry major. This coursework can help a Chemistry graduate establish a clear strength in several fields of application of chemistry. These pathways, including additional credits, also make double majors with Chemistry more feasible. Contact the Chemistry advisor for further information concerning programs of study in Chemistry. Sample Chemistry career pathways are listed at the Chemistry Department web site (<https://www.chem.iastate.edu/undergraduate-student-info/>).

University and/or College Requirements

As majors in the College of Liberal Arts and Sciences, Chemistry students must meet College of Liberal Arts and Sciences (<http://catalog.iastate.edu/collegeofliberalartsandsciences/#lascollegerequirementstext>) and University-wide requirements (<http://catalog.iastate.edu/collegescurricula/>) for graduation, in addition to those stated above for the major.

LAS majors require a minimum of 120 credits, including a minimum of 45 credits at the 3000/4000 level. You must also complete the LAS world language requirement and career proficiency requirement.

Communication Proficiency requirement: The College of Liberal Arts and Sciences aligns with the University Communication Proficiency Grade Requirement (<https://catalog.iastate.edu/academics/#communicationproficiencypolicytext>). At a minimum, students must demonstrate their communication proficiency by earning a grade of C or better in ENGL 2500. The department requires a grade of C- or better in ENGL 3140.

Required General Education electives include a minimum of 12 credits from Group I (Arts and Humanities) and a minimum of 9 credits from Group III (Social Sciences).

Additionally, all ISU majors must complete a three-credit course in U.S. Cultures and Communities (formerly U.S. diversity) and a three-credit course in International Perspectives. These courses may also be used to meet Group I and III Requirements. Discuss with your advisor how the two courses that you select can be applied to your graduation plan.

Lists of approved courses are available online: LAS General Education Approved Course List (<https://las.iastate.edu/academics/general-education/general-education-approved-course-list/>)

Arts and Humanities		12
Social Sciences		9
LAS 2030	Professional Career Preparation	1
LIB 1600	Introduction to College Level Research	1
ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
ENGL 3140	Technical Communication	3
World Language (First Semester)		4
World Language (second semester)		4
Completion of three years of a world language in high school fulfills this requirement.		
Total Credits		40

Chemistry, B.S

Freshman		
Fall	Credits Spring	Credits
CHEM 1770 ^{1,F}	4 CHEM 1780 ¹	3
CHEM 1770N ^{1,F}	1 CHEM 1010B ^{2,S}	1
CHEM 1010A ^{2,F}	1 MATH 1660	4
MATH 1650	4 ENGL 2500	3
ENGL 1500	3 Electives	3
LIB 1600	1	
Electives		
	14	14

Sophomore		
Fall	Credits Spring	Credits
CHEM 3310	3 CHEM 3320	3
CHEM 3330L ^{1,F}	2 CHEM 3340L ^{1,S}	2
CHEM 1100 ^F	1 CHEM 2110	2
MATH 2650	4 CHEM 2110L	2
PHYS 2310	4 PHYS 2320	4
PHYS 2310L	1 PHYS 2320L	1
Electives	3 LAS 2030	1
	18	15

Junior		
Fall	Credits Spring	Credits
CHEM 3240	3 CHEM 3250	3
CHEM 3160 ^F	2 CHEM 3220L	3
CHEM 3160L ^F	2 CHEM 3010 ^S	2

World Language (First Semester) ³	4 CHEM 5500 (strongly recommended)	1
Electives	3 World Language (Second Semester) ⁴	4
	Electives	3
14		16
Senior		
Fall	Credits Spring	Credits
CHEM 4020 ^F	3 CHEM 4010L	1
ENGL 3140	3 Advanced Chemistry Choice ^{2,4,5}	2-3
Advanced Chemistry Choice ^{1,4,5}	2-3 BBMB 3010 (strongly recommended)	3
Electives	6 CHEM 3990 (strongly recommended)	1-30
	Electives	3
14-15		10-40

Total Credits: 115-146

¹ The following substitutions may occur:
[CHEM 1670/CHEM 1670L] may be substituted for [CHEM 1770/CHEM 1770L] only if the Chemistry major has been declared after receiving credit for [CHEM 1670/CHEM 1670L]

[CHEM 2010/CHEM 2010L (6 cr.)] may be substituted for [CHEM 1770/CHEM 1770N/CHEM 178 (8 cr.)]. Advanced high school chemistry and strong algebra skills are necessary for success in CHEM 2010. Math ACT of 24 or greater is strongly recommended.
[CHEM 3310L/CHEM 3320L] may be substituted for [CHEM 3330L/CHEM 3340L]. However, this substitution may result in a program which is deficient in the laboratory experience recommended by the American Chemical Society.

² Required if part of the Chemistry Learning Community.

³ Completion of three years of a world language in high school fulfills this requirement.

⁴ The completion of two courses (minimum of 2 credits each) is mandatory within the Chemistry BS degree. In addition to Advanced Chemistry Courses (4000 and 5000 level), certain courses in Biochemistry-Biophysics, Chemical Engineering, Computer Science, Mathematics, and Materials Science and Engineering are acceptable. Up to four credits in undergraduate research (CHEM 3390 and/or 4990) can be counted as one of the two advanced chemistry courses. CHEM 5500 may not be used to satisfy the Advanced Chemistry requirement.

⁵ The program as listed above meets the standard for a certified degree of the American Chemical Society's Committee on Professional Training if BBMB 3010 or 4040 is one of the Advanced Chemistry Courses.

F Class offered Fall Semester only.

S Class offered Spring Semester only.

Chemistry, B.A.

Freshman

Fall	Credits Spring	Credits
CHEM 1770 ^{1,F}	4 CHEM 1780 ¹	3
CHEM 1770N ^{1,F}	1 CHEM 1010B ^{2,S}	1
CHEM 1010A ²	1 MATH 1660	4
MATH 1650	4 ENGL 2500	3
ENGL 1500	3 Electives	3
LIB 1600	1	
14		14

Sophomore

Fall	Credits Spring	Credits
CHEM 3310	3 CHEM 3320	3
CHEM 3330L ^{1,F}	2 CHEM 3340L ^{1,S}	2
CHEM 1100 (strongly recommended) ^F	1 CHEM 2110	2
PHYS 2310 ¹	4 CHEM 2110L	2
PHYS 2310L	1 PHYS 2320 ¹	4
Electives	6 PHYS 2320L	1
17		14

Junior

Fall	Credits Spring	Credits
CHEM 3240	3 CHEM 3250	3
CHEM 3160 ^F	2 CHEM 3210L ^S	2
CHEM 3160L ^F	2 CHEM 3010 ^S	2
World Language (First semester) ²	4 CHEM 5500 (strongly recommended) ^S	1
LAS 2030	1 World Language (Second Semester) ²	4
Electives	6 Electives	3
18		15

Senior

Fall	Credits Spring	Credits
ENGL 3140	3 BBMB 3010 (strongly recommended)	3
Electives	9 CHEM 3990 (strongly recommended, credits variable)	1-30
	Electives	12
12		16-45

Total Credits: 120-149

¹ The following substitutions may occur:

[CHEM 1770/CHEM 1770L] may be substituted for [CHEM 1670/CHEM 1670L] only if the Chemistry major has been declared after receiving credit for [CHEM 1670/CHEM 1670L]

[CHEM 2010/CHEM 2010L (6 cr.)] may be substituted for [CHEM 1770/CHEM 1770N/CHEM 178 (8 cr.)]. Advanced high school chemistry and strong algebra skills are necessary for success in CHEM 2010. Math ACT of 24 or greater is strongly recommended.

[CHEM 3310L/CHEM 3320L] may be substituted for [CHEM 3330L/CHEM 3340L]. However, this substitution may result in a program which is deficient in the laboratory experience recommended by the American Chemical Society.

[PHYS 1310/1310L and PHYS 1320/1320L] may be substituted for [PHYS 2310/2310L and 2320/2320L]; however, [PHYS 2310/2310L and PHYS 2320/2320L] are highly recommended.

² Required if part of the Chemistry Learning Community.

³ Completion of three years of a world language in high school fulfills this requirement.

⁴ Individuals earning a B.A. degree in Chemistry who have taken 3310L, 3340L and 3220L can obtain American Chemical Society certification by taking an additional advanced chemistry lecture course of BBMB3010 or BBMB4040. CHEM 5500 may not be used to satisfy the Advanced Chemistry requirement.

F Class offered Fall Semester only.

S Class offered Spring Semester only.

Four-year plans for advanced coursework options to complete the Chemistry major are listed at (<https://www.chem.iastate.edu/undergraduate-student-info>) (<https://www.chem.iastate.edu/undergraduate-student-info/>).

Minor in Chemistry

As per University requirement, the minor must fulfill the following requirements:

- at least 9 credits in courses numbered 2000 or above, of which at least 6 credits are in courses numbered 3000 or above.
- at least 3 credits taken at Iowa State University.
- at least 3 credits that are not used to meet any other department, college, or university requirement.

Credits used to meet the minor requirements may also be used to satisfy the credit requirement for graduation and to meet credit requirements in courses numbered 3000 or above.

Some students may have to exceed the graduation credit requirement set by their college in order to meet the requirements of both the minor and the major. Courses taken for a minor may not be taken on a pass-not pass

basis. A student may not receive both an undergraduate major and a minor of the same name.

In addition to University policies governing minors (<https://catalog.iastate.edu/academics/#degreeplanningtext>), LAS minors require at least 6 credits in courses numbered 3000 and above, taken at ISU with a grade of C or higher. Completed minors and certificates will be recorded on the transcript.

The Department offers a Minor in Chemistry which may be earned by completing 15 credits in chemistry courses chosen as follows:

Required Discipline

CHEM 1770 & CHEM 1780 or CHEM 2010	General Chemistry I and General Chemistry II ¹ Advanced General Chemistry	5-7
CHEM 1770L or CHEM 2010L	Laboratory in General Chemistry I Laboratory in Advanced General Chemistry	1
CHEM 1630/L and CHEM 1670/L can be used in place of CHEM 1770/L if the Minor was declared after credit was received.		
Total Credits		6-8

The remaining 7-9 credits can be chosen among the following courses in ANY combination (i.e., courses do not need to be all from the same Chemistry focus area). Some courses might have pre-requisites. Some paths may require more than 15 credits. Students may count only of these two combinations [CHEM 2310/CHEM 2310L] or [CHEM 3310/CHEM 3310L & CHEM 3320/CHEM 3320L] toward the Minor.

Chemistry Area Options²

Analytical Chemistry

CHEM 2110 & 2110L	Quantitative and Environmental Analysis and Quantitative and Environmental Analysis Laboratory	4
CHEM 3160 & 3160L	Instrumental Methods of Chemical Analysis and Instrumental Analysis Laboratory	4

Organic Chemistry (Students may count one of these organic chemistry combinations toward the Minor)

CHEM 2310 & 2310L	Elementary Organic Chemistry and Laboratory in Elementary Organic Chemistry	4
CHEM 3310 & 3310L & CHEM 3320 & CHEM 3320L	Organic Chemistry I and Laboratory in Organic Chemistry I and Organic Chemistry II and Laboratory in Organic Chemistry II	8

Inorganic Chemistry

CHEM 3010	Inorganic Chemistry	2
CHEM 4020	Advanced Inorganic Chemistry	3
CHEM 4010L	Inorganic Chemistry Laboratory	1

Physical Chemistry

CHEM 3240	Introductory Quantum Mechanics	3
CHEM 3250	Chemical Thermodynamics	3
CHEM 3260	Chemical Kinetics	1
CHEM 3210L	Laboratory in Physical Chemistry	2
	or CHEM 3220LLaboratory in Physical Chemistry	

¹ Chem 1630/L and Chem 1670/L can be used in place of Chem 1770/L if the Minor was declared after credit was received.

² 4000- and 5000-level courses listed on the Chemistry catalog can also be chosen to fulfill the 15-credit requirement for the Minor.

Concurrent Program

The concurrent Chemistry/MBA program is designed to be completed in five academic years, with three years of undergraduate coursework followed by two years of MBA studies alongside the remaining undergraduate courses.

Concurrent students are part of the full-time MBA program. Admission to the concurrent MBA program is competitive. You should apply during your junior year. Successful candidates demonstrate superior academic ability, strong leadership attributes, and clear career focus. Previous business coursework is not a requirement for application.

Internships, co-op experiences, extracurricular, and leadership activities are highly valued in the MBA candidate selection process. However, you aren't required to have additional coursework in business in preparing for the MBA.

Admitted students typically have a cumulative GPA of 3.00 or above and have scored 600 or higher on the GMAT exam or GRE equivalent. If you're interested in the concurrent MBA program, you should apply by **March 15** of your junior year to be considered for scholarships and assistantships. The final application deadline is June 1.

Graduate Programs

The Department offers work for the degrees Master of Science and Doctor of Philosophy with majors in Chemistry, Analytical, Inorganic, Organic, and Physical Chemistry. Co-majors may be taken between areas within Chemistry or between one of the areas in Chemistry and another department. Courses in other areas of Chemistry as well as courses in other departments may be used to satisfy the requirement for coursework outside the major field. A Ph.D. student in Chemistry may choose an additional specialty in one of six areas: Materials Chemistry, Industrial Chemistry, Biomolecular Sciences, Chemistry Education, Chemical Instrumentation, and Forensic Chemistry. A minimum of ten credits is required for each additional specialty. A course which counts towards an additional specialty may also count toward the outside course requirement. A minor in Chemistry is available to students in

other departments. The Department participates in the interdepartmental major in Toxicology.

The Department of Chemistry requires all graduate students majoring in Chemistry to teach as part of their training for an advanced degree. Prerequisite to major graduate work is the completion of undergraduate work in Chemistry, Mathematics, and Physics substantially equivalent to that required of undergraduate Chemistry majors at this institution.

Classical Studies

The cross-disciplinary Classical Studies Program engages students with the civilizations of ancient Greece and Rome and their influence, both past and present, on western and world cultures. The Classical Studies minor and Interdisciplinary Studies major include an integrated curriculum of courses in the cultures, literatures, history, archaeology, and art of ancient Greece and Rome from the Bronze Age to Late Antiquity. Students also study Elementary Latin. Current information about the Program may be found at: <http://language.iastate.edu/academic-programs/classical-studies/>. (<http://language.iastate.edu/academic-programs/classical-studies/>)

Courses in Classical Studies provide background and a classical context for students whose major fields of study or career interests include History, Anthropology, English, World Languages and Cultures, Philosophy, Women's and Gender Studies, material culture, law, medicine, political science, the life sciences, and related fields.

Students interested in pursuing an Interdisciplinary Studies major or minor in Classical Studies should meet with an academic advisor in the Department of World Languages and Cultures (<https://language.iastate.edu/advising/>) and the Classical Studies Program director (<https://language.iastate.edu/directory/#clst>).

(Note: neither this major nor minor prepares students for graduate study in Classical Studies.)

Student Learning Outcomes

Upon the completion of their program of study, students with an interdisciplinary studies major in Classical Studies will demonstrate proficiency in three areas: Knowledge and Evidence, Interdisciplinarity, and Cross-Cultural Literacy.

1. Knowledge and Evidence: acquisition and communication of knowledge about the ancient Greco-Roman world through the use, critical evaluation, and contextualization of diverse bodies of evidence.
2. Interdisciplinarity: integration of subdisciplines and other fields and their methodologies to understand the complexities and limitations of various bodies of evidence and connect texts and artifacts to their cultural contexts.

3. Cross-Cultural Literacy: meaningful and creative engagement with multiple perspectives, ability to think from the perspective of a different value system and imagine different everyday experiences and different social norms.

Interdisciplinary Studies Major in Classical Studies (CLST)

Students interested in pursuing an Interdisciplinary Studies major in Classical Studies should consult the Program Chair (see "Program Faculty" at <https://language.iastate.edu/classical-studies/>) or an Academic Advisor in the Department of World Languages and Cultures (<https://language.iastate.edu/advising/>).

Required Latin Languages Courses (6 Credits)

(1000-level courses cannot count toward major credit requirements.)

LATIN 1010	Elementary Latin I	3
LATIN 1020	Elementary Latin II	3

The major requires 36 credits and permits great flexibility while maintaining academic rigor, breadth, and focus. Many courses are cross listed with those in other departments (see course descriptions, below).

A. Required Foundation Course: (3 credits)

CLST 2730	Greek and Roman Mythology	3
or CLST 2750	The Ancient City	

B. Required Ancient History Courses: (6 credits)

CLST 4020	Greek Civilization	3
CLST 4030	Roman Civilization	3

C. Additional Courses: Students must take at least 27 credits chosen from a, b, and c below (or approved by the Program Committee), with a minimum of 3 credits from each section (not including the course used for the Required Foundation Course).

a) Material Culture and Art: (at least 3 credits)

CLST 3690	Ancient Egypt	3
CLST 3760A	Classical Archeology: Bronze Age and Early Iron Age Greece	3
CLST 3760B	Classical Archeology: Archaic through Hellenistic Greece (ca 700-30 BCE)	3
CLST 3760C	Classical Archaeology: Roman Archaeology (ca 1000 BCE-400 CE)	3
CLST 3830	Greek and Roman Art	3
CLST 3840	Roman Italy: An Introduction	2
CLST 3850	Study Abroad: Roman Italy: Building the Empire	3

b) Literature: (at least 3 credits)

CLST 3530	World Literature: Western Foundations through Renaissance	3

CLST 3720	Greek and Roman Tragedy and Comedy	3
CLST 3730	Heroes of Greece, Rome, and Today	3

c) Cultural Studies: (at least 3 credits)

CLST 2730	Greek and Roman Mythology	3
CLST 2750	The Ancient City	3
CLST 3040	Cultural Heritage of the Ancient World	3
CLST 3100	Ancient Philosophy	3
CLST 3500	Rhetorical Traditions	3
CLST 3670	Christianity in the Roman Empire	3
CLST 3680	Religions of Ancient Greece and Rome	3
CLST 3700X	Topics in the Ancient Mediterranean	3
CLST 3740	Sex, Gender, and Culture in the Ancient Mediterranean World	3
CLST 4100	Soul, Mind, and World in Ancient Greek Philosophy	3
CLST 4300	Foundations of Western Political Thought	3
CLST 4800	Seminar in Classical Studies	3
CLST 4900	Independent Study	1-6
LATIN 4900	Independent Study	1-6
CLST 5300	Foundations of Western Political Thought	3

Notes

1. The list of acceptable courses may include courses not currently in the list above. Contact the Classical Studies Program director for information on eligible courses.

2. The general requirements for the Interdisciplinary Studies major in the College of Liberal Arts and Sciences must be met. All courses in the major must be at the 2000-level or higher. At least 15 credits must be at the 3000-level or higher with at least 6 credits at the 4000-level or higher. An average grade of C or better must be earned in 15 credits at the 3000-level or higher in the major.

3. Communication Proficiency requirement: According to the university-wide Communication Proficiency Grade Requirement, students must demonstrate their communication proficiency by earning a grade of C or better in ENGL 2500 Written, Oral, Visual, and Electronic Composition (or ENGL 2500H Written, Oral, Visual, and Electronic Composition: Honors). In addition, the Department requires a grade of C or better in any course numbered between 3500 and 3790 in Classical Studies.

4. LATIN 4900 Independent Study (1-6 credits, repeatable up to 9 credits): This option will only occasionally be available and only to students who have successfully completed intermediate-level Latin coursework elsewhere.

As majors in the College of Liberal Arts and Sciences, Interdisciplinary Studies students must meet College of Liberal Arts and Sciences and

University-wide requirements for graduation in addition to those stated above for the major.

LAS majors require a minimum of 120 credits, including a minimum of 45 credits at the 3000/4000 level. You must also complete the LAS world language requirement and career proficiency requirement.

Students in all ISU majors must complete a three-credit course in U.S. diversity and a three-credit course in international perspectives. Check (<http://www.registrar.iastate.edu/courses/div-ip-guide.html>) for a list of approved courses. Discuss with your advisor how the two courses that you select can be applied to your graduation plan.

Minor in Classical Studies

The minor in Classical Studies requires 18 credits: 6 credits of Latin and 12 credits of CLST courses taught in English. The minor must include at least 3 credits that are not used to meet any other department, college, or university requirement.

a) The following set of courses in Latin: (6 credits)

LATIN 1010	Elementary Latin I	3
LATIN 1020	Elementary Latin II	3

b) One of the following introductory courses: (3 credits) 3

CLST 2730	Greek and Roman Mythology (or)	
CLST 2750	The Ancient City	

c) One course in ancient history from those listed below or approved by the program committee: (3 credits) 3

CLST 4020	Greek Civilization	
CLST 4030	Roman Civilization	

d) Two additional courses (not used to meet other CL ST minor requirements) from those listed below or approved by the program committee: (6 credits) 6

One of these classes (3 crs) must be at the 3000-level or above.

CLST 2730	Greek and Roman Mythology	
CLST 2750	The Ancient City	
CLST 3040	Cultural Heritage of the Ancient World	
CLST 3100	Ancient Philosophy	
CLST 3500	Rhetorical Traditions	
CLST 3530	World Literature: Western Foundations through Renaissance	
CLST 3670	Christianity in the Roman Empire	
CLST 3680	Religions of Ancient Greece and Rome	
CLST 3690	Ancient Egypt	
CLST 3700X	Topics in the Ancient Mediterranean	
CLST 3720	Greek and Roman Tragedy and Comedy	
CLST 3730	Heroes of Greece, Rome, and Today	

CLST 3740	Sex, Gender, and Culture in the Ancient Mediterranean World
CLST 3760A	Classical Archeology: Bronze Age and Early Iron Age Greece
CLST 3760B	Classical Archeology: Archaic through Hellenistic Greece (ca 700-30 BCE)
CLST 3760C	Classical Archaeology: Roman Archaeology (ca 1000 BCE-400 CE)
CLST 3830	Greek and Roman Art
CLST 3840	Roman Italy: An Introduction
CLST 3850	Study Abroad: Roman Italy: Building the Empire
CLST 4020	Greek Civilization
CLST 4030	Roman Civilization
CLST 4100	Soul, Mind, and World in Ancient Greek Philosophy
CLST 4300	Foundations of Western Political Thought
CLST 4800	Seminar in Classical Studies
CLST 4900	Independent Study
CLST 5300	Foundations of Western Political Thought
LATIN 4900	Independent Study

The Classical Studies Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

Climate Science

Climate impacts global environmental and ecological systems, human health, water availability, agricultural systems and food security, human migrations, and economic systems. Future climate change is projected to further worsen food insecurity, water scarcity, human migrations, and global conflict.

This major is designed to give the students a solid foundation on how the climate system works and competency in areas of data analysis, planning and mitigation, and science communication. Students will take core courses in climate science and complementary areas and select at least one focus area for additional specialization. Focus areas includes: advanced climate science; data visualization; design and planning for sustainability; food, agriculture and biodiversity; policy and human behavior; and science communication.

Student Learning Outcomes:

Graduates of the Climate Science degree will have the skills and knowledge to:

1. Understand scientific principles and their application to scientific inquiry and to societal concerns relating to climate science.

2. Demonstrate a broad understanding of the climate system, how it works on multiple timescales, and the utility of tools, such as models, and their strengths and limitations in the context of climate science.
3. Demonstrate a broad understanding of climate issues and policies.
4. Think critically about the range of climate information, data, and literature coming from a variety of sources and distill application-relevant knowledge.
5. Demonstrate proficiency in data analysis and problem-solving of relevant climate systems, issues, and challenges.
6. Understand societal concerns related to climate change to develop and/or promote practical and applied research within the climate change research community.
7. Work with diverse teams whose members have a range of professional and disciplinary skills relevant to climate issues.
8. Work to identify climate-related needs and develop strategies to address these needs.
9. Use systems thinking approaches to better understand/solve climate change issues.
10. Effectively communicate in oral, written, and visual formats.

Climate Science Core Curriculum

CRP 2930	Environmental Planning	3
or MATE 2200	Globalization and Sustainability	
ECON 3800	Energy, Environmental and Resource Economics	3
GEOL 1000	How the Earth Works	3
or GEOL 1010	Environmental Geology: Earth in Crisis	
GEOL 1000L	How the Earth Works: Laboratory	1
GEOL 3240	Energy and the Environment	3
GEOL 4150	Paleoclimatology	3
JLMC 3470	Science Communication	3
MTEOR 1400	Climate and Society	3
MTEOR 2060	Introduction to Weather and Climate	3
MTEOR 3600	Ocean-Atmosphere Interactions	3
MTEOR 4040	Global Change	3
Capstone Choice		2
Total Credits		33

Required Supporting Courses

CHEM 1630	College Chemistry	5-6
& 1630L	and Laboratory in College Chemistry *	
or CHEM 1670	General Chemistry for Engineering Students	
& 1670L	and Laboratory in General Chemistry for Engineering	
or CHEM 2010	Advanced General Chemistry	
& 2010L	and Laboratory in Advanced General Chemistry	
ECON 1010	Principles of Microeconomics	3

MATH 1600	Survey of Calculus (MATH 1650 required for Advanced Climate Science Pathway)	4
or MATH 1650	Calculus I	
PHYS 1310 & 1310L	General Physics I and General Physics I Laboratory	5
or PHYS 2310 & 2310L	Introduction to Classical Physics I and Introduction to Classical Physics I Laboratory	
STAT 3050	Engineering Statistics	3
or STAT 1010	Principles of Statistics	
or STAT 1040	Introduction to Statistics	
Total Credits		20-21

* Students with previously earned credit for CHEM 1770 and CHEM 1770L may use it to meet this requirement.

Pathway Requirement

Students must complete one specialized pathway. All pathways require at least 15 credits; students choosing the Advanced Climate Science Pathway will complete 20 credits. All pathways require 9 credits at the 3000-level or higher. Students are encouraged to carefully review course prerequisites when planning course selections in their chosen pathways.

- Advanced Climate Science
- Data Visualization
- Design and Planning for Sustainability
- Food, Agriculture and Biodiversity
- Policy and Human Behavior
- Science Communication

Advanced Climate Science

Advanced Climate Science requires MATH 1660; PHYS 1320 or PHYS 2320; plus 12 credits from the choices listed. The pathway requires 9 credits at the 3000-level or higher.

MATH 1660	Calculus II	4
PHYS 1320	General Physics II	4
or PHYS 2320	Introduction to Classical Physics II	
12 credits from the following:		
AGRON 4050	Soil-Plant-Animal-Atmosphere Physics	3
AGRON 4060	World Climates	3
GEOL 4020	Watershed Hydrology	3
GEOL 4110	Hydrogeology	4
GEOL 4520	Intro GIS for Geoscientists (or other advanced GIS course such as GEOL 4880)	3
GEOL 4680	Applied Geostatistics for Geoscientists	3
GEOL 4740	Glacial and Quaternary Geology	3
GEOL 4790	Surficial Processes	3

GEOL 4830	Environmental Biogeochemistry	3
GEOL 4890	Survey of Remote Sensing Technologies	3
MTEOR 2270	Computational Meteorology I (or other computer programming course such as GEOL 5590)	3
MTEOR 3010	General Meteorology	4
MTEOR 3410	Atmospheric Physics I	3
MTEOR 4520	Climate Modeling	3
MTEOR 4080	Numerical Weather and Climate Prediction	3

Data Visualization

Data Visualization requires 15 credits from the choices listed. The pathway requires 9 credits at the 3000-level or higher.

ARCH 4390	Computational Design Theory	3
ART 2120	Studio Fundamentals: Digital Media	3
ART 3080	Computer Modeling, Rendering and Virtual Photography	3
ART 4080	Principles of 3D Animation	3
ART 4700	Data, Code, and Form	3
ART 4730	Video Art	3
ART 4750	Interactive Art	3
CRP 2510	Fundamentals of Geographic Information Systems	3
CRP 3510	Geospatial Analysis and Visualization	3
CRP 4490	Geodesign: Planning for Sustainable Futures	3
CRP 4560	GIS Programming and Automation	3
GEOL 4520	Intro GIS for Geoscientists	3
GEOL 4880	Raster GIS for Geoscientists	3
LA 2110	Digital Design Methods for Landscape Architecture	3
LA 4540	Fundamentals of Remote Sensing and Spatial Analysis	3
LA 4590	Digital Design Methods for Landscape Architecture	3
STAT 3320	Visual Communication of Quantitative Information	3

Design and Planning for Sustainability

Design and Planning for Sustainability requires 15 credits from the choices listed. The pathway requires 9 credits at the 3000-level or higher.

ARCH 4510	Whole Building Energy Performance Modeling	3
ARCH 5580	Sustainability and Green Architecture	3
CRP 2510	Fundamentals of Geographic Information Systems	3
CRP 2910	World Cities and Globalization	3
CRP 2930	Environmental Planning	3
CRP 3010	Urban Analytical Methods	4
CRP 3510	Geospatial Analysis and Visualization	3
CRP 3830	Theory of the Planning Process	3
CRP 4450	Transportation Policy and Planning	3

CRP 4490	Geodesign: Planning for Sustainable Futures	3
CRP 4490	Geodesign: Planning for Sustainable Futures	3
CRP 4570	Geogames for Civic Engagement	3
CRP 4600	Social Justice and Planning	3
CRP 4840	Sustainable Communities	3
CRP 4920	Planning Law, Administration and Implementation	3
GEOL 4520	Intro GIS for Geoscientists	3
GEOL 4880	Raster GIS for Geoscientists	3
LA 2700	Foundations in Natural Resource Policy and History	3

Food, Agriculture and Biodiversity

Food, Agriculture and Biodiversity requires 15 credits from the choices listed. The pathway requires 9 credits at the 3000-level or higher.

AECL 2310	Principles of Wildlife & Fisheries Conservation	3
BIOL 4710	Introductory Conservation Biology	3
AGRON 1800	Global Agriculture in a Changing World	3
AGRON 1810	Introduction to Crop Science	3
AGRON 1820	Introduction to Soil Science	3
AGRON 3160	Crop Structure-Function Relationships	3
AGRON 3170	Principles of Weed Science	3
AGRON 3340	Forage Crop Management	3
AGRON 3420	World Food Issues: Past and Present	3
AGRON 4050	Soil-Plant-Animal-Atmosphere Physics	3
AGRON 4060	World Climates	3
BIOL 2040	Biodiversity	2
BIOL 2110	Principles of Biology I	3
BIOL 3120	Ecology	4
BIOL 3550	Plants and People	3
BIOL 3660	Plant Systematics	4
BIOL 3700	GIS for Ecology and Environmental Science	3
or NREM 4460	Integrating GPS and GIS for Natural Resource Management	
ENT 3700	Insect Biology	3
or AECL 3660	Natural History of Iowa Vertebrates	
or BIOL 3540	Animal Behavior	
ENT 3740	Insects and Our Health	3
ENT 4710	Insect Ecology	3
GLOBE 3040	Socio-Economic Global Resource Systems	3
GLOBE 3600	Global Health	3
HORT 3420	Landscape Plant Installation, Establishment, and Management	3
HORT 4750	Urban Forestry	3

NREM 3010	Natural Resource Ecology and Soils	4
NREM 3110	Field Ecology in Montana	4
NREM 3900	Fire Ecology and Management	3
NREM 4520	Ecosystem Management: Integrating Ecology, Society, and Policy	3

Policy and Human Behavior

Policy and Human Behavior requires POLS 2830 plus 12 credits from the choices listed. The pathway requires 9 credits at the 3000-level or higher.

POLS 2830	Introduction to Environmental Politics and Policies	3

12 credits from the following:

HIST 3620	Global Environmental History	3
HIST 3630	U. S. Environmental History	3
PHIL 2300	Moral Theory and Practice	3
PHIL 3300	Ethical Theory	3
PHIL 3340	Environmental Ethics	3
POLS 3350	Science, Technology, and Public Policy	3
POLS 3440	Public Policy	3
POLS 4430	Energy Policy	3
POLS 4800	Ethics and Public Policy	3
PSYCH 3180	Judgment and Decision Making	3
MATE 2200	Globalization and Sustainability	3
SOC 3820	Environmental Sociology	3
SOC 3310	Social Class and Inequality	3
SOC 3480	Global Poverty, Resources and Sustainable Development	3

Science Communication

Science Communication requires 15 credits from the choices listed. The pathway requires 9 credits at the 3000-level or higher.

SCIVZ 3230	Scientific Illustration Principles and Techniques	3
SCIVZ 3260	Digital Rendering	3
SCIVZ 3270	Illustration as Communication	3
COMST 3270	Persuasion and Social Influence	3
ENGL 3320	Visual Communication of Quantitative Information	3
ENGL 3550	Literature and the Environment	3
ENGL 4770	Seminar in Technical Communication	3
JLMC 2600	Media Controversies in Science and Technology	3
JLMC 4010	Mass Communication Theory	3
JLMC 4740	Communication Technology and Social Change	3
JLMC 4760	World Communication Systems	3
PHIL 2060	Introduction to Logic and Scientific Reasoning	3
PR 2200	Principles of Public Relations	3

PR 3050	Publicity Methods	3
PR 3230X	Strategic Communication in Agriculture and the Environment	3

As majors in the College of Liberal Arts and Sciences, Climate Science students must meet College of Liberal Arts and Sciences and University-wide requirements for graduation in addition to those stated above for the major.

LAS majors require a minimum of 120 credits, including a minimum of 45 credits at the 3000/4000 level. You must also complete the LAS world language requirement.

Communication Proficiency requirement: According to the university-wide Communication Proficiency Grade Requirement, students must demonstrate their communication proficiency by earning a grade of C or better in ENGL 2500.

Students in all ISU majors must complete a three-credit course in U.S. Cultures and Communities and a three-credit course in International Perspectives. Check (<http://www.registrar.iastate.edu/courses/div-ip-guide.html>) for a list of approved courses. Discuss with your advisor how the two courses that you select can be applied to your graduation plan.

Climate Science 4-Year Plan

This plan is an example only; students should discuss their graduation plan with their advisor.

Freshman

Fall	Credits Spring	Credits
GEOL 1120	1 GEOL 1130	1
MTEOR 1400	3 MATE 2200	3
GEOL 1000	3 CHEM 1630	4
GEOL 1000L	1 CHEM 1630L	1
STAT 1010	4 MTEOR 2060	3
ENGL 1500	3 Arts and Humanities choice	3
	15	15

Sophomore

Fall	Credits Spring	Credits
ECON 1010	3 GEOL 3240	3
MATH 1600	4 ECON 3800	3
ENGL 2500	3 Arts and Humanities choice	3
LIB 1600	1 Climate Science Pathway choice	3
PHYS 1310	4 U.S. Cultures and Communities choice	3
PHYS 1310L	1	
	16	15

Junior		
Fall	Credits Spring	Credits
MTEOR 4040	3 MTEOR 3600	3
GEOL 4150	3 JLMC 3470	3
Climate Science Pathway choice (3000+)	3 Climate Science Pathway choice (3000+)	3
Arts and Humanities choice	3 Social Science choice	3
Elective (3000+ level)	3 Elective (3000+ level)	3
15		15

Senior		
Fall	Credits Spring	Credits
Climate Science Pathway choice (3000+)	3 Climate Science Pathway choice	3
Elective (3000+ level)	3 Climate Science Capstone Course	2
Arts and Humanities choice	3 Elective (3000+ level)	3
Elective (3000+ level)	3 Elective (3000+ level)	3
World Language 1010 choice/Elective	3-4 World Language 1020 choice/Elective	3-4
15-16		14-15

Total Credits: 120-122

Communication Studies

The Communication Studies Major

comst.las.iastate.edu (<https://comst.las.iastate.edu/>)

The Communication Studies Program focuses on human communication, exploring the ways humans create and negotiate meaning. Communication Studies majors master a focused course of inquiry into interpersonal processes as they create and sustain relationships and impact individuals, groups, and organizations. The Communication Studies curriculum builds primarily on social science traditions in developing a liberal arts education emphasizing human communication. Students in the Communication Studies major study applied communication theory and research in interpersonal, small group, organizational, intercultural, and other contexts.

The Communication Studies (COMST) major teaches students how to think critically, giving them the ability to examine complex communication issues, and develop and implement strategies grounded in evidence-based research. This prepares students for careers in business and industry and graduate education. Students majoring in COMST will find their career opportunities enhanced in professions requiring applied communication expertise, e.g., human resource management, public relations, training and development, sales management, recruitment, event planning, sales, management,

organizational development, business communication, law, and international and intercultural relations.

Student Learning Outcomes

Upon graduation Communication Studies majors will...

- Develop foundational knowledge of human communication.
- Apply human communication strategies in a diverse world.
- Evaluate and utilize evidence-based research.
- Cultivate communication competence.

University-wide Requirements

To meet the University’s Communication Proficiency requirement students are required to take:

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition or ENGL 2500H Written, Oral, Visual, and Electronic Composition: Honors	3
Plus one of the following:		3
ENGL 3020	Business Communication	
ENGL 3090	Proposal and Report Writing	
ENGL 3140	Technical Communication	
ENGL 4150	Business and Technical Editing	

A grade of C or higher is required in ENGL 2500 Written, Oral, Visual, and Electronic Composition (or ENGL 2500H Written, Oral, Visual, and Electronic Composition, Honors).

Total Credits 9

Students in all majors must complete a three-credit course in U.S. Cultures and Communities and a three-credit course in International Perspectives. (COMST 3100 fulfills the international perspective requirement/COMST 2100 and SPCM 3230 fulfill the U.S. Cultures and Communities requirement). Approved courses are listed at: <http://www.registrar.iastate.edu/courses/div-ip-guide.html> (<http://www.registrar.iastate.edu/students/div-ip-guide/>). Discuss with your advisor how the two courses that you select can be applied to your graduation plan.

LAS College Requirements

As majors in the College of Liberal Arts and Sciences, Communication Studies students must meet College of Liberal Arts and Sciences and University-wide requirements for graduation in addition to those stated above for the major.

LAS majors require a minimum of 120 credits, including a minimum of 45 credits at the 3000/4000 level. Students must also complete the LAS world language requirement, career proficiency requirement and LAS general education requirements. In accordance with college

requirements, an overall average in Communication Studies courses of C (2.0) or better is required. This means students need a 2.0 GPA in the 33 hours taken to fulfill the major requirements in Communication Studies.

The Communication Studies Major

Communication Studies majors must earn at least 120 credits, with 45 credits at the 3000-4000 levels, and a minimum of 33 credits in COMST.

Core Requirements (15 credits)

COMST 1010	Introduction to Communication Studies	3
COMST 2110	Interpersonal Communication	3
COMST 3010	Communication Theories	3
COMST 3030	Introduction to Communication Research Methods	3
Plus one of the following:		3
COMST 2140	Professional Communication	
COMST 2180	Communication and Conflict Management	
COMST 2100	Communication and U.S. Diversity	
SPCM 2120	Fundamentals of Public Speaking	
Total Credits		15

Upper Division Requirements (15 credits). Select five courses from the following

COMST 3100	Intercultural Communication	3
COMST 3110	Relational Communication	3
COMST 3130	Leadership Communication Theories	3
COMST 3140	Organizational Communication	3
COMST 3170	Small Group Communication	3
COMST 3190	Communication Training and Development	3
COMST 3250	Nonverbal Communication	3
COMST 3270	Persuasion and Social Influence	3
COMST 3300	Communication in a Digital World	3
SPCM 3230	Gender and Communication	3
COMST 4110X	Family Communication Dynamics	3
COMST 4120	Health Communication	3
COMST 4500A	Special Topics in Communication Studies: General	3
Total Credits		15

Capstone Course Requirement (3 credits)

COMST 4040	Research Seminar	3

Additional Recommended Course

STAT 1010	Principles of Statistics	4

Communication Studies, B.A.

Freshman

Fall	Credits Spring	Credits
ENGL 1500	3 Elective	3
COMST 1010	3 Social Science Choice	3
Humanities Choice	3 Humanities Choice	3
LIB 1600	1 International Perspectives Course	3
Natural Science Choice	3 COMST 2110	3
COMST 1040	1	
14		15

Sophomore

Fall	Credits Spring	Credits
World Language/Elective	3-4 World Language/Elective	3-4
ENGL 2500	3 Elective	3
Humanities Choice	3 Math Choice (STAT 1010 recommended)	3-4
Social Science Choice	3 COMST 3030	3
COMST 2100, 2140, 2180, or SPCM 2120	3 Natural Science Choice	2-3
	LAS 2030	1
15-16		15-18

Junior

Fall	Credits Spring	Credits
COMST 3010	3 Upper Division Comm. Requirement	3
U.S. Cultures and Communities Choice	3 Upper Division Comm. Requirement	3
Natural Science Choice	3 Humanities Choice	3
Elective 3000+	3 Elective - 3000+	3
Social Science Choice	3 Elective - 3000+	3
15		15

Senior

Fall	Credits Spring	Credits
Upper Division Comm Requirement	3 COMST 4040	3
Upper Division Comm Requirement	3 Upper Division Comm Requirement	3
Any Elective	4 Verbal Comm--ENGL 3020, 3090, or 3140	3
Electives 3000+	3 Elective 3000+	3

Elective 3000+	3 Elective 3000+	3
	16	15

Total Credits: 120-124

The Communication Studies Minor (18 credits)

The requirements for a minor in COMST may be fulfilled by credit in:

COMST 1010	Introduction to Communication Studies	3
COMST 3010	Communication Theories	3
Select one (1) 2000-Level course:		3
COMST 2100	Communication and U.S. Diversity	
COMST 2110	Interpersonal Communication	
COMST 2140	Professional Communication	
COMST 2180	Communication and Conflict Management	
Plus 3 3000-level courses, (9) credits from the following:		9
COMST 3100	Intercultural Communication	
COMST 3110	Relational Communication	
COMST 3130	Leadership Communication Theories	
COMST 3140	Organizational Communication	
COMST 3170	Small Group Communication	
COMST 3190	Communication Training and Development	
COMST 3250	Nonverbal Communication	
COMST 3270	Persuasion and Social Influence	
COMST 3300	Communication in a Digital World	
COMST 4110X	Family Communication Dynamics	
COMST 4120	Health Communication	
COMST 4500A	Special Topics in Communication Studies: General	

Students must earn an overall average of C (2.0) or better in all courses taken for the minor.

The minor must include at least 3 credits that are not used to meet any other department, college, or university requirement.

Total Credits 18

The Communication Studies Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

Computer Science Overview

<http://www.cs.iastate.edu>

The department of Computer Science offers Bachelor of Science and Bachelor of Arts degrees in Computer Science in the College of Liberal Arts and Sciences.

The undergraduate curriculum in Computer Science leading to the Bachelor of Science degree is accredited by the Computing Accreditation Commission of ABET, <http://www.abet.org>. This degree equips students with a sound knowledge of the foundations of Computer Science as well as problem-solving and system design skills necessary to create robust, efficient, reliable, scalable, and flexible software systems. The B.S. degree in Computer Science prepares students for graduate study in Computer Science and for various business, industry, and government positions including computer scientists, information technologists, and software developers.

The purpose of the Bachelor of Arts degree in Computer Science is to accommodate students who wish to pursue a major in Computer Science while taking more courses outside of the major than a Bachelor of Science degree program permits. This will include students pursuing double majors, students pursuing one or more strong minors, and students pursuing broader liberal educations. The B.A. program retains the rigor of our B.S. program while allowing students to spread the breadth of their education over other disciplines in addition to Computer Science.

The main educational objectives of the B.S. degree program in Computer Science at Iowa State University are that its graduates demonstrate expertise, engagement, and learning within two to five years after graduation.

- **Expertise:** Graduated students should have the ability to establish peer-recognized expertise in the discipline. They should have the ability to articulate this expertise by formulating and solving problems of interest, by creating or deriving value through the application of technology, and by using mathematical foundations, algorithmic principles, and computer science theory in designing, implementing and evaluating computer-based systems and processes which meet the desired needs of their employers.
- **Engagement:** Graduated students should have the ability to be engaged in the profession through the practice of computer science in industry, academia, or the public sector. They should demonstrate effective teaming and commitment to working with others by applying communications skills and professional knowledge.
- **Learning:** Graduated students should have the ability to engage in sustained learning through graduate work, professional improvement opportunities, and self-study so that they can adapt to the role played by information processing in ever-changing areas of science, technology, and society.

Student Learning Outcomes

Upon graduation, students should have:

1. An ability to analyze a complex computing problem, and to apply principles of computing and other relevant disciplines to identify solutions.
2. An ability to design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.
3. An ability to communicate effectively in a variety of professional contexts.
4. An ability to recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.
5. An ability to function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.
6. An ability to apply computer science theory and software development fundamentals to produce computing-based solutions.

Undergraduate Curriculum in Software Engineering

The Department of Computer Science, together with the Department of Electrical and Computer Engineering, also offer a curriculum leading to an undergraduate degree in Software Engineering. The Software Engineering curriculum offers emphasis areas in Software Engineering principles, process, and practice. Students may also take elective courses in Computer Engineering and Computer Science.

Degree Requirements

As majors in the College of Liberal Arts and Sciences, students pursuing both the B.A. and the B.S. in Computer Science must meet College of Liberal Arts and Sciences and University-wide requirements for graduation in addition to those stated below for the major.

LAS majors require a minimum of 120 credits, including a minimum of 45 credits at the 3000/4000 level. You must also complete the LAS world language requirement and career proficiency requirement.

Students in all ISU majors must complete a three-credit course in U.S. Cultures and Communities and a three-credit course in International Perspectives. Check (<http://www.registrar.iastate.edu/courses/div-ip-guide.html>) for a list of approved courses. Discuss with your advisor how the two courses that you select can be applied to your graduation plan.

Degree requirements for the B.S. in Computer Science:

The B.S. departmental requirements consist of a minimum of 49 credits in Computer Science and satisfaction of written and oral requirements. The following courses are required:

COMS 1010	Orientation	R
COMS 1270	Introduction to Computer Programming	3
COMS 2270	Object-oriented Programming	4
COMS 2280	Introduction to Data Structures	3

COMS 3090	Software Development Practices	3
COMS 3110	Introduction to the Design and Analysis of Algorithms	3
COMS 3210	Introduction to Computer Architecture and Machine-Level Programming	3
COMS 3270	Advanced Programming Techniques	3
COMS 3310	Theory of Computing	3
COMS 3420	Principles of Programming Languages	3
COMS 3520	Introduction to Operating Systems	3
COMS 4020		
At least 15 credits, including at least 6 credits of 4000-level courses, all with a grade of C- or better, from the following:		15
COMS 3190	Construction of User Interfaces	
COMS 3360	Introduction to Computer Graphics	
COMS 3620	Object-Oriented Analysis and Design	
COMS 3630	Introduction to Database Management Systems	
COMS 4070	Applied Formal Methods	
COMS 4090	Software Requirements Engineering	
COMS 4100	Distributed Development of Software	
COMS 4120	Formal Methods in Software Engineering	
COMS 4130	Program Analysis	
COMS 4150	Software System Safety	
COMS 4170	Software Testing	
COMS 4180	Introduction to Computational Geometry	
COMS 4190X	Trustworthy Healthcare Software	
MATH 4210	Logic for Mathematics and Computer Science	
COMS 4240	Introduction to High Performance Computing	
COMS 4250	High Performance Computing for Scientific and Engineering Applications	
COMS 4260	Introduction to Parallel Algorithms and Programming	
COMS 4300	Concurrent Programming in Practice	
COMS 4330	Molecular Programming of Nanoscale Devices and Processes	
COMS 4340	Quantum Information and Complexity	
COMS 4350	Algorithms for Large Data Sets: Theory and Practice	
COMS 4370	Computer Game and Media Programming	
COMS 4400	Principles and Practice of Compiling	
COMS 4410	Programming Languages	
COMS 4530	Privacy Preserving Algorithms and Data Security	
COMS 4540	Fundamentals of Remote Sensing and Spatial Analysis	

COMS 4550	Simulation: Algorithms and Implementation	
COMS 4590X	Security and Privacy in Cloud Computing	
COMS 4610	Principles and Internals of Database Systems	
COMS 4630X	Healthcare Data Privacy, Security and Confidentiality: Principles and Algorithms	
COMS 4640X	AI for Healthcare	
COMS 4720	Principles of Artificial Intelligence	
COMS 4740	Introduction to Machine Learning	
COMS 4760	Motion Planning for Robotics and Autonomous Systems	
COMS 4770	Foundations of Robotics and Computer Vision	
COMS 4810	Numerical Methods for Differential Equations	
COMS 4870	Introduction to Network Programming and Cloud Computing	
COMS 4880	Computer Networks	
CPRE 4160	Software Evolution and Maintenance	
CPRE 4190	Software Tools for Large Scale Data Analysis	
CPRE 4300	Network Protocols and Security	
CPRE 4310	Basics of Information System Security	
CPRE 4580	Real Time Systems	
CPRE 4890	Computer Networking and Data Communications	
SE 4220	Cloud Computing - Software Development	

Total Credits **46**

COMS 4140 **may not** be applied towards fulfilling the 4000-level electives.

Toward satisfying the requirements of the College of Liberal Arts and Sciences, the following courses should be included:

PHIL 3430	Philosophy of Technology	3
SPCM 2120	Fundamentals of Public Speaking	3
LAS 2030	Professional Career Preparation	1
At least 17 credits of Math and Statistics		17
MATH 1650	Calculus I	4
MATH 1660	Calculus II	4
COMS 2300	Discrete Computational Structures	3
One Statistics course from:		
STAT 3050	Engineering Statistics	3
STAT 3300	Probability and Statistics for Computer Science	3
STAT 3410	Introduction to the Theory of Probability and Statistics I	4
STAT 3470	Probability and Statistical Theory for Data Science	4
At least one Math course from:		
MATH 2070	Matrices and Linear Algebra	3
MATH 2650	Calculus III	4

MATH 2660	Elementary Differential Equations	3
MATH 2670	Elementary Differential Equations and Laplace Transforms	4
MATH 3040	Combinatorics	3
MATH 3140	Graph Theory	3
MATH 3170	Theory of Linear Algebra	4

One of the following 2-course Natural Science sequences (with labs):

BIOL 2110 & 2110L	Principles of Biology I and Principles of Biology Laboratory I	8
& BIOL 2120 & BIOL 2120L	and Principles of Biology II and Principles of Biology Laboratory II	

Or

BIOL 2550 & 2550L	Fundamentals of Human Anatomy and Fundamentals of Human Anatomy Laboratory	8
& BIOL 2560 & BIOL 2560L	and Fundamentals of Human Physiology and Fundamentals of Human Physiology Laboratory	

Or

CHEM 1770 & 1770L	General Chemistry I and Laboratory in General Chemistry I	9
& CHEM 1780 & CHEM 1780L	and General Chemistry II and Laboratory in College Chemistry II	

Or

GEOL 1000 & 1000L	How the Earth Works and How the Earth Works: Laboratory	8
& GEOL 2020 & GEOL 2020L	and History of the Earth and History of the Earth: Laboratory	

Or

PHYS 2310 & 2310L	Introduction to Classical Physics I and Introduction to Classical Physics I Laboratory	10
& PHYS 2320 & PHYS 2320L	and Introduction to Classical Physics II and Introduction to Classical Physics II Laboratory	

The following courses meet the communication proficiency requirement:

LIB 1600	Introduction to College Level Research	1
ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
One of the following		
ENGL 3020	Business Communication	3
ENGL 3050	Creative Writing: Nonfiction	3
ENGL 3090	Proposal and Report Writing	3
ENGL 3140	Technical Communication	3

Degree requirements for the B.A. in Computer Science:

The B.A. departmental requirements consist of a minimum of 31 credits in Computer Science and satisfaction of written and oral requirements.

The following courses are required:

Computer Science core:

COMS 1010	Orientation	R
COMS 1270	Introduction to Computer Programming	3
COMS 2270	Object-oriented Programming	4
COMS 2280	Introduction to Data Structures	3
COMS 3090	Software Development Practices	3
COMS 3110	Introduction to the Design and Analysis of Algorithms	3

Advanced Computer Science, five 3000/4000-level courses chosen from lists (a) and (b) below, with at least one at the 4000-level and at least two chosen from list (a). COMS 4140 may not be applied towards fulfilling the 4000-level electives.

(a) Software and Hardware Systems:

COMS 3210	Introduction to Computer Architecture and Machine-Level Programming
COMS 3270	Advanced Programming Techniques
COMS 3420	Principles of Programming Languages
COMS 3520	Introduction to Operating Systems
COMS 3620	Object-Oriented Analysis and Design
COMS 3630	Introduction to Database Management Systems
COMS 4090	Software Requirements Engineering
COMS 4100	Distributed Development of Software
COMS 4120	Formal Methods in Software Engineering
COMS 4130	Program Analysis
COMS 4150	Software System Safety
COMS 4170	Software Testing
COMS 4400	Principles and Practice of Compiling
COMS 4410	Programming Languages
COMS 4540	Fundamentals of Remote Sensing and Spatial Analysis
COMS 4870	Introduction to Network Programming and Cloud Computing
COMS 4880	Computer Networks

(b) Other Advanced Computer Science:

COMS 3190	Construction of User Interfaces
COMS 3310	Theory of Computing
COMS 3360	Introduction to Computer Graphics
COMS 3500	Number Theory

COMS 4070	Applied Formal Methods
COMS 4180	Introduction to Computational Geometry
COMS 4190X	Trustworthy Healthcare Software
MATH 4210	Logic for Mathematics and Computer Science
COMS 4240	Introduction to High Performance Computing
COMS 4250	High Performance Computing for Scientific and Engineering Applications
COMS 4260	Introduction to Parallel Algorithms and Programming
COMS 4300	Concurrent Programming in Practice
COMS 4330	Molecular Programming of Nanoscale Devices and Processes
COMS 4340	Quantum Information and Complexity
COMS 4350	Algorithms for Large Data Sets: Theory and Practice
COMS 4370	Computer Game and Media Programming
COMS 4530	Privacy Preserving Algorithms and Data Security
COMS 4550	Simulation: Algorithms and Implementation
COMS 4590X	Security and Privacy in Cloud Computing
COMS 4610	Principles and Internals of Database Systems
COMS 4630X	Healthcare Data Privacy, Security and Confidentiality: Principles and Algorithms
COMS 4640X	AI for Healthcare
COMS 4720	Principles of Artificial Intelligence
COMS 4740	Introduction to Machine Learning
COMS 4760	Motion Planning for Robotics and Autonomous Systems
COMS 4770	Foundations of Robotics and Computer Vision
COMS 4810	Numerical Methods for Differential Equations

Total Credits **31**

Toward satisfying the requirements of the College of Liberal Arts and Sciences, the following courses should be included:

Mathematics Core (3 courses):

MATH 1650	Calculus I
MATH 1660	Calculus II
COMS 2300	Discrete Computational Structures

Additional Mathematics (1 course from the following):

COMS 3310	Theory of Computing
MATH 2070	Matrices and Linear Algebra
MATH 2650	Calculus III
MATH 2660	Elementary Differential Equations

MATH 2670	Elementary Differential Equations and Laplace Transforms	
MATH 3040	Combinatorics	
MATH 3140	Graph Theory	
MATH 3170	Theory of Linear Algebra	
Statistics (1 course from the following):		
STAT 3050	Engineering Statistics	
STAT 3300	Probability and Statistics for Computer Science	
STAT 3410	Introduction to the Theory of Probability and Statistics I	
STAT 3470	Probability and Statistical Theory for Data Science	
SPCM 2120	Fundamentals of Public Speaking	3
Natural Sciences: minimum 8 credits from approved College list		

The following courses meet the communication proficiency requirement:

LIB 1600	Introduction to College Level Research	1
ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
One of the following		
ENGL 3020	Business Communication	3
ENGL 3050	Creative Writing: Nonfiction	3
ENGL 3090	Proposal and Report Writing	3
ENGL 3140	Technical Communication	3

The following pertains to both the B.S. and the B.A. in Computer Science:

Students must earn at least a C- in MATH 1650, MATH 1660, and each Computer Science course taken to fulfill the Degree Program. The LAS College requires the major must contain at least 8 credits in courses taken at Iowa State University that are numbered 3000 or above and in which the student’s grade is C or higher.

According to the university-wide Communication Proficiency Grade Requirement, students must demonstrate their communication proficiency by earning a grade of C or better in ENGL 2500. The Department requires a C or higher in the upper-level ENGL course (3020, 3050, 3090, 3140).

To obtain a bachelor’s degree from the College of Liberal Arts and Sciences, curriculum in liberal arts and sciences, a student must earn at least 45 credits at the 3000 level or above taken at a four-year college. All such credits, including courses taken on a pass/not pass basis, may be used to meet this requirement.

Students must take at least 15 credits of Computer Science courses at the 3000 level or higher at Iowa State University while resident here. Computer Science transfer courses need to be a minimum grade of C or higher to be considered for course substitution.

**Four Year Plan
Computer Science, B.S.**

Freshman			
Fall	Credits	Spring	Credits
COMS 1010		R COMS 2270	4
COMS 1270		3 MATH 1660	4
MATH 1650		4 ENGL 2500	3
ENGL 1500		3 LIB 1600	1
SOCIAL SCIENCE		3 ARTS & HUMANITIES	3
		13	15
Sophomore			
Fall	Credits	Spring	Credits
COMS 2280		3 COMS 3210	3
COMS 2300		3 COMS 3110	3
SCIENCE SEQUENCE PART 1		4 COMS 3000/4000 ELECTIVE	3
SOCIAL SCIENCE		3 SCIENCE SEQUENCE PART 2	4
WORLD LANGUAGE 1010/ ELECTIVE		3-4 WORLD LANGUAGE 1020/ ELECTIVE	3-4
LAS 2030		1	
		17-18	16-17
Junior			
Fall	Credits	Spring	Credits
COMS 3090		3 COMS 3270	3
COMS 3000/4000 ELECTIVE		3 COMS 3310	3
MATH ELECTIVE		3 STAT 3000 ELECTIVE	3
SPCM 2120		3 ENGL 3000 ELECTIVE	3
ARTS & HUMANITIES		3 PHIL 3430	3
		15	15
Senior			
Fall	Credits	Spring	Credits
COMS 3420		3 COMS 3520	3
COMS 3000/4000 ELECTIVE		3 COMS 4020	2-3
COMS 4000 ELECTIVE		3 COMS 4000 ELECTIVE	3
SOCIAL SCIENCE & USCC/IP		3 ARTS & HUMANITIES & USCC/IP	3
ELECTIVE		2-3 ELECTIVE	3
		14-15	14-15
Total Credits: 119-123			

Computer Science, B.A.

Freshman

Fall	Credits Spring	Credits
COMS 1010	R COMS 2270	4
COMS 1270	3 MATH 1660	4
MATH 1650	4 ENGL 2500	3
ENGL 1500	3 Arts and Humanities	3
Social Science	3 LIB 1600	1
13		15

Sophomore

Fall	Credits Spring	Credits
COMS 2280	3 COMS 3110	3
COMS 2300	3 Arts and Humanities	3
Natural Science 1	4 Natural Science 2	4
Elective	3 Elective	3
World Languages 1	3-4 World Languages 2	3-4
LAS 2030	1	
17-18		16-17

Junior

Fall	Credits Spring	Credits
COMS 3090	3 COMS 3000/4000-level Elective	3
MATH Elective	3-4 ENGL 3000-level Elective	3
SPCM 2120	3 Elective	3
Arts and Humanities	3 STAT 3000-level Elective	3
Elective	3 Social Science	3
15-16		15

Senior

Fall	Credits Spring	Credits
COMS 3000/4000-level Elective	3 COMS 3000/4000-level Elective	3
COMS 3000/4000-level Elective	3 COMS 3000/4000-level Elective	3
Social Science and USCC/IP	3 Arts and Humanities and USCC/IP	3
Elective	3 Elective	3
Elective	2-3 Elective	3
14-15		15

Total Credits: 120-124

Note: The B.A. in Computer Science, like other B.A. degrees in LAS, gives students more freedom than the B.S. to design their own curricula. However, LAS degree requirements impose some rigor on this freedom. For example, the B.A. requires 24 upper-level credits in Computer Science,

Mathematics, and Statistics, but LAS requires at least 45 upper-level credits, so a substantial fraction of B.A. students' extra freedom will be confined to upper-level courses.

Undergraduate Minor in Computer Science

The Department of Computer Science offers an undergraduate minor in Computer Science. The minor requires at least 16 credits in computer science courses. COMS 4140 cannot be used to fulfill minor requirements.

A minimum grade of C- is required in COMS 2270 and COMS 2280. A minimum grade of C is required in both COMS 3110 and the three credits of 3000-level Computer Science courses and above. Students must meet all prerequisites for Computer Science courses taken to fulfill the minor. At least 6 credits of the minor must be in courses numbered 3000 and above with a grade of C or higher and 3 credits must be completed at ISU. The minor must include at least 3 credits that are not used to meet any other department, college, or university requirement.

COMS 2270	Object-oriented Programming	4
COMS 2280	Introduction to Data Structures	3
COMS 2300	Discrete Computational Structures	3
COMS 3110	Introduction to the Design and Analysis of Algorithms	3
3 credits in COMS courses at the 3000 level or above		3

The Computer Science Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

Certificate in Computing Applications

Students interested in the computing applications, may want to explore the Certificate in Computing Applications; it is a cross-disciplinary course of study in the Colleges of Liberal Arts and Sciences, Engineering, and Business.

Concurrent Bachelors and Masters Degrees

The Computer Science Department offers the following concurrent B.S./M.S. degree programs:

B.S./M.S. in Computer Science

B.S. in Computer Science /M.S. in Artificial Intelligence

B.S. in Software Engineering /M.S. in Computer Science

B.S. in Software Engineering /M.S. in Artificial Intelligence

These concurrent B.S./M.S. degrees offer highly motivated and focused students the opportunity for accelerated study. Students will be allowed

to double count up to 12 credits. This program will pair undergraduate students in the concurrent program with research teams of graduate students and dedicated faculty members prominent in their fields of expertise. Students who declare concurrent enrollment will be considered graduate-level students, and therefore eligible for graduate research assistantships and scholarships. Click here for application instructions (<https://www.cs.iastate.edu/concurrent-bsms-computer-science/>).

More information can be found here: <https://www.cs.iastate.edu/cs.iastate.edu/concurrent-comajor-transfer>. (<https://www.cs.iastate.edu/cs.iastate.edu/concurrent-comajor-transfer/>)

Graduate Programs

The department offers graduate programs leading to degrees of Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) with a major in Computer Science. The Doctor of Philosophy degree may also be earned with computer science as a co-major with some other discipline. Additionally, the department offers a Master of Science (M.S.) in Artificial Intelligence. This program is for graduate-level students with strong quantitative backgrounds who are interested in learning AI and machine-learning techniques. The department also offers graduate minors in both Computer Science and Artificial Intelligence for students majoring in other disciplines.

Established research areas include algorithms, artificial intelligence, computational complexity, computer architecture, bioinformatics, computational biology, computer networks, database systems, formal methods, information assurance, machine learning and neural networks, multimedia, operating systems, parallel and distributed computing, programming languages, robotics, and software engineering. There are also numerous opportunities for interdisciplinary research.

Typically, students beginning graduate work in the Department of Computer Science have completed a bachelor's degree or equivalent in Computer Science. However, some students with undergraduate majors in other areas, such as mathematical, physical, or biological science or engineering become successful graduate students in Computer Science.

For the degree Master of Science, 31 - 34 semester credits are required. A thesis or a creative component demonstrating research and the ability to organize and express significant ideas in computer science is required.

The purpose of the doctoral program is to train students to do original research in Computer Science. Each student is also required to attain knowledge and proficiency commensurate with a leadership role in the field. The Ph.D. requirements are governed by the student's program of study committee within established guidelines of the department and the graduate college. They include coursework (demonstrating breadth and depth of knowledge), a research skills requirement, a preliminary examination, and a doctoral dissertation and final oral examination.

The department recommends that all graduate students majoring in Computer Science teach as part of their training for an advanced degree.

Computing Applications Certificate

The Certificate in Computing Applications is a cross-disciplinary course of study in the Colleges of Liberal Arts and Sciences, Engineering, and Business. It is designed for undergraduates not already enrolled in majors in Computer Science, Software Engineering, or Computer Engineering who wish to enhance their degree and employment possibilities by adding expertise in computing applications. The certificate program focuses on teaching students the essential skills required to develop and use computing applications in their subject domains. This certificate program will help students to be successful in today's workplace, ensuring they have the basic knowledge of programming languages and computer systems needed to enhance their employment opportunities.

The certificate program is offered jointly among the three colleges and their respective departments housing the majors of computer science, computer engineering, software engineering, and management information systems.

The program consists of 9 credit hours selected from the core and 12 credit hours in electives.

The program consists of 9 credit hours selected from the core and 12 credit hours in electives.

Part I - Core 9-10 Credits

Students will complete either Sequence 1 or Sequence 2		
SEQUENCE 1		9-10 Credits
COMS 1070	Windows Application Programming	3
or COMS 1270 Introduction to Computer Programming		
or COMS 2070 Fundamentals of Computer Programming		
COMS 1060	Introduction to Web Programming	3
or COMS 1130 Introduction to Spreadsheets and Databases		
COMS 2520	Linux Operating System Essentials	3
or DS 2010 Introduction to Data Science		
SEQUENCE 2		10 Credits
COMS 2270	Object-oriented Programming	4
COMS 2280	Introduction to Data Structures	3
COMS 2520	Linux Operating System Essentials	3
or DS 2010 Introduction to Data Science		

Part II - Electives

12 Credits

Designated Electives for the Certificate

Students will choose one elective course from the following list of courses and are responsible for satisfying the course pre-requisites of the elective selected.

- CPRE 2300 Cyber Security Fundamentals
- BCBIO 3220 Introduction to Bioinformatics and Computational Biology
- LA 2110 Digital Design Methods for Landscape Architecture
- CRP 2510 Fundamentals of Geographic Information Systems
- STAT 3010 Intermediate Statistical Concepts and Methods
- PSYCH 3010 Research Design and Methodology
- SOC 3020 Research Methods for the Social Sciences
- ECON 2070 Applied Economic Optimization
- Any course at 3000 level or above in Computer Science (COMS), Computer Engineering (CPRE), Management Information Systems (MIS), or Software Engineering (SE)

The remaining 9 credits of electives are intended to allow students to develop further computing applications expertise especially within their major. These 9 elective credits can be advanced courses in their major, courses on the above electives list, or any other coursework approved by the Computer Science Advisor on the "request for undergraduate certificate." At least 9 of the 12 elective credits must be in courses numbered 3000 or above and taken at Iowa State University.

The Computer Applications Certificate is an LAS Certificate and must meet University-wide policies for undergraduate certificates.

Criminal Justice

The Criminal Justice program in the College of Liberal Arts and Sciences offers a Bachelor of Arts degree and a minor in Criminal Justice.

Your adventure begins with your academic advisor. Please contact cjsocadvising@iastate.edu for more information.

Students in this major will learn about the components of the juvenile and criminal justice systems, become acquainted with the issues affecting these systems, apply theoretical concepts to real-world phenomena, interface with criminal justice and social service providers, and plan an academic and/or applied career in criminal justice.

Student Learning Outcomes

Graduates of this program will:

- Understand theories of crime, victimization, and criminal justice (i.e., theories about social bonds, learning, social control, conflict, labeling, rehabilitation, alternatives to incarceration).

- Think critically about crime, victimization, and criminal justice (i.e., be able to apply, critique, compare, and integrate knowledge in the area).
- Understand how race/ethnicity, gender, wealth, and power are related to crime, victimization, and criminal justice.
- Understand and be able to use basic social science research methods, as well as those most relevant to the study of crime, victimization, and criminal justice.
- Be familiar with career paths in the criminal justice system and make career choices that best fit their career interests.
- Make appropriate decisions, think creatively and be able to express themselves in written and oral communication to supervisors and clients.

Degree Requirements

University Requirements

International Perspectives	3
U.S. Cultures and Communities	3
Total Credits	6

Communication Proficiency

According to the university-wide Communication Proficiency Grade Requirement, students must demonstrate their communication proficiency by earning a grade of C or better in ENGL 1500 and ENGL 2500. In addition, majors must also take an advanced course in ENGL 3020 or ENGL 3090 or ENGL 3140 with a grade of C or better.

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
LIB 1600	Introduction to College Level Research	1
ENGL 3020	Business Communication	3
or ENGL 3090	Proposal and Report Writing	
or ENGL 3140	Technical Communication	
Total Credits		10

World Language and career proficiency

3 years of High School

SPAN 1970X	Accelerated Elementary Spanish	4
2 semesters at the college level		8
LAS 2030	Professional Career Preparation	1
Total Credits		13

General Education Coursework

Students must select from a variety of LAS approved general education courses in each area listed below. A full list of approved courses can be found at <https://las.iastate.edu/students/academics/general-education/>.

Arts and Humanities	12
Math	3

Natural Sciences	8
Social Sciences	9
Total Credits	32

Program of Study

A program of study that meets the needs and interests of the student and departmental requirements will be developed in consultation with the major advisor. Students must maintain a GPA of 2.0 or higher in their core courses.

SOC 1150	Orientation to Sociology	1
or CJ 1200	The Criminal Justice League Learning Community Seminar	
CJ 2400	Introduction to the U.S. Criminal Justice System	3
CJ 2410	Youth and Crime	3
CJ 2420	Criminology	3
CJ 3400	Deviant and Criminal Behavior	3
CJ 4020	White-Collar Crime	3
or CJ 4030	Criminal Offenders	
or CJ 4060	Gender and Crime	
CJ 4600	Criminal and Juvenile Justice Internship	3
Select one of the following courses		3
CJ 3200	American Judicial Process	
CJ 3320	Philosophy of Law	
PHIL 3390	Liberty and Law in America	
CJ 4040	Criminal Justice Policies	
PSYCH 3830	Psychology and Law	
Select 5 of the following courses		15
CJ 3200	American Judicial Process	
CJ 3320	Philosophy of Law	
CJ 3350	Race, Ethnicity, and the US Criminal Justice System	
PHIL 3390	Liberty and Law in America	
CJ 3510	Police and Society	
CJ 3520	Punishment, Corrections, and Society	
CJ 3540	Prevention of Crime and Delinquency	
CJ 3600	Latinas and Victimization	
CJ 4020	White-Collar Crime	
CJ 4040	Criminal Justice Policies	
CJ 4050	Drugs and Crime	
CJ 4060	Gender and Crime	
CJ 4100	Capital Punishment	
CJ 4510	Contemporary Issues in Policing	
CJ 4700	Ethical Issues in Criminal Justice	

CJ 4840	Topical Studies in Criminal and Juvenile Justice
PSYCH 3830	Psychology and Law
Total Credits	37

LAS majors require a minimum of 120 credits, **including a minimum of 45 credits at the 3000/4000 level**. You must also complete the LAS world language requirement and career proficiency requirement.

As majors in the College of Liberal Arts and Sciences, Criminal Justice students must meet College of Liberal Arts and Sciences and University-wide requirements for graduation in addition to those stated above for the major.

Students in all ISU majors must complete a three-credit course in U.S. Cultures and Communities and a three-credit course in International Perspectives. Check (<http://www.registrar.iastate.edu/courses/div-ip-guide.html>) for a list of approved courses. Discuss with your advisor how the two courses that you select can be applied to your graduation plan.

Criminal Justice, B.A.

Freshman

Fall	Credits Spring	Credits
SOC 1150 or CJ 1200	1 CJ 1210	1
CJ 2400	3 CJ 2410	3
ENGL 1500	3 ENGL 2500	3
LIB 1600	1 Arts and Humanities Choice	3
Social Science Choice	3 Social Science Choice	3
Arts and Humanities Choice	3 Natural Science Choice	3
	14	16

Sophomore

Fall	Credits Spring	Credits
CJ 3400	3 CJ 2420	3
World Languages/Elective	3-4 World Languages/Elective	3-4
Arts and Humanities Choice	3 Math Choice	3
Natural Science Choice	3 International Perspectives	3
Elective	3 Elective	3
LAS 2030	1	
	16-17	15-16

Junior

Fall	Credits Spring	Credits
CJ 4020, 4030, or 4060	3 Criminal Justice Special Topics	3
Criminal Justice Special Topics	3 Criminal Justice Special Topics	3
ENGL 3020, 3090, or 3140	3 Arts and Humanities Choice	3
Social Science Choice	3 Natural Science Choice	2

Elective	3 Elective	3
	15	14
Senior		
Fall	Credits Spring	Credits
CJ 3200, 3320, PHIL 3390, or PSYCH 3830	3 CJ 4600	3
Criminal Justice Special Topics	3 Criminal Justice Special Topics	3
U.S. Cultures and Communities	3 Elective	3
Elective	3 Elective	3
Elective	3 Elective	3
	15	15

Total Credits: 120-122

Special Topics choices: CJ 3200/POLS 3200; CJ 3320/PHIL 3320, PHIL 3390; CJ 3350, CJ 3510, CJ 3520, CJ 3540, CJ 3600, CJ 4020, CJ 4040, CJ 4050, CJ 4060, CJ 4100, CJ 4510, CJ 4700, CJ 4840*; and PSYCH 3830.

*May take up to 9 credits of CJ 4840 special topics.

Note: This is an example four-year plan. Your actual semester schedules may vary.

Criminal Justice Minor

The Criminal Justice minor offers an opportunity for students to learn about the components of the criminal and juvenile justice systems, to become acquainted with the issues and problems affecting these systems, to apply theoretical concepts to real world problems, and to plan a career in the criminal justice field.

Students who declare a minor in Criminal Justice are required to complete 18 total credits. Students may do up to nine credits of SOC 4600 but only three of those credits may be applied to the minor. Nine credits must be at the 3000 or 4000 level. The minor must include at least 3 credits that are not used to meet any other department, college, or university requirement. Students must have a minimum grade point average of 2.0 in courses for the minor.

CJ 2400	Introduction to the U.S. Criminal Justice System	3
CJ 4600	Criminal and Juvenile Justice Internship	3
Four additional C J courses		12
Total Credits		18

The Criminal Justice Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

Data Science Overview

Data Science is a rapidly growing academic discipline fueled by the proliferation of rich and complex data emerging from activities in science, industry, and governments. As a result, there is strong demand for data science professionals today in Iowa as well as across the nation and globe, and this market is expected to continue to grow in the next decade. The data science programs are intended for students who wish to study the data science discipline for its own sake as well as for students studying any discipline at Iowa State University with the goal of enabling them to work in data science. The courses in the data science program are designed to provide students with the requisite background that would enable them to take jobs with significant data science components, e.g., establishing and operating data analysis pipelines. The capstone will provide an opportunity for students to apply data science concepts to a domain problem while working in a multi-disciplinary team setting.

The Data Science major is intended for students with strong quantitative backgrounds and has the goal of educating students on the technical fundamentals of Data Science, with a focus on developing the knowledge and skills needed to transform data into insights. The major is an excellent opportunity for individuals who want to prepare themselves for the exciting Data Scientist positions that are in high demand today.

The Data Science minor is intended for students studying any discipline at Iowa State and is designed to give students an in-depth understanding of data science as it is applied to a variety of domains.

The Data Science certificate is intended for current Iowa State students or anybody who has already earned baccalaureate degree. The program is designed to prepare students for future work with significant Data Science components. The capstone will provide an opportunity for students to apply data science concepts to a domain problem while working in a multi-disciplinary team setting.

Student Learning Outcomes for Data Science Major

After successfully completing the program, students majoring in Data Science will demonstrate:

1. An understanding of and an ability to apply the following data science concepts, tools and methods to data analysis pipelines:
 - a. data acquisition
 - b. data preprocessing
 - c. exploratory data analysis
 - d. inferential and predictive thinking, modeling and analysis
 - e. computational thinking, data structures, and algorithms

- 2. An understanding of ethical, legal, societal, and economic concerns in the application of data science concepts.
- 3. An ability to visualize, interpret and communicate the output of data analysis pipelines to stakeholders.
- 4. An ability to function on multi-disciplinary teams using concepts and tools from data science.

See Undergraduate Minor and Undergraduate Certificate subpages for the respective learning outcomes.

Data Science Major Purpose

The Bachelor of Science degree program in Data Science is intended for students with strong quantitative backgrounds and has the goal of educating students on the technical fundamentals of data sciences, with a focus on developing the knowledge and skills needed to manage and analyze large-scale, heterogeneous data to address a wide range of problems.

Requirements

The B.S. in Data Science consists of 120 total credit hours including: (1) 39 credit hours in the major core, three credits of which constitute a capstone course that is expected to provide experiential learning; (2) 9 credit hours in an application emphasis area to examine applications and theory of data sciences in a specific area; and (3) 23 credit hours of foundation courses. The capstone course will provide an opportunity for students to apply data science concepts to an application area while working in a multi-disciplinary team setting.

Data Science Major Requirements

Data Science Core Courses		39
DS 1100	Orientation to Data Science	R
DS 2010	Introduction to Data Science	3
DS 2020	Data Acquisition and Exploratory Data Analysis	3
DS 3030	Concepts and Applications of Machine Learning	3
DS 4010	Data Science Capstone	3
COMS 2280	Introduction to Data Structures	3
COMS 2300	Discrete Computational Structures	3
or CPRE 3100	Theoretical Foundations of Computer Engineering	
COMS 3110	Introduction to the Design and Analysis of Algorithms	3
COMS 3630	Introduction to Database Management Systems	3
CPRE 4190	Software Tools for Large Scale Data Analysis	4
STAT 3010	Intermediate Statistical Concepts and Methods	4
STAT 3470	Probability and Statistical Theory for Data Science	4
STAT 4770	Introduction to Categorical Data Analysis	3

At least 9 credits from the following categories to fulfill the emphasis area:

At least 6 credits from courses at the 3000, 4000, or 5000 level from the following designations:

ABE, ADVRT, AGRON, ANS, ARCH, BCBIO, COMS, CRP, CPRE, CYBE, CYBSC, DS, EE, ECON, FIN, GIS, IE, JLMC, LA, LING, MATH, MIS, MKT, POLS, SE, SOC, STAT, TSM	6

At least 3 credits from one of the following courses:

BCBIO 4010	Bioinformatics of Sequences	3
BCBIO 4060	Bioinformatics of OMICS	
COMS 3420	Principles of Programming Languages	
COMS 4130	Program Analysis	
MATH 4210	Logic for Mathematics and Computer Science	
COMS 4240	Introduction to High Performance Computing	
COMS 4260	Introduction to Parallel Algorithms and Programming	
COMS 4350	Algorithms for Large Data Sets: Theory and Practice	
COMS 4400	Principles and Practice of Compiling	
COMS 4540	Fundamentals of Remote Sensing and Spatial Analysis	
COMS 4610	Principles and Internals of Database Systems	
COMS 4740	Introduction to Machine Learning	
CPRE 3880	Embedded Systems II: Mobile Platforms	
CPRE 4160	Software Evolution and Maintenance	
CPRE 4250	High Performance Computing for Scientific and Engineering Applications	
CPRE 4310	Basics of Information System Security	
EE 4250	Machine learning: A Signal Processing Perspective	
IE 3120	Optimization	
IE 4830	Data Mining	
IE 4870	Big Data Analytics and Optimization	
MATH 3730	Introduction to Scientific Computing	
MATH 4070	Applied Linear Algebra	
MATH 4240	Introduction to High Performance Computing	
MATH 4810	Numerical Methods for Differential Equations	
STAT 4212	Experimental Design and Data Analysis	
STAT 4730	Introduction to Survey Sampling	
STAT 4750	Introduction to Multivariate Data Analysis	

Total Credits 9

Toward satisfying pre-requisites and requirements of the College of Liberal Arts and Sciences, the following courses or their equivalents are also required:

COMS 1270	Introduction to Computer Programming	3
COMS 2270	Object-oriented Programming	4
MATH 1650	Calculus I	4
MATH 1660	Calculus II	4
MATH 2650	Calculus III	4
MATH 2070	Matrices and Linear Algebra	3
STAT 2010	Introduction to Statistical Concepts and Methods	4
World Language 3 years in high school or 1 year in college		0 - 8
Natural Science		8
Social Science		9
Arts and Humanities		12
LAS 2030	Professional Career Preparation	1

The following courses meet the communication proficiency requirement:

LIB 1600	Introduction to College Level Research	1
ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
One of the following:		
ENGL 3020	Business Communication	3
ENGL 3140	Technical Communication	3
ENGL 3320	Visual Communication of Quantitative Information (cross-listed as STAT 3320)	3

As majors in the College of Liberal Arts and Sciences, Data Science students must meet College of Liberal Arts and Sciences and University-wide requirements for graduation in addition to those stated above for the major.

LAS majors require a minimum of 120 credits, including a minimum of 45 credits at the 3000/4000 level or above taken at a four-year college. All such credits, including courses taken on a pass/not pass basis, may be used to meet this requirement. You must also complete the LAS world language requirement and career proficiency requirement.

Students in all ISU majors must complete a three-credit course in U.S. Cultures and Communities and a three-credit course in International Perspectives. Check (<http://www.registrar.iastate.edu/courses/div-ip-guide.html>) for a list of approved courses. Discuss with your advisor how the two courses that you select can be applied to your graduation plan.

According to the university-wide Communication Proficiency Grade Requirement, students must demonstrate their communication proficiency by earning a grade of C or better in ENGL 2500. The Data

Science program requires a C or higher in the upper-level ENGL course (3020, 3140, or 3320).

Four Year Plan B.S., Data Science

Freshman

Fall	Credits Spring	Credits
DS 1100	R MATH 1660	4
MATH 1650	4 COMS 2270	4
COMS 1270	3 STAT 2010	4
ENGL 1500	3 ENGL 2500	3
LIB 1600	1	
Social Science	3	
14		15

Sophomore

Fall	Credits Spring	Credits
DS 2010	3 DS 2020	3
MATH 2650	4 MATH 2070	3
COMS 2280	3 COMS 2300 or CPRE 3100	3
STAT 3010	4 Social Science/International Perspectives	3
Arts and Humanities/U.S. Cultures and Communities	3 Arts and Humanities	3
	LAS 2030	1
17		16

Junior

Fall	Credits Spring	Credits
DS 3030	3 COMS 3630	3
STAT 3470	4 STAT 4770	3
COMS 3110	3 Arts and Humanities	3
Arts and Humanities (3000+ level)	3 Natural Science	4
Elective or World Language	3-4 Elective or World Language	3-4
16-17		16-17

Senior

Fall	Credits Spring	Credits
Application Emphasis Area	3 DS 4010	3
Application Emphasis Area	3 CPRE 4190	4
ENGL 3020, 3140, or 3320	3 Application Emphasis Area	3
Natural Science	4 Social Science (3000+ Level)	3
13		13

The major elective courses will come from Data Science emphasis areas as outlined on the Undergraduate Major page. A student must take at least 9 credits of 3000+ courses from a wide variety of designations.

Additionally, 3 credits must be chosen from a list of elective courses with a data or analysis emphasis.

All students are required to take at least 45 hours of courses at the 3000+ level or above. This may require taking additional electives.

Data Science Minor

Purpose

The minor in data science is intended for students studying any discipline at Iowa State and is designed to give students an in-depth understanding of data science as it is applied to a variety of domains. The minor in data science will prepare students with the technical and communication skills to enter the workforce as domain experts with data science skills.

Learning Outcomes for Data Science Minor

After completing the minor in data science, students will demonstrate:

- An ability to apply data science concepts, tools and technologies to data analysis pipelines,
- An understanding of ethical, legal, societal, and economic concerns in application of data science concepts,
- An ability to visualize, interpret and communicate the output of data analysis pipelines to stakeholders, and
- An ability to function on multi-disciplinary teams using concepts and tools from data science.

Requirements

The minor in data science requires the completion of 15 credit hours, including 9 credits from the data science core and 6 credits from approved data science electives.

At least 6 credits in courses numbered 3000-level with a grade of C or higher.

At least 3 credits taken at Iowa State.

At least 3 credits that are not used to meet any other department, college, or university requirement.

Courses for the minor cannot be taken on a pass/not-pass basis.

Course Requirements for Data Science Minor

Core Courses (9 credits)

DS 2010	Introduction to Data Science (Required)	3
DS 2020	Data Acquisition and Exploratory Data Analysis (Required)	3
DS 3010	Applied Data Modeling and Predictive Analysis (Required)	3

* DS 3010 has a prerequisite of an introductory statistics course:

STAT 1010, STAT 1040, STAT 1050, STAT 2010, STAT 2260, STAT 2310, STAT 3050, STAT 3220, or STAT 3300.

Electives (6 credits)		
ABE 3160	Applied Numerical Methods for Agricultural and Biosystems Engineering	3
ADVRT 3350	Advertising Media Planning	3
ADVRT 4970	Special Topics in Communication	1-3
AGRON 2700	Geospatial Technologies	3
AGRON 4250	Crop and Soil Modeling	3
BCBIO 3220	Introduction to Bioinformatics and Computational Biology	3
COMS 3110	Introduction to the Design and Analysis of Algorithms	3
COMS 3630	Introduction to Database Management Systems	3
COMS 4240	Introduction to High Performance Computing	3
COMS 4350	Algorithms for Large Data Sets: Theory and Practice	3
COMS 4530	Privacy Preserving Algorithms and Data Security	3
COMS 4740	Introduction to Machine Learning	3
CRP 2510	Fundamentals of Geographic Information Systems	3
CRP 3510	Geospatial Analysis and Visualization	3
CRP 4520	Geographic Data Management and Planning Analysis	3
CRP 4540	Fundamentals of Remote Sensing and Spatial Analysis	3
CRP 4560	GIS Programming and Automation	3
CPRE 4190	Software Tools for Large Scale Data Analysis	4
CPRE 4260	Introduction to Parallel Algorithms and Programming	4
ECON 3710	Introductory Econometrics	4
EE 4280	Image Analysis using Machine Learning	3
ENGL 3320	Visual Communication of Quantitative Information	3
FIN 4500	Analytical Methods in Finance	3
IE 3120	Optimization	3
IE 4830	Data Mining	3
LA 5580	Web Mapping and Spatial Data Visualization	3
LING 4100	Language as Data	3
MATH 3040	Combinatorics	3
MATH 3140	Graph Theory	3
MATH 3730	Introduction to Scientific Computing	3
MATH 4220X	Mathematical Principles of Data Science	3
MIS 4360	Introduction to Business Analytics	3

MIS 4460	Advanced Business Analytics	3
MKT 4680	Analytics for Marketing Strategies	3
STAT 3010	Intermediate Statistical Concepts and Methods	4
STAT 3300	Probability and Statistics for Computer Science	3
STAT 4279	Statistical Computing for Data Analysis	3
STAT 4750	Introduction to Multivariate Data Analysis	3
STAT 4770	Introduction to Categorical Data Analysis	3
STAT 4830	Empirical Methods for the Computational Sciences	3
TSM 4330	Precision Agriculture	3

The Data Science Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

Data Science Certificate

Purpose

The certificate in data science is intended for students studying any discipline at Iowa State and is designed to prepare them for future work with significant data science components. The data science certificate is also available to students who have already earned a Baccalaureate degree from Iowa State or elsewhere. The capstone will provide an opportunity for students to apply data science concepts to a domain problem while working in a multi-disciplinary team setting. The certificate in data science will prepare students with the technical and communication skills to enter the workforce as domain experts with data science skills.

Learning Outcomes for Data Science Certificate

After completing the certificate in data science, students will demonstrate:

- An ability to apply data science concepts, tools and technologies to data analysis pipelines,
- An understanding of ethical, legal, societal, and economic concerns in application of data science concepts,
- An ability to visualize, interpret and communicate the output of data analysis pipelines to stakeholders, and
- An ability to function on multi-disciplinary teams using concepts and tools from data science.

Requirements

The certificate in data science requires the completion of 21 credit hours, including 9 credits from the data science core, 9 credits from approved data science electives, and a three-credit data science capstone experience.

At least 9 credits must be taken in courses numbered at the 3000-level or above. At least 6 credits must be taken at Iowa State University.

Courses for the certificate cannot be taken on a pass/not-pass basis.

Course Requirements for Data Science Certificate

Core Courses (9 credits)

DS 2010	Introduction to Data Science (Required)	3
DS 2020	Data Acquisition and Exploratory Data Analysis (Required)	3
DS 3010	Applied Data Modeling and Predictive Analysis (Required)	3

* DS 3010 has a prerequisite of an introductory statistics course: STAT 1010, STAT 1040, STAT 1050, STAT 2010, STAT 2260, STAT 2310, STAT 3050, STAT 3220, or STAT 3300.

Electives (9 credits)

ABE 3160	Applied Numerical Methods for Agricultural and Biosystems Engineering	3
ADVRT 3350	Advertising Media Planning	3
ADVRT 4970	Special Topics in Communication	1-3
BCBIO 3220	Introduction to Bioinformatics and Computational Biology	3
COMS 3110	Introduction to the Design and Analysis of Algorithms	3
COMS 3630	Introduction to Database Management Systems	3
COMS 4240	Introduction to High Performance Computing	3
COMS 4350	Algorithms for Large Data Sets: Theory and Practice	3
COMS 4530	Privacy Preserving Algorithms and Data Security	3
COMS 4740	Introduction to Machine Learning	3
CRP 2510	Fundamentals of Geographic Information Systems	3
CRP 3510	Geospatial Analysis and Visualization	3
CRP 4520	Geographic Data Management and Planning Analysis	3
CRP 4560	GIS Programming and Automation	3
CPRE 4190	Software Tools for Large Scale Data Analysis	4
CPRE 4260	Introduction to Parallel Algorithms and Programming	4
ECON 3710	Introductory Econometrics	4
ENGL 3320	Visual Communication of Quantitative Information	3
FIN 4500	Analytical Methods in Finance	3
IE 3120	Optimization	3
IE 4830	Data Mining	3
LING 4100	Language as Data	3
MATH 3040	Combinatorics	3
MATH 3140	Graph Theory	3
MATH 3730	Introduction to Scientific Computing (MATH 4220X::Mathematical Principals of Data Science)	3

MATH 4220X	Mathematical Principles of Data Science	3
MIS 4360	Introduction to Business Analytics (::Mathematical Principals of Data Science)	3
MIS 4460	Advanced Business Analytics	3
MKT 4680	Analytics for Marketing Strategies	3
STAT 3010	Intermediate Statistical Concepts and Methods	4
STAT 3300	Probability and Statistics for Computer Science	3
STAT 4279	Statistical Computing for Data Analysis	3
STAT 4750	Introduction to Multivariate Data Analysis	3
STAT 4770	Introduction to Categorical Data Analysis	3
STAT 4830	Empirical Methods for the Computational Sciences	3
Data Science capstone experience (3 credits)		
DS 4010	Data Science Capstone	3

The Data Science Certificate is an LAS Certificate and must meet University-wide policies for undergraduate certificates.

Earth Science

Earth Science

The Earth Science major is a program leading to the Bachelor of Science (B.S.) or Bachelor of Art (B.A.).

The B.S. program emphasizes an interdisciplinary approach to Earth system processes at multiple temporal and spatial scales. The degree is suitable for students interested in identifying and monitoring interactions between the lithosphere, hydrosphere, atmosphere, and human activities. It prepares students for consulting and geotechnical careers in the private and government sectors.

The B.A. emphasizes an interdisciplinary field and prepares the student primarily for a career in secondary education. For students interested in secondary education, please contact Dr. Cinzia Cervato for additional guidance.

Student Learning Outcomes

Upon graduation, students should be able to:

- Demonstrate the ability to think critically;
- Exhibit a broad understanding of Earth systems and processes;
- Demonstrate scientific literacy and its application to scientific inquiry and societal concerns;
- Demonstrate proficiency in data collection, management, and analysis including understanding sources of error and/or uncertainty;
- Demonstrate competency with geoscience-specific techniques and field methods.
- Read and critically evaluate relevant literature and information;

- Use appropriate tools from chemistry, physics, biology, mathematics, and data science to solve discipline-specific problems;
- Present information effectively in written and oral forms;
- Work in a team environment in alignment with the ISU principles of community;
- Work independently;
- Attain employment in the geosciences or related fields or pursue graduate studies.

EARTH SCIENCE

Students can pursue either the Bachelor of Science (B.S.) or the Bachelor of Art (B.A.) degree with a major in Earth Science.

Required courses for the B.S. include:

GEOL 1000	How the Earth Works	3
or GEOL 1010 Environmental Geology: Earth in Crisis		
or GEOL 2010 Geology for Engineers and Environmental Scientists		
GEOL 1000L	How the Earth Works: Laboratory	1
GEOL 3020	Summer Field Studies	6
GEOL 3150	Mineralogy and Earth Materials	3
GEOL 3150L	Laboratory in Mineralogy and Earth Materials	1
GEOL 3560	Structural Geology and Tectonics	4
GEOL 3570	Geological Mapping and Field Methods	1
GEOL 3680	Sedimentary Geology	4
GEOL 4020	Watershed Hydrology	3
GEOL 4110	Hydrogeology	4
GEOL 4520	Intro GIS for Geoscientists	3
GEOL 4790	Surficial Processes	3

And 9 credits of Earth Science electives in agronomy, environmental science, meteorology, or other approved areas.

Total Credits	45

Required supporting courses for the B.S. include:

CHEM 1770	General Chemistry I	4
CHEM 1770L	Laboratory in General Chemistry I	1
CHEM 1780	General Chemistry II	3
CHEM 1780L	Laboratory in College Chemistry II	1
MATH 1600	Survey of Calculus	4
PHYS 1310	General Physics I	4
PHYS 1310L	General Physics I Laboratory	1
PHYS 1320	General Physics II	4
PHYS 1320L	General Physics II Laboratory	1
STAT 1040	Introduction to Statistics	3

STAT 3010	Intermediate Statistical Concepts and Methods	4
Total Credits		30

Communication Proficiency requirement: According to the university-wide Communication Proficiency Grade Requirement, students must demonstrate their communication proficiency by earning a grade of C or better in ENGL 2500. The department requires a grade of C or better in the below communication courses.

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
	or ENGL 2500H Written, Oral, Visual, and Electronic Composition: Honors	
ENGL 3090	Proposal and Report Writing	3
	or ENGL 3140 Technical Communication	
	or ENGL 3020 Business Communication	
	or JLMC 3470 Science Communication	
Total Credits		9

As majors in the College of Liberal Arts and Sciences, Earth Science students must meet College of Liberal Arts and Sciences and University-wide requirements for graduation in addition to those stated above for the major.

Students in all ISU majors must complete a three-credit course in U.S. Cultures and Communities and a three-credit course in International Perspectives. Check (<http://www.registrar.iastate.edu/courses/div-ip-guide.html>) for a list of approved courses.

LAS majors require a minimum of 120 credits, including a minimum of 45 credits at the 3000/4000 level in addition to the LAS world language and cultures and career preparation requirement (LAS 2030 Professional Career Preparation). At least 8 credits in the major from 3000+ courses must earn grade C or better. The average grade of all courses in the major must be 2.0 or higher.

Required courses for the B.A. include:

GEOL 1000	How the Earth Works	3
	or GEOL 1010 Environmental Geology: Earth in Crisis	
	or GEOL 2010 Geology for Engineers and Environmental Scientists	
GEOL 1000L	How the Earth Works: Laboratory	1
GEOL 3020	Summer Field Studies	6
GEOL 2020	History of the Earth	3
GEOL 2020L	History of the Earth: Laboratory	1
GEOL 3150	Mineralogy and Earth Materials	3
GEOL 3150L	Laboratory in Mineralogy and Earth Materials	1
GEOL 3560	Structural Geology and Tectonics	4
GEOL 3570	Geological Mapping and Field Methods	1

GEOL 3650	Igneous and Metamorphic Petrology	3
GEOL 3680	Sedimentary Geology	4
MTEOR 2060	Introduction to Weather and Climate	3
ASTRO 1200	The Sky and the Solar System	3
ASTRO 1500	Stars, Galaxies, and Cosmology	3
	And 3 credits of geology electives	3
Total Credits		42

Required supporting courses for the B.A. include:

CHEM 1770	General Chemistry I	4
CHEM 1770L	Laboratory in General Chemistry I	1
CHEM 1780	General Chemistry II	3
CHEM 1780L	Laboratory in College Chemistry II	1
PHYS 1310	General Physics I	4
PHYS 1310L	General Physics I Laboratory	1
PHYS 1320	General Physics II	4
PHYS 1320L	General Physics II Laboratory	1

One of the following

MATH 1510	Calculus for Business and Social Sciences	3
	or MATH 1600 Survey of Calculus	
	or MATH 1650 Calculus I	

One of the following

STAT 1010	Principles of Statistics	4
	or STAT 1040 Introduction to Statistics	

And one course in Biology 3

Total Credits **29**

Communication Proficiency requirement: According to the university-wide Communication Proficiency Grade Requirement, students must demonstrate their communication proficiency by earning a grade of C or better in ENGL 2500. The department requires a grade of C or better in ENGL 3090 or ENGL 3140.

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
	or ENGL 2500H Written, Oral, Visual, and Electronic Composition: Honors	

One of the following:

ENGL 3090	Proposal and Report Writing	3
	or ENGL 3140 Technical Communication	

Total Credits **9**

As majors in the College of Liberal Arts and Sciences, Earth Science students must meet College of Liberal Arts and Sciences and University-

wide requirements for graduation in addition to those stated above for the major.

Students in all ISU majors must complete a three-credit course in U.S. Cultures and Communities and a three-credit course in International Perspectives. Check (<http://www.registrar.iastate.edu/courses/div-ip-guide.html>) for a list of approved courses.

LAS majors require a minimum of 120 credits, including a minimum of 45 credits at the 3000/4000 level in addition to the LAS world language and cultures and career preparation requirement (LAS 2030 Professional Career Preparation). At least 8 credits in the major from 3000+ courses must earn grade C or better. The average grade of all courses in the major must be 2.0 or higher.

Teacher Preparation Focus

Earth Science majors seeking certification to teach Earth Science in secondary schools follow the requirements of the B.A. degree in Earth Science. In addition, they must take the complementary coursework listed below and meet all of the requirements of the Secondary Major in Education. Some of these courses, and some of the required coursework for the Secondary Major in Education, may also apply to LAS general education requirements.

Complementary Coursework

PSYCH 2300	Developmental Psychology	3
EDUC 4180	Secondary Science Methods I	3
EDUC 4190	Secondary Science Methods II	3

One course in American History or Government

Notes: Teacher license requirements are established by the Iowa Department of Education and the Iowa Board of Educational Examiners and are subject to change. Recent changes may not be reflected in this catalog, but advisers and faculty will be aware. Some students pursuing the Earth Science decide to complete the Earth Science major and continue their studies as graduate students in Iowa State's Science Education, Masters of Teaching (M.A.T.) program (<https://education.iastate.edu/graduate-students/graduate-programs/division-of-teaching-learning-leadership-and-policy/educator-prep-programs-for-licensure-recommendation/science-education-m-a-t/endorsements/>).

Earth Science, B.A.

NOTE: Course plan, sequence and credit amounts will vary depending upon which endorsement area(s) a student chooses to pursue. In addition, this plan is solely an example of one possible academic layout. This plan can and likely will be modified based on transfer credit, advanced placement (AP) credit, dual enrollment credit, "test out" credit, course offerings, schedule conflicts and entry term. *It is our expectation that students know the requirements of their academic program and develop*

and follow an academic plan based on their academic catalog and degree audit using their individual academic advisor as a resource in this process.

Potential pathway for the B.A. major in Earth Science with the Secondary Major in Education:

Freshman

Fall	Credits	Spring	Credits	Summer	Credits
ENGL 1500		3 EDUC 2040		3 PSYCH 2300 (social science)	3
LIB 1600		1 GEOL 1130		1 Social Science Option ¹	3
GEOL 1000		3 GEOL 2020		3	
GEOL 1000L		1 GEOL 2020L		1	
CHEM 1770		4 CHEM 1780		3	
CHEM 1770L		1 CHEM 1780L		1	
MATH 1510, 1600, or 1650		3-4 ASTRO 1200		3	
GEOL 1120		1 MTEOR 2060		3	
		17-18		18	6

Sophomore

Fall	Credits	Spring	Credits	Summer	Credits
ENGL 2500		3 GEOL 3650		3 Humanities Option ¹	3
PHYS 1310		4 PHYS 1320		4	
PHYS 1310L		1 PHYS 1320L		1	
GEOL 3150		3 PSYCH 3330 (social science)		3	
GEOL 3150L		1 Humanities Option ¹		3	
LAS 2030		1 ASTRO 1500		3	
EDUC 2020		3			
EDUC 2800L		0.5			
EDUC 2190		1			
				Apply/ Accepted to Educator Preparation Program	
		17.5		17	3

Junior

Fall	Credits	Spring	Credits	Summer	Credits
EDUC 3470		3 ENGL 3020, 3090, 3140, or JLMC 3470		3 GEOL 3020	6
EDUC 4180		3 EDUC 4190		3	
EDUC 2800A		1-2 EDUC 4800J		2	
GEOL 3570		1 COMST 2110, SPCM 2120, or THTRE 3580		3	
GEOL 3680		4 STAT 1010 or 1040		3-4	
HIST 2800 or 2810 (humanities)		3 GEOL 3560		4	
15-16		18-19		6	

Senior

Fall	Credits	Spring	Credits
Geology Option ¹		3 EDUC 4170J	16
Humanities Option ¹		3 PPAT	
SPED 4010	3		
EDUC 4060	3		
Social Science Option ¹			
Biology Option ¹	3		
Apply to student teach			
Apply for graduation			
18		16	

Students must take an American History (counts as humanities) or American Government (counts as social science).

¹ Choose from list of approved courses available from an advisor.

EARTH SCIENCE, B.S.

Potential pathway for the B.S. in Earth Science degree:

Freshman

Fall	Credits	Spring	Credits
ENGL 1500		3 CHEM 1780	3
GEOL 1000 or 1010		3 CHEM 1780L	1
GEOL 1000L		1 STAT 1040	3
CHEM 1770		4 Arts-and- Humanities Choice	3
CHEM 1770L		1 World Language	3-4
LIB 1600	1		
MATH 1600	4		
17		13-14	

Sophomore

Fall	Credits	Spring	Credits
ENGL 2500		3 Arts-and- Humanities Choice	3
GEOL 3150		3 PHYS 1320	4
GEOL 3150L		1 PHYS 1320L	1
PHYS 1310		4 STAT 3010	4
PHYS 1310L		1 World Language	3
LAS 2030	1		
13		15	

Junior

Fall	Credits	Spring	Credits	Summer	Credits
GEOL 3680		4 GEOL 4520		3 GEOL 3020	6
GEOL 3570		1 Social- Science Choice		3	
Elective		3-4 GEOL 3560		4	
Arts-and- Humanities Choice		3 Elective		3-4	
11-12		13-14		6	

Senior

Fall	Credits	Spring	Credits
GEOL 4020		3 Electives	3
Social Science Choice		3 Arts-and- Humanities Choice	3

ENGL 3090, 3020, 3140, or JLMC 3470	3 Social- Science Choice	3
GEOL 4790	3 GEOL 4110	4
12		13

Graduate Programs

The department offers programs leading to the Master of Science and Doctor of Philosophy with majors in Geology, Earth Science, and Meteorology. Students desiring a major in the above fields normally will have a strong undergraduate background in the physical and mathematical sciences. Individuals desiring to enter a graduate program are evaluated by considering their undergraduate preparation and performance along with their expressed goals in the statement of purpose. All prospective students should reach out to individual faculty members who they wish to work with prior to applying.

Programs of study are designed on an individual basis in accordance with requirements of the Graduate College and established requirements for each departmental major. Additional coursework is normally taken in complementary areas such as aerospace engineering, agronomy (soil science), chemistry, civil and construction engineering, computer engineering, computer science, engineering mechanics, environmental science, materials engineering, mathematics, mechanical engineering, microbiology, physics, or statistics. Departmental requirements provide a strong, broad background in the major and allow considerable flexibility in the program of each individual.

A dissertation is required of all Ph.D. candidates.

M.S. students in Geology are required to complete a thesis. The M.S. in Earth Science is available to students electing the non-thesis (Creative Component) option in Geology or Meteorology.

Graduates in Geology specialize in a sub-discipline, but they comprehend and can communicate the basic principles of geology and supporting sciences. They possess the capacity for critical and independent thinking. They are able to write a fundable research proposal, evaluate current relevant literature, carry out the proposed research, and communicate the results of their research to peers at national meetings and to the general public. They work as consultants on engineering and environmental problems, explorers for new minerals and hydrocarbon resources, researchers, teachers, writers, editors, and museum curators.

Ecology, Evolution, and Organismal Biology

Overview

Within the Biological Sciences, studies of ecology, evolution, and organismal biology are essential in understanding the complex relationships of life on Planet Earth. Ecology focuses on the interactions among organisms as well as the interactions between organisms and their physical environments. Evolutionary theory addresses the origins and interrelationships of species. Organismal biology studies both the diversity of biological organisms and the structure and function of individual organisms.

Undergraduate Study

The Department of Ecology, Evolution, and Organismal Biology (<https://www.eeob.iastate.edu/>) (EEOB) offers several undergraduate majors with other departments. Students interested in the areas of ecology, evolution, and organismal biology should major in Biology, Environmental Science, or Genetics. The Biology Major is administered and offered jointly by the EEOB (<https://www.eeob.iastate.edu/>) and GDCB (<https://www.gdcb.iastate.edu/>) departments. The faculty of EEOB, together with those in GDCB and BBMB (<https://www.bbmb.iastate.edu/>), administer and offer the Genetics Major. Faculty in EEOB, in cooperation with faculty from other departments on campus, administer and offer the Environmental Science Major. Each of these majors are available through the College of Liberal Arts and Sciences or through the College of Agriculture and Life Sciences. Faculty in the EEOB Department also teach undergraduate courses at Iowa Lakeside Laboratory (see the Iowa Lakeside Laboratory listing).

Graduate Study

The department offers graduate work leading to both Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) degrees. EEOB graduate students major in one of several interdepartmental majors including Bioinformatics and Computational Biology, Ecology and Evolutionary Biology, Environmental Science, Genetics, Interdisciplinary Graduate Studies, Neuroscience, and Toxicology. The EEOB faculty members are active in the interdepartmental graduate majors and teach a wide range of graduate courses. Faculty research programs cover a wide range of specializations including physiology and physiological ecology; microbiology; animal behavior; evolutionary genetics of plants and animals; modeling of evolutionary and ecological processes; plant and animal systematics; neurobiology; developmental biology; aquatic and wetland ecology; functional, population, community, landscape, and ecosystem ecology; and conservation biology. For further information on faculty research interests check the EEOB web site (<http://www.eeob.iastate.edu/>). Some EEOB faculty teach graduate courses at Iowa Lakeside Laboratory. Field Station

courses are also available through the Gulf Coast Marine Laboratory and the Organization for Tropical Studies (see the Biology listing).

Students who are enrolled in the interdepartmental graduate majors with EEOB affiliation are required to participate in departmental seminars, to participate in research activities, and to show adequate progress and professional development while pursuing their degree. For both the M.S. and Ph.D. degrees, it is expected that research conducted by the student will culminate in the writing and presentation of a thesis or dissertation. Requirements and guidelines for study are provided by the Graduate College, the EEOB faculty, and the individual student's major professor and Program of Study Committee. General information about graduate study requirements can be found at the web site for the Graduate College and requirements for the interdepartmental majors can be found by following the links from the EEOB web site above. Although not a formal requirement, the EEOB faculty recommends that students pursuing the Ph.D. include teaching experience in their graduate training.

Economics Overview

www.econ.iastate.edu (<http://www.econ.iastate.edu>)

Economics teaches the ability to reason clearly and to address complex issues using tools and decision-making models from economics, mathematics, and statistics, as well as concepts from the biological, physical, and social sciences. The study of economics also helps students to: develop an understanding of the interactions of technology, human activity, and the environment; apply systematic approaches to making optimal choices; analyze quantitative information; and communicate concepts and findings to industry professionals, organizations, governments, and the general public.

Strong training in economic reasoning serves as a foundation for a variety of rewarding careers and for advanced study in a range of professional and academic fields. Economics majors are provided the tools of critical analysis and human relations skills that are essential for being informed citizens, finding and excelling in many career fields, and becoming lifelong learners.

Student Learning Outcomes

Graduates from the Department of Economics at Iowa State University are expected to be able to:

1. Understand and apply concepts of scarcity, marginal analysis, opportunity cost and comparative advantage.
2. Critically analyze the efficiency and equity implications of market and non-market processes of allocation.

3. Evaluate policies, regulations, and business strategies using economic models and theories.

4. Use quantitative and qualitative information to evaluate economic questions.

5. Understand the determinants of differences in economic performance over time and across space.

Degree Requirements

Economics Major, College of Liberal Arts and Sciences

The Economics major in the College of Liberal Arts and Sciences prepares students for advanced studies in Economics, Finance, and Analytics, for professional degrees such as medicine, law and business administration (MBA), and for careers in finance, business and economic research, management, insurance, brokerage, real estate, labor relations, international development, and government service. Candidates for the Bachelor of Science degree with a major in Economics must fulfill requirements established by the College of Liberal Arts and Sciences. For details of undergraduate curricula in liberal arts and sciences, see College of Liberal Arts and Sciences. A double major in Economics and Agricultural Business is permitted. A double major in Economics and Business Economics is not permitted. A major in Business Economics with a minor in Economics is not permitted. A minor in Economics cannot be combined with a major in Agricultural Business, and minors in both Agricultural Business and Economics are not permitted.

Students majoring in Economics are required to take the following courses within the General Education Area of Mathematics:

Choose one of the following pairs:

7-8

MATH 1600 & ECON 2070	Survey of Calculus and Applied Economic Optimization
MATH 1650 & ECON 2070	Calculus I and Applied Economic Optimization *
MATH 1650 & MATH 1660	Calculus I and Calculus II

Choose one of the following pairs:

6

STAT 2260 & STAT 3260	Introduction to Business Statistics I and Introduction to Business Statistics II
STAT 3410 & STAT 3420	Introduction to the Theory of Probability and Statistics I and Introduction to the Theory of Probability and Statistics II

Students planning to attend graduate programs in Economics or related fields are encouraged to take MATH 1650 Calculus I, MATH 1660 Calculus II, STAT 3410 Introduction to the Theory of Probability and

Statistics I, and STAT 3420 Introduction to the Theory of Probability and Statistics II.

Students planning for careers in the finance industry or government sectors are encouraged to enroll in STAT 2260 Introduction to Business Statistics I and STAT 3260 Introduction to Business Statistics II.

Students must complete the following courses in economics:

ECON 1010	Principles of Microeconomics	3
ECON 1020	Principles of Macroeconomics	3
ECON 3010	Intermediate Microeconomics	3-4
ECON 3020	Intermediate Macroeconomics	3
ECON 3710	Introductory Econometrics	4
Three credits of ECON 2300-2390, 3000-3890, 4000-4890 courses.		3
Nine credits of 4000-4890 level ECON courses.		9
ECON 4920	Graduating Senior Survey	R

A minimum of 18 credits of economics coursework must be earned at Iowa State University. Economics majors must earn a minimum GPA of 2.0 across ECON 1010 Principles of Microeconomics, ECON 1020 Principles of Macroeconomics, ECON 3010 Intermediate Microeconomics, and ECON 3020 Intermediate Macroeconomics, with no grade in these lower than a C-.

Communication Proficiency Requirement: According to the university-wide Communication Proficiency Grade Requirement, students must demonstrate their communication proficiency by earning a grade of C or better in ENGL 2500. In addition, the Economics major requires a grade of C or better in ENGL 3020 or ENGL 3140.

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition or ENGL 2500H Written, Oral, Visual, and Electronic Composition: Honors	3
ENGL 3020	Business Communication or ENGL 3140 Technical Communication	3

Students in all ISU majors must complete a three-credit course in both U.S. Cultures and Communities and in International Perspectives. The two courses may simultaneously meet the following graduation requirements: Social Science, Arts/Humanities, ECON 4000-4890, or Econ courses from approved list. Please discuss with your advisor.

LAS majors require a minimum of 120 credits, **including a minimum of 45 credits at the 3000/4000 level**. Three of the required 45 credits at the 3000+ level must be earned in a general education group outside the group of your major. Economics majors must meet or complete the LAS world language requirement and career proficiency requirement.

As majors in the College of Liberal Arts and Sciences, Economics students must meet College of Liberal Arts and Sciences and University-wide requirements for graduation in addition to those stated above for the major.

Four Year Plan
 Bachelor of Science in Economics

Freshman		
Fall	Credits Spring	Credits
ECON 1010	3 ECON 1020	3
ENGL 1500	3 ECON 2070 ^a	3
LIB 1600	1 Arts and Humanities	3
MATH 1600 ^a	4 Natural Science	3
Arts and Humanites	3 Social Science	3
14		15

Sophomore		
Fall	Credits Spring	Credits
ECON 3010	4 ECON 3020	3
ENGL 2500	3 STAT 3260 ^b	3
STAT 2260 ^b	3 Elective or World Language	4
LAS 2030	1 Social Science	3
Elective or World Language	4 Natural Science	3
15		16

Junior		
Fall	Credits Spring	Credits
ECON 3710	4 ECON 4000-4890	3
ECON 2300-2390, 3000-3890, or 4000-4890	3 Electives	9
Arts and Humanities	3 International Perspectives or U.S. Cultures and Communities	3
Elective	2	
International Perspectives or U.S. Cultures and Communities	3	
15		15

Senior		
Fall	Credits Spring	Credits
ECON 4000-4890	3 ECON 4000-4890	3
ENGL 3020 or 3140	3 ECON 4920	R
Arts and Humanities	3 Natural Science	2

Electives	6 Electives	10
	15	15

Total Credits: 120

Students in all ISU majors must complete a three-credit course in both U.S. Diversity and in International Perspectives. The two courses may simultaneously meet the following graduation requirements: Social Science, Arts/Humanities, ECON 4000-4890, or Econ courses from approved list. Please discuss with our advisor. LAS majors require a minimum of 120 credits, **including a minimum of 45 credits at the 3000/4000 level**. Three of the required 45 credits at the 3000+ level must be earned in a general education group outside the group of your major. Econ majors must meet or complete the LAS world language requirement. In addition, Econ majors must earn a minimum of 18 credits from courses taught by the Department of Economics at ISU.

- a MATH 1650 (Calculus I) and MATH 1660 (Calculus II) may be substituted for MATH 1600 and ECON 2070.
- b STAT 3410 (Introduction to Theory of Probability & Stats I) and STAT 3420 (Introduction to Theory of Probability & Stats II) may be substituted for STAT 2260 and 3260.

Minor

Economics Minor, College of Liberal Arts and Sciences

For a minor in Economics, students complete a minimum of 15 credits. The minor must include at least 3 credits that are not used to meet any other Department, College, or University requirement and at least 9 credits at 2000+; and 6 of those at 3000+.

ECON 1010	Principles of Microeconomics	3
ECON 1020	Principles of Macroeconomics	3
ECON 3010	Intermediate Microeconomics *	3-4
Three credits of ECON 2300-2390, 3000-3890, 4000-4890 courses.		3
Three credits of ECON 3000-3890, 4000-4890 courses.		3
Total Credits		15-16

* Pre-reqs for ECON 3010 include MATH 1660 Calculus II or ECON 2070 Applied Economic Optimization.

The Economics Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 9 credits in courses numbered 2000 and above; and 6 of those credits in courses numbered 3000 and above, with a grade of C or higher.

The Department of Economics has concurrent Bachelor of Science/ Master of Science (B.S./M.S.) programs designed especially for seniors who wish to pursue advanced studies. Concurrent BS/MS programs are economics (B.S.) with economics (M.S.) or agricultural economics (M.S.).

The concurrent B.S./M.S. program allows seniors to complete an M.S. degree within 12 months of B.S. completion.

For more information about our concurrent undergraduate and graduate programs in Economics, visit: <https://www.econ.iastate.edu/iowa-state-ms-econ-programs> (<https://www.econ.iastate.edu/iowa-state-ms-econ-programs/>).

Graduate Programs

Graduate Programs in Economics and Agricultural Economics

The Department of Economics offers work toward the degrees Master of Science and Doctor of Philosophy with majors in Economics and Agricultural Economics. The Department also offers minors to students with majors in other departments. For more information, visit our web site at www.econ.iastate.edu (<http://www.econ.iastate.edu>).

Students do not need to have an undergraduate major in Economics or Agricultural Economics to qualify for graduate work in the Department. However, students must have completed undergraduate coursework in macroeconomics, microeconomics, statistics, calculus, and matrix algebra. Some background in math courses emphasizing logic and proofs is preferred, particularly for the Ph.D.

Candidates for the degree Master of Science (thesis option) are required to complete satisfactorily 30 credits of acceptable graduate work, including preparation of a thesis.

Candidates for the degree Master of Science (non-thesis option) may fulfill requirements by satisfactorily completing 32 credits of acceptable graduate work, including preparation of a creative component.

Programs of study for the doctorate are organized by each student in consultation with the major professor and the student's committee. Subject to staffing constraints, the Department offers coursework to support the following fields of concentration: agricultural economics, applied econometrics, environmental and resource economics, financial economics, human resources, industrial organization, international economics, and macroeconomics. Students must complete advanced courses in microeconomic and macroeconomic theory, quantitative methods and econometrics, and two fields from the list above. Students are required to participate in workshops and demonstrate competence in theory by passing qualifying examinations.

English

UNDERGRADUATE STUDY

Students in the undergraduate majors offered through the English department (<https://engl.iastate.edu/>) develop critical thinking, cultural

awareness, effective communication, imagination, leadership, pedagogy, and agency as citizens.

In a communication-rich and globally connected world, these skills play a crucial role in every profession. Studying in English expands and deepens individual engagement in the social, cultural, artistic, scientific, technical, and environmental work of society.

Students interested in majoring in English can choose from this range of options:

- **B.A. in English** (designed so that majors experience the broad, diverse scope of English studies and create a course plan to match their personal interests and professional goals)
- **B.A. with a Secondary Major in Education** (for students seeking licensure in secondary education with an opportunity to earn an ESL endorsement as well)
- **B.S. in English** (by fulfilling B.A. in English requirements and taking 12 additional credits in natural science, social science, or mathematics)

The English major offers a flexible degree that allows students to gain experience in fields such as literature, rhetoric, creative writing, English education, film, literary editing, and professional communication.

Please visit the Department of English website (<https://engl.iastate.edu/>) to learn more about the opportunities available to English majors as well as the other specialized undergraduate majors offered by the department. The diverse majors within English prepare students for careers that span law, medicine, theology, business, education, advocacy, event planning, management, marketing, publishing, nonprofit and government communication, public service, sales, and speech writing, library science, web design and communication consulting, editing, software documentation, usability and user experience, as well as scientific, technical, and environmental writing.

Adding a major or minor in English to your field of study at Iowa State increases your communication, analytical, and critical thinking skills and will play a key role in your life as a student and in your life after graduation.

B.A./B.S. in English Learning Outcomes

Students who major in English (with a B.A. or B.S.) will be able to:

- Analyze how texts and media reflect, shape, or challenge diverse intellectual, political, and/or cultural concerns in their eras and our own.
- Understand, apply, analyze, synthesize, and evaluate content knowledge. Competencies include discipline-specific terms, history of the field, theories in the field, elements of criticism, and cultural knowledge.

- Engage in critical thinking and effective communication by analyzing and interpreting information and ideas, conducting research, and making connections between and among divergent views.
- Plan, prepare, present, and evaluate written, oral, visual, and electronic communication. These competencies include scholarly skills and tools; communication that is analytical, persuasive, and/or expressive; and peer and self-editing.

Students who choose the English Education Emphasis will additionally be prepared to

- Understand how learners grow and develop, valuing individual differences and cultural diversity to ensure inclusive learning environments.
- Apply the content area's central concepts and structures by using a variety of instructional strategies, including technology, to encourage student creativity, problem solving, and collaboration.
- Use multiple methods of assessment to engage learners in their own growth, monitor learner progress, and guide the teacher's and learner's decision making.
- Create instructional plans that support students in meeting rigorous learning goals by drawing upon the content area knowledge, curriculum, cross-disciplinary skills, and pedagogy.
- Evaluate one's pedagogy for the effects of choices and actions on others (learners, families, other professionals, and the community).

B.A. and B.S. in English Requirements

The English major offers a flexible degree that allows students to gain experience in fields such as literature, rhetoric, creative writing, English education, film, literary editing, and professional communication.

The Undergraduate Program of Study is designed so that majors can experience the broad, diverse scope of English studies and configure a course plan to match their personal interests and professional goals. Suggested degree plans for several customizations are available and students may choose and combine courses in any way that meets the requirements for the degree.

Students interested in the B.A. degree in English need to complete 36 credits, based on the table below. Students interested in the B.S. degree in English need to complete the B.A. requirements, plus 12 additional credits in linguistics, natural science, mathematics, social science, or selected courses in kinesiology. Students seeking to complete the English Major and be recommended for teacher licensure need to complete specified coursework in English and meet the requirements of the Secondary Major in Education.

To graduate with a major in the English department and meet the university-wide Communication Proficiency Grade Requirement, a student must have the following:

- Earned credit for or received a grade of at least a C in ENGL 1500 Critical Thinking and Communication and ENGL 2500 Written, Oral, Visual, and Electronic Composition.
- Completed and earned at least a C in one of the department's advanced communications courses.
- Earned at least a C or higher in each of the ENGL courses applied to the ENGL major.

As majors in the College of Liberal Arts and Sciences, English students must meet College of Liberal Arts and Sciences and University-wide requirements for graduation in addition to those stated below for the major. LAS majors require a minimum of 120 credits, **including a minimum of 45 credits at the 3000/4000 level**. You must also complete the LAS world language and career proficiency (LAS 2030) requirements. Students in all ISU majors must complete a three-credit course in U.S. Cultures and Communities and a three-credit course in International Perspectives. Check (<http://www.registrar.iastate.edu/courses/div-ip-guide.html>) for a list of approved courses. Discuss with your advisor how the two courses that you select can be applied to your graduation plan.

The first table below lays out the requirements and options of the English major. The second table shares the specific requirements for English majors seeking licensure in English education. The English major requires a minimum of 15 credits of major requirements earned at the 3000 level and a total of 9 credits of major requirements earned at the 4000 level. English majors transferring from other institutions must earn at least 18 of their credits in English from Iowa State.

English Major

Texts and Language: Choose 5 15

ENGL 2010	Introduction to Literature *
ENGL 2070	Introduction to Creative Writing
ENGL 2140	Introduction to Technical Communication
ENGL 2200	Descriptive English Grammar
ENGL 2220	Artificial Intelligence and Writing
ENGL 2250	Survey of British Literature to 1800 *
ENGL 2260	Survey of British Literature since 1800 *
ENGL 2270	Survey of American Literature to 1865 *
ENGL 2280	Survey of American Literature since 1865 *
ENGL 2370	Survey of Film History *
ENGL 2600	Introduction to Literary Study *
ENGL 3530	World Literature: Western Foundations through Renaissance *
ENGL 3540	World Literature: Seventeenth Century to the Present *

Advanced Communication: Choose 1 3

ENGL 3020	Business Communication

ENGL 3030	Free-Lance Writing for Popular Magazines
ENGL 3040	Creative Writing: Fiction
ENGL 3050	Creative Writing: Nonfiction
ENGL 3060	Creative Writing: Poetry
ENGL 3080	Write Like a Woman
ENGL 3090	Proposal and Report Writing
ENGL 3130	Rhetorical Website Design
ENGL 3140	Technical Communication
ENGL 3150	Creative Writing: Screenplays
ENGL 3160	Creative Writing: Playwriting

Critical Reading and Textual Analysis: Choose 2 6

ENGL 2750	Analysis of Popular Culture Texts
ENGL 3100	Rhetorical Analysis
ENGL 3390	Literary Theory and Criticism
ENGL 3550	Literature and the Environment *
ENGL 3960	Teaching the Reading of Young Adult Literature

Literature of Social and Environmental Justice: Choose 1

ENGL 2400	Introduction to American Indian Literature
ENGL 3450	Women's Literature *
ENGL 3460	American Indian Literature
ENGL 3470	African American Literature *
ENGL 3490	Multicultural Literatures of the United States *
ENGL 3520	Queer Literature *
ENGL 3550	Literature and the Environment *
ENGL 3890	Postcolonial Literature

Historical Perspective Requirement. A minimum of 9 credits of coursework in Historical Perspective is required. This Requirement may overlap with the above requirements. Courses listed above with an * next to them or any of the courses in the following list can apply to this requirement.

ENGL 3600	Studies in American Literature to 1800
ENGL 3620	Studies in 19th Century American Literature
ENGL 3640	Studies in American Literature: 1900 to the Present
ENGL 3700	Shakespeare
ENGL 3730	Studies in British Literature: The Middle Ages
ENGL 3750	Studies in British Literature: The Restoration and 18th Century
ENGL 3760A	Studies in British Literature: Romantic
ENGL 3760B	Studies in British Literature: Victorian
ENGL 3930	The History of Children's Literature
ENGL 3950A	Study and Travel: Literature
ENGL 4200	History of the English Language

Minimum of 12 additional English Electives at the 2000, 3000, and 4000 level (does not include ENGL 2500). A total of 15 credits of major requirements must be at the 3000 level. A total of nine credits of major requirements must be at the 4000 level.

Total Credits **36**

English Major with Teacher Preparation Focus

All students preparing to become teachers need to complete the requirements of the major as laid out below and also complete the requirements of the Secondary Major in Education. including student teaching. English student teaching credits can apply toward the 4000 level courses requirement of the English major. Note: Teacher license requirements are established by the Iowa Department of Education and the Iowa Board of Educational Examiners and are subject to change. Recent changes may not be reflected in this catalog, but advisers and faculty will be aware.

Texts and Language: 15

ENGL 2250	Survey of British Literature to 1800
ENGL 2260	Survey of British Literature since 1800
ENGL 2270	Survey of American Literature to 1865
ENGL 2280	Survey of American Literature since 1865
ENGL 2600	Introduction to Literary Study

Advanced Communication: Choose 1 3

ENGL 3020	Business Communication
ENGL 3030	Free-Lance Writing for Popular Magazines
ENGL 3040	Creative Writing: Fiction
ENGL 3050	Creative Writing: Nonfiction
ENGL 3060	Creative Writing: Poetry
ENGL 3090	Proposal and Report Writing
ENGL 3130	Rhetorical Website Design
ENGL 3140	Technical Communication
ENGL 3150	Creative Writing: Screenplays
ENGL 3160	Creative Writing: Playwriting

Critical Reading and Textual Analysis: 9

ENGL 3100	Rhetorical Analysis
or ENGL 3390 Literary Theory and Criticism	
ENGL 3530	World Literature: Western Foundations through Renaissance
ENGL 3540	World Literature: Seventeenth Century to the Present

Literature of Social and Environmental Justice: Choose 1 3

ENGL 3450	Women's Literature
ENGL 3460	American Indian Literature
ENGL 3470	African American Literature

ENGL 3490	Multicultural Literatures of the United States
ENGL 3890	Postcolonial Literature
Language and Methods for Teachers 21	
ENGL 2190	Introduction to Linguistics
ENGL 2200	Descriptive English Grammar
ENGL 3960	Teaching the Reading of Young Adult Literature
ENGL 3970	Practice and Theory of Teaching Writing in the Secondary Schools
ENGL 4200	History of the English Language
EDUC 4260	Principles of Secondary Education
ENGL 4940	Practice and Theory of Teaching Literature in the Secondary Schools

Total Credits **51**

Complementary Coursework for Teacher Preparation

These courses, expected as part of the Teacher Preparation program, may also apply to college general education requirements. Some of the required coursework for the Secondary Major in Education may also apply.

Complementary Coursework 9

PSYCH 2300	Developmental Psychology
SPCM 2120	Fundamentals of Public Speaking
or THTRE 3580 Oral Interpretation	
And one course in American History or Government	

ESL Endorsement Requirements

At Iowa State University, ESL is an add-on endorsement, which means that students need to be certified in another area and to take all basic teacher preparation courses. The growing number of English learners in our public schools make the ESL endorsement a useful addition to a teaching license.

To add English as a Second Language, students must earn credits in the following courses. In some cases, relevant special topics courses or experimental courses may be substituted. Some courses have prerequisites. Endorsement requirements are established by the Iowa Department of Education and the Iowa Board of Educational Examiners and are subject to change. Recent changes may not be reflected in this catalog, but advisers and faculty will be aware.

ENGL 2190	Introduction to Linguistics	3
ENGL 2200	Descriptive English Grammar	3
ENGL 3220	Language and Society	3
or USLS 4200 Bilingualism & The Education of Latinx Youth		
or EDUC 5200 Bilingualism & The Education of Latinx Youth		

ENGL 3180 & ENGL 3240	Introduction to ESL methods and materials and Introduction to Teaching ESL Literacy (ENGL/ LING 3180, ENGL/LING 3240)	6
OR		
ENGL 3240 & ENGL 3250	Introduction to Teaching ESL Literacy and Teaching Methods for ESL Learners: Oral Communication Skills (ENGL/LING 3240, ENGL/ LING 3250)	6
ENGL 4250	Second Language Learning and Teaching	3
Practicum courses taken through the School of Education at ISU		
EDUC 3800S	Pre-Student Teaching Experience II: English as a Second Language (ESL)	1
EDUC 4800S	Pre-Student Teaching Experience III: English as a Second Language (ESL)	2

Reading Endorsement Requirements

At Iowa State University, the 5-12 reading endorsement is an add-on endorsement, which means that students need to be certified in another area and to take all basic teacher preparation courses. The reading endorsement is a useful addition to a teaching license.

To add a Reading Endorsement, students must earn credits in the following courses. In some cases, relevant special topics courses or experimental courses may be substituted. Some courses have prerequisites. Some courses may apply to both the English major and to the Reading Endorsement. Endorsement requirements are established by the Iowa Department of Education and the Iowa Board of Educational Examiners and are subject to change. Recent changes may not be reflected in this catalog, but advisers and faculty will be aware.

ENGL 2190 or LING 4710	Introduction to Linguistics Language and Reading Development in Children	3
EDUC 3950 or EDUC 5510	Teaching Disciplinary Literacy Assessment for Literacy and Learning	3
ENGL 3960 or EDUC 4590	Teaching the Reading of Young Adult Literature Critical Approaches to Teaching Children's and Adolescent Literature	3
ENGL 3970	Practice and Theory of Teaching Writing in the Secondary Schools	3
EDUC 4520/5520	Assessment for Literacy and Learning	3
EDUC 4560/5560 or EDUC 5530	Integrating Technology into Literacy Teaching Adolescent Readers with Reading Difficulties	3
ENGL 4940	Practice and Theory of Teaching Literature in the Secondary Schools	3
EDUC 4880/5880	Supervised Tutoring in Reading	3
Total Credits		24

English, B.A., B.S.

Freshman

Fall	Credits Spring	Credits
ENGL 1500	3 Social Science Choice	3
Humanities Choice	3 Natural Science Choice	3
Social Science Choice	6 Humanities Choice	3
World Language/Elective	3-4 Math Choice	3
LIB 1600	1 World Language/Elective	4
16-17		16

Sophomore

Fall	Credits Spring	Credits
ENGL 2500	3 Texts & Lang. Course 2000- level (Group A)*	3
Texts & Lang. Course 2000- level (Group A)*	3 Crit. Reading & Text. Analysis (Group B)*	3
Natural Science Group	3 Texts & Lang. Course 2000- level (Group A)*	3
Texts & Lang. Course 2000- level (Group A)*	3 Natural Science Choice	3
Humanities Choice	3 ENGL 3400s/3520 - U.S. Cultures and Communities*	3
LAS 2030	1	
16		15

Junior

Fall	Credits Spring	Credits
ENGL Advanced Communication (Group C)*	3 Crit. Reading & Text. Analysis (Group B)*	3
Texts & Lang. Course 2000- level (Group A)*	3 ENGL Elective 4000+ (Group D)*	3
ENGL Elective 3000+ (Group D)*	3 Electives/Courses in Minor	6
Elective/Course for Minor	3 ENGL Elective 3000+ (Group D)*	3
Humanities Choice	3	
15		15

Senior

Fall	Credits Spring	Credits
ENGL 4000+ (Group D)*	3 Electives	12
Electives	3 ENGL 4000+ (Grp D)	3
Electives/Course for Minor	6	
12		15

Total Credits: 120-121

* See English Advisor for a list of courses suited to major groups A, B, C, & D and other distributed requirements that must be met.

English, B.A. - English Education

Freshman

Fall	Credits Spring	Credits
ENGL 1500 (or waiver)	3 Humanities Choice	3
Humanities Choice	3 ENGL 2500	3
PSYCH 2300	3 EDUC 2190	1
POLS 1110	3 MATH 1040, 1050, 1500, STAT 1010, or STAT 1040 (or any Math higher than 1500)	3-4
or American History selection (HIST 2210 or 2220 or any HIST course with "U.S." or "American" in the course title)	World Language 1020 or waiver	4
World Language 1010 or waiver	4 EDUC 2040	3
LIB 1600	1	
	17	17-18

Sophomore

Fall	Credits Spring	Credits
ENGL 2200	3 Literature Survey – ENGL 2250-2280	3
ENGL 2600 (or ENGL 2010)	3 ENGL 3960	3
Natural Science Elective	3 ENGL 2190	3
Literature Survey – ENG 2250–2280	3 EDUC 2020	3
Humanities or Social Science Choice	3 ENGL 3100 or 3390	3
SPCM 2120 or THTRE 3580	3 or SPCM 3000+ course	
EDUC 2800L (Apply to Teacher Preparation Program)	0.5 LAS 2030	1
Maintain 2.5+ GPA		
	18.5	16

Junior

Fall	Credits Spring	Credits
EDUC 4060	3 PSYCH 3330 or EDUC 3330	3
Advanced Communication Choice	3 ENGL 3540	3
SPED 4010	3 ENGL 3970	3

Literature Survey – ENGL 2250-2280	3 ENGL 4200	3
EDUC 3950	3 Literature Survey – ENGL 2250-2280	3
Natural Science Elective	3 EDUC 3800A	1-2
	Apply to take English 4940	
	18	16-17

Senior

Fall	Credits Spring	Credits
ENGL 4940	3 ENGL 4170E	1-30
ENGL 3530	3	
Env/Soc Justice Literature elective-ENGL 3400 Series	3	
Natural Science Elective	3	
EDUC 4800E	2	
EDUC 4260	3	
Apply for Student Teaching		
	17	1-30

Total Credits: 120.5-151.5

English Minor Requirements

The minor in English prepares students in any discipline for which communication activities are needed to succeed in their professions. Minors in English will complete 15 credits beyond ENGL 1500 Critical Thinking and Communication and ENGL 2500 Written, Oral, Visual, and Electronic Composition. At least 9 credits must be numbered 2000 level or above, of which at least 6 credits are in courses numbered 3000 level or above. ENGL 2500 and additional courses require a grade of C or higher (not C-). Three credits must be taken at Iowa State. The minor must include at least 3 credits that are not used to meet any other department, college, or university requirement.

The English Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

GRADUATE STUDY

The Department of English offers graduate work leading to three Master of Arts degrees, one Master of Fine Arts degree, two Doctor of Philosophy degrees, and one TESL/TEFL Certificate. The department also offers two concurrent degree programs in which undergraduate students can earn a Master of Arts degree with one additional year of study. Information on application requirements and procedures for all majors is available on the Graduate Studies “How To Apply” (<https://engl.iastate.edu/academics/graduate-studies/how-to-apply/>) website.

The M.A. in English (<https://engl.iastate.edu/academics/graduate-studies/english/>) degree program offers advanced study of literature, film, research, writing, and the teaching of reading. Students admitted to the M.A. in English choose between two areas of specialization: (1) Literature or (2) Literature and the Teaching of Reading. These tracks prepare students for a variety of career paths, including teaching at the secondary or college levels, publishing, research, administration, and work in nonprofit sectors. For individuals interested in pursuing research at the Ph.D. level and/or teaching at the high school, college, or university level, the specialization in Literature provides excellent preparation through this program's small class sizes, research opportunities, and professionalization. The specialization in Literature and the Teaching of Reading is designed for licensed teachers who wish to take graduate literature courses and work toward a reading endorsement by taking three reading courses in Education.

The M.A. in Rhetoric, Composition, and Professional Communication (RCPC) (<https://engl.iastate.edu/academics/graduate-studies/rhetoric-composition-professional-communication/>) prepares students for careers as professional communicators, including careers in technical and business writing, UX design and web development, and technical editing. Graduates also are prepared to teach writing, including business and technical communication, at the postsecondary level. Students can choose to complete a thesis or one of two creative-component options.

The M.A. in TESL/Applied Linguistics (TESL/AL) (<https://apling.engl.iastate.edu/ma-program-in-tesl-applied-linguistics/>) prepares students for careers in teaching English to non-native speakers of English, either in the U.S. or abroad. Students with M.A. degrees in TESL teach adults and younger learners in a wide variety of contexts, supervise language programs, work for testing organizations, and create language teaching materials. Students admitted to the degree program can use their elective courses to pursue extended expertise in areas such as Computer-Assisted Language Learning, Language Assessment, English for Specific Purposes (ESP), or Corpus and Computational Linguistics. The M.A. in TESL/Applied Linguistics (<https://apling.engl.iastate.edu/ma-program-in-tesl-applied-linguistics/>) has a foreign language requirement that may be fulfilled in a number of ways. Students whose native language is other than English are considered to have met the language requirement after satisfying the Graduate College English requirement. For undergraduates at ISU, the M.A. in TESL/AL can also be completed through the concurrent degree option, which allows linguistics majors who meet admissions requirements to pursue an M.A. degree in TESL/AL with just one additional year of study.

The Master of Arts (M.A.) degree programs require a minimum of 30 hours of graduate credit, including a final thesis or creative component (3 credits).

The Master of Fine Arts (M.F.A.) program in Creative Writing and Environment (CWE) (<https://www.engl.iastate.edu/creative-writing/mfa-program-in-creative-writing-and-environment/>) cultivates in its students an interdisciplinary approach to research and writing. The program's unique design allows writers to develop a heightened environmental imagination that finds expression in quality, publishable works of fiction, nonfiction, poetry, and drama. The program is designed to prepare students for careers as writers, teachers, editors, and environmental educators. The M.F.A. degree requires 54 hours of graduate credit: a core of creative writing and other English courses, a book-length thesis (6 credits), experiential environmental fieldwork (3 credits), and 12 credits in disciplines other than English (such as Landscape Architecture, Anthropology, or Environmental Science, among many others) relevant to an individual student's research interests and thesis project.

The Doctor of Philosophy (Ph.D.) in Applied Linguistics and Technology (ALT) (<https://apling.engl.iastate.edu/ph-d-in-applied-linguistics-and-technology/>) focuses on English language description, teaching, learning, and assessment, with particular emphasis on issues and practices related to technology: analysis of language using computational and corpus linguistic methods as well as the study of computer technology in English language teaching, learning, assessment, and second language pronunciation. The degree prepares students for a variety of academic appointments in departments of applied linguistics and English and for professional opportunities in research and development, international publishing, and government agencies in the U.S. and around the world where English is taught and used for specific educational, vocational, and professional purposes. Candidates are required to complete 72 hours of graduate credit including a dissertation, to meet a foreign language requirement that may be fulfilled in a number of ways (students whose native language is other than English are considered to have met the language requirement after satisfying the Graduate College English requirement), and to pass a portfolio assessment, a preliminary examination (consisting of a dissertation proposal and an oral defense of the proposal), and an oral defense of the completed dissertation.

The Ph.D. in Rhetoric and Professional Communication (RPC) (<https://engl.iastate.edu/academics/graduate-studies/rhetoric-and-professional-communication-ph-d/>) applies rhetorical theory to the practice of written, oral, and visual communication in professional communities (e.g., industry and science) and in public spaces that frame deliberation, controversy, and communal identity. The degree prepares graduates for academic positions in rhetoric, in multimodal composition, and in business, professional, and technical communication, as well as for work in the private and public sectors as professional communication specialists, editors, designers, and communication managers. Candidates are required to complete 72 hours of graduate credit, including a dissertation, and to pass a portfolio assessment, a preliminary examination, and an oral defense of the dissertation.

A Graduate Certificate in Teaching English as a Second Language/ Teaching English as a Foreign Language (TESL/TEFL) (<https://apling.engl.iastate.edu/tesltefl-graduate-certificate/>) prepares students to teach English to non-native speakers of English either in the U.S. or abroad. It offers students grounding in the linguistic understanding of English and a flexible program of study with courses in teaching methodology, language assessment, and the use of technology to address students' language needs. This 12-credit program has two prerequisites, one core requirement, and three graduate course electives.

The department offers qualified graduate students an opportunity to gain professional experience through teaching and research assistantships, fieldwork and internships, and departmental research activities. Graduate teaching assistants are responsible for teaching, with faculty supervision, courses in ISUComm Foundation Courses, ISUComm Advanced Communication (business and technical communication), ISUComm Speech Communication, and English as a Second Language (ESL). Research assistants may be assigned to faculty members engaged in research projects. Various admissions awards are available as well: the Janet Anderson-Hsieh Scholarship is awarded each year to one Applied Linguistics and Technology doctoral student; one or more Pearl Hogrefe Fellowships in Creative Writing (<https://www.engl.iastate.edu/creative-writing/how-to-apply/pearl-hogrefe-fellowship-in-creative-writing/>), covering stipend and tuition, are awarded each year to outstanding graduate students; Freda Huncke Endowment Graduate Teaching Fellowships are awarded to select students each year.

The English Department offers minors in each of its graduate programs. A graduate minor at the M.A. level requires 9 credits of English at the 5000 or 6000 level in the respective major (English, RCPC, TESL/AL). A graduate minor within the M.F.A. program in Creative Writing and Environment requires an approved application and completion of 12 graduate credits of creative writing. A graduate minor at the Ph.D. level requires 12 credits at the 5000 or 6000 level in the respective major (ALT or RPC).

GRADUATE PROGRAM LEARNING OUTCOMES

M.A. in English

- Expand knowledge related to the study of literature and film that includes a diversity of authors/directors, genres, theories, and cultural-historical contexts.
- Communicate research effectively through oral and written presentations.
- Conduct independent scholarship in ways that consistently demonstrate ethical practice and professionalism.
- For graduate students who receive a teaching assistantship, develop strategies for the effective teaching of undergraduate students.

M.A. in Rhetoric, Composition, and Professional Communication

The RCPC program combines the pedagogy focus of a degree in rhetoric and composition with the technical skill and practicality of a degree in professional communication. Upon graduation, students will demonstrate the ability to

- Understand the interplay of rhetoric, composition, and professional communication in local and global contexts.
- Analyze a rhetorical situation and develop communication that responds to it effectively and ethically.
- Develop communication that helps build a socially just society.
- Use communication to contribute to an affirming and inclusive classroom/workplace environment.
- Apply the historical and theoretical understanding necessary to assess the use of specific communication technologies within complex organizations.
- Combine verbal and visual communication skills to produce effective communication in contemporary organizations.

Measures for evaluating a student's success in meeting these objectives includes:

- Achievement on coursework
- Familiarity with useful and common software programs and technologies
- Successful completion of a thesis or a creative-component project

M.A. in TESL/Applied Linguistics

- Demonstrate independence, reflective practices, and professionalism in teaching and assessment of English as a second language.
- Demonstrate knowledge of and confidence with the use of computer applications relevant to English language teaching.
- Formulate important research questions for guiding investigations that contribute to theory and practice in one or more areas of applied linguistics.
- Carry out research in one area of applied linguistics that will increase understanding of English language teaching.
- Evaluate research in the field to identify its contribution to theory, research, and practice in applied linguistics.
- Communicate ideas, discoveries, and findings to others in a professional and creative manner.
- Collaborate with other professionals to create and investigate new knowledge, practices, and products for English language teaching.

M.F.A. in Creative Writing and Environment

- Demonstrate understanding of craft and professional practice through coursework, workshops, and completion of refined imaginative literary manuscripts in multiple genres.
- Identify, research, and examine—through coursework, fieldwork, and literary practice—the natural world and the environmental imagination.
- Broaden and deepen understanding of literary and theoretical traditions of the major genres and the methodologies of craft analysis and practice.
- Broaden and deepen understanding of the cultural and natural environment through significant coursework in environmental courses available at Iowa State University both within and beyond the M.F.A. program and English department.
- Design, write, workshop, refine, and defend a significant body of publishable- or production-quality imaginative writing, including a full-length thesis manuscript, which demonstrates professional understanding and application of craft and technique, literary tradition, and the environmental imagination.
- Gain practical training and experience in creating and fostering a healthy literary community and sustaining a professional life in letters through teaching and research assistantships and internships, literary journal editorial internships and positions, as well as land stewardship, reading series, and other outreach opportunities.

Ph.D. in Applied Linguistics and Technology

- Demonstrate knowledge of and confidence with the use of computer applications relevant to teaching, learning, research, and assessment in applied linguistics.
- Design, implement, and evaluate algorithms for automating linguistic analysis tasks based on knowledge of natural language and speech processing programming.
- Formulate important research questions for guiding investigations that contribute to theory and practice in one or more areas of applied linguistics.
- Apply principles of research methodology to design data collection and analysis procedures to address research questions in at least one area of applied linguistics.
- Interpret and evaluate findings in view of their contribution to theory, research, and practice in the relevant area.
- Communicate ideas, discoveries, and findings to others in a professional and creative manner.
- Collaborate with other professionals to create and investigate new knowledge, practices, and products.
- Demonstrate independence and professionalism in teaching and research.

Ph.D. in Rhetoric and Professional Communication

At the time of graduation, RPC students will demonstrate an ability to

- Understand theories, research methods, and concepts in rhetoric, professional communication, and multimodal composition.
- Apply these theories, research methods, and concepts in scholarly activity, including research and teaching.
- Use a variety of technologies and media for scholarly research and for developing audience-centered communication.
- Analyze, synthesize, and critique communication in a variety of organizational and public contexts.
- Analyze, synthesize, and critique research related to rhetoric, professional communication, and multimodal composition.
- Develop scholarship that makes a significant contribution to the field.
- Develop communication that helps build a socially just society.

Measures for evaluating a student's success in meeting these objectives includes:

- Display of an ability to develop a clear and cogent argument using relevant evidence in coursework
- Annual reviews
- Qualifying examination (i.e., portfolio assessment)
- Preliminary exams (written and oral)
- Completion and defense of a dissertation

Graduate Certificate in TESL/TEFL

- Demonstrate growth in reflective practice and professionalism in English language teaching.
- Demonstrate metalinguistic knowledge of English structure and use.
- Evaluate research in the field to identify its contribution to English language teaching practice.
- Communicate and collaborate with others to achieve professional goals for English language teaching.

Environmental Science Interdepartmental Undergraduate Programs

Environmental Science provides an integrated, quantitative, and interdisciplinary approach to the study of environmental systems. The magnitude and complexity of environmental problems are creating a growing need for scientists with rigorous, interdisciplinary training in environmental science. The Environmental Science program is designed to prepare students for positions of leadership in this rapidly changing discipline. Environmental Science graduates have a solid foundation in biological and physical natural sciences and the specialized training necessary for integrated analysis of environmental systems.

Undergraduate Study

The Environmental Science undergraduate major is offered through both the College of Agriculture and Life Sciences and the College of Liberal Arts and Sciences. Environmental Science majors complete foundation courses in natural sciences and mathematics, plus a major consisting of an integrated core of Environmental Science courses and additional advanced course work in Environmental Science. Scientific rigor is stressed throughout the program, beginning with the foundation courses in the first two years of the curriculum. The upper level core courses emphasize a dynamic systems approach that provides a framework for integrating physical, chemical, and biological aspects of environmental systems. Beyond the required core, students select from a broad array of advanced courses to either develop greater breadth, or specialization in areas including, but not limited to, water resources, climate impacts and adaptation, environmental restoration and management, and geographic information systems (see <https://www.ensci.iastate.edu/> for additional information on areas of specialization).

Student Learning Outcomes

Environmental Science graduates should be able to:

Environmental foundations:

- explain physical and biological components, processes and interactions within ecosystems
- explain how human activities impact the environment and how societies are affected by environmental conditions

Integrated environmental analysis:

- demonstrate a broad understanding of environmental systems and issues utilizing an interdisciplinary framework
- demonstrate proficiency in data analysis and problem-solving of relevant environmental systems/problems
- use a systems approach to conduct integrated, quantitative, and interdisciplinary analyses and modeling of environmental systems and problems

Communication:

- communicate clearly and effectively to a range of audiences using appropriate written, oral, visual, and electronic techniques
- read, listen, observe and reflect effectively

Problem solving/critical thinking:

- apply a rational and objective approach to analyzing and interpreting information
- critically evaluate arguments

College of Liberal Arts and Sciences

<http://www.ensci.iastate.edu>

Students seeking an Environmental Science major complete the following:

1. A foundation of approved supporting courses in science and mathematics including biology, chemistry, earth science, physics, mathematics, and statistics.
2. 33 credits of course work in the major, including a required core of 21 credits.

A combined average grade of C or higher is required in courses applied in the major.

1. Environmental Science: 33 credits

ENSCI 1100	Orientation to Environmental Science	1
ENGL 2010	Introduction to Literature	3
ENSCI 2020	Exploration of Environmental and Sustainability Issues	1
ENSCI 2030	Exploration of Environmental Science	1
ENSCI 2500	Environmental Geography	3
ENSCI 2510	Biological Processes in the Environment	3
ENSCI 3120	Ecology	4
ENSCI 3180	Introduction to Ecosystems	3
ENSCI 3190	Analysis of Environmental Systems	3
Additional ENSCI choice courses		12
Total Credits		34

2. Mathematics & Statistics: 6-8 credits

Choose one of the following:		3-4
MATH 1040	Introduction to Probability	
MATH 1500	Discrete Mathematics for Business and Social Sciences	
MATH 1510	Calculus for Business and Social Sciences	
MATH 1600	Survey of Calculus	
MATH 1650	Calculus I	
COMS 1060	Introduction to Web Programming	
COMS 1070	Windows Application Programming	
DS 2010	Introduction to Data Science	
DS 2020	Data Acquisition and Exploratory Data Analysis	
Choose one of the following:		3-4
STAT 1010	Principles of Statistics	
STAT 1040	Introduction to Statistics	
Total Credits		6-8

3. Physical & Life Sciences: 21-24 credits

BIOL 2110	Principles of Biology I	3

Choose from one of the following:	5-6

CHEM 1630 & 1630L	College Chemistry and Laboratory in College Chemistry	

CHEM 1670 & 1670L	General Chemistry for Engineering Students and Laboratory in General Chemistry for Engineering	

CHEM 1770 & 1770L	General Chemistry I and Laboratory in General Chemistry I	

CHEM 2010 & 2010L	Advanced General Chemistry and Laboratory in Advanced General Chemistry	

Choose from one of the following:	3-4

CHEM 2310 & 2310L	Elementary Organic Chemistry and Laboratory in Elementary Organic Chemistry	

CHEM 3310 & 3310L	Organic Chemistry I and Laboratory in Organic Chemistry I	

BBMB 2210	Structure and Reactions in Biochemical Processes	

AGRON 2590	Organic Compounds in Plants and Soils	

Choose 3 of the following:	9

AGRON 1820	Introduction to Soil Science	

AGRON 2820	Soil Conservation and Land Use	

GEOL 1000	How the Earth Works	
or GEOL 2010	Geology for Engineers and Environmental Scientists	

MTEOR 2060	Introduction to Weather and Climate	

BIOL 2120	Principles of Biology II	

CHEM 1780 & 1780L	General Chemistry II and Laboratory in College Chemistry II	

PHYS 1150	Physics for the Life Sciences	
or PHYS 1310	General Physics I	

or PHYS 2310	Introduction to Classical Physics I	

Total Credits	20-22

4. Communications: 7-10 credits

ENGL 1500	Critical Thinking and Communication	3

ENGL 2500	Written, Oral, Visual, and Electronic Composition	3

LIB 1600	Introduction to College Level Research	1

Embedded communication coursework in ENSCI 2030 and ENSCI 3120		

Total Credits	7

Additional communication courses required of majors in the College of Agriculture and Life Sciences

Choose 1 of the following:	3

SPCM 2120	Fundamentals of Public Speaking	

AGEDS 3110	Presentation and Sales Strategies for Agricultural Audiences	

COMST 2140	Professional Communication	

Total Credits	3

5. General Education: 15-21 credits**Additional general education requirements in the College of Agriculture and Life Sciences**

Humanities	3

Social Science	3

Ethics	3

International Perspectives course from university approved list	3

U.S. Cultures and Communities course from university approved list	3

Total Credits	15

additional general education requirements in the College of Liberal Arts and Sciences

Arts and Humanities courses from college approved list	12

Social Science courses from college approved list	9

(Select courses to include 3 cr. of International Perspectives and 3 cr. of U.S. Cultures and Communities)

Students must have completed 3 years of a single world language in high school or take 4-8 credits of World Languages at the university level

LAS 2030	Professional Career Preparation	1

Total Credits	22

Electives (28-35 credits)

As majors in the College of Liberal Arts and Sciences, Environmental Science students must meet College of Liberal Arts and Sciences and University-wide requirements for graduation in addition to those stated above for the major.

LAS majors require a minimum of 120 credits, including a minimum of 45 credits at the 3000/4000 level. You must also complete the LAS world language requirement and career proficiency requirement.

Bachelor of Science B.S. (LAS)**Freshman**

Fall	Credits Spring	Credits
ENGL 1500	3 ENSCI 2030	1
ENSCI 1100 ¹	1 BIOL 2110	3
ENSCI 2010	2 BIOL 2110L (or elective)	1
ENSCI 2020	1 CHEM 1780	3
CHEM 1770	4 CHEM 1780L	1
CHEM 1770L	1 Mathematics, Programming, or Data Science choice	3-4
STAT 1010 or 1040	3-4 Arts and Humanities choice ²	3

LIB 1600	1	
16-17		15-16
Sophomore		
Fall	Credits Spring	Credits
ENSCI 2500 ¹	3 ENSCI 2510	3
Social science choice ²	3 Organic chemistry choice ³	3
ENGL 2500	3 Physical or Life Science choice ³	3
Physical or Life Science choice ³	3 Arts and humanities choice ²	3
Elective	1-2 Social science choice ²	3
LAS 2030	1 Summer: Consider field experience such as an internship or field station courses.	
14-15		15
Junior		
Fall	Credits Spring	Credits
ENSCI 3120	4 ENSCI 3180	3
Environmental science choice ¹	3 ENSCI 3190	3
Arts and humanities choice ³	3 Arts and humanities choice ²	3
Elective	3 Elective	3
Elective	1-2 Elective	3
	Summer: Consider field experience such as an internship or field station courses.	
14-15		15
Senior		
Fall	Credits Spring	Credits
Environmental science choice ¹	3 Environmental science choice ¹	3
Social science choice ²	3 Environmental science choice ¹	3
Electives	9 Electives	9
15		15

Students in all ISU majors must complete a 3 credits in U.S. Cultures and Communities and a 3 credits in International Perspectives. Check the Environmental Science website (<http://www.ensci.iastate.edu>) for a list of approved courses.

Minimum of 120 credits required, including a minimum of 45 credits at the 300/400 level.

¹ Students complete at least 32 credits in Environmental Science including ENSCI 1100, ENGL 2010, ENSCI 2500, ENSCI 3120, ENSCI 3180, ENSCI 3190 and 12 additional credits of approved ENSCI coursework.

² Students complete at least 12 credits in arts and humanities and 9 credits in social science from approved lists. These credits can also be used to meet the U.S. Cultures and Communities and International Perspectives requirements.

³ Students choose one course from the following Physical or Life Science related courses: AGRON 1820, AGRON 2820, BIOL 2120, CHEM 1780 & CHEM 1780L, GEOL 1000, GEOL 2010, MTEOR 2060, PHYS 1150, PHYS 1310, PHYS 2310. Students choose from one of the following Organic Chemistry options: CHEM 2310 & CHEM 2310L, CHEM 3310 & CHEM 3310L, BBMB 2210, or AGRON 2590.

Graduate Study

Contact information for the graduate program:

Lynette Edsall

camelot@iastate.edu (mstolt@iastate.edu)

515-294-1191

<https://ensci.iastate.edu/>

The Environmental Science graduate program offers an interdepartmental curriculum leading to M.S. and Ph.D. degrees with a major in Environmental Science. Faculty from the colleges of Agriculture and Life Sciences, Engineering, and Liberal Arts and Sciences cooperate to offer courses and research opportunities covering a broad array of environmental topics. Cooperating departments include Agricultural and Biosystems Engineering; Agronomy; Animal Science; Civil, Construction and Environmental Engineering; Ecology, Evolution and Organismal Biology; and Earth, Atmosphere, and Climate.

Applicants should have completed an undergraduate or master's degree in one of the biological, chemical, physical, or engineering sciences or should have equivalent preparation.

The Environmental Science Graduate Program emphasizes fundamental concepts and research, which at the same time address major environmental issues. The curriculum is designed to provide the interdisciplinary approach needed in environmental science education and research. In addition to work in their chosen area of specialization, students are afforded a broad exposure to the biological, chemical and physical aspects of environmental systems and the specialized training necessary for integrated analysis of these systems.

Information on application procedures, curriculum requirements, and faculty research areas is available on the Environmental Science Graduate Program website (<https://ensci.iastate.edu/>).

Environmental Studies

Environmental Studies

Interdepartmental Undergraduate Program

Environmental Studies deals with the relationship and interactions between humans and the environment. Students in any college at ISU may elect to take a secondary major or minor in Environmental Studies. The curriculum is designed to give students an understanding of current and emerging environmental issues and an appreciation of different perspectives regarding these issues. Courses are provided for students pursuing careers related to the environment and for others who simply want to know more about environmental issues.

The secondary major in Environmental Studies requires a total of 24 credits, including 1 course from the list of general survey courses, 1 course from the list of integrative/issues courses, and 2 courses from the list of human/societal perspectives courses. At least 12 credits must be 3000 level or above. At least 6 credits must be earned at ISU. Credits used to meet the secondary major requirements may also be used to satisfy the credit requirement of graduation and to meet credit requirements in courses numbered 300 or above.

Environmental Studies is a secondary major; students must meet all university-wide requirements for the Secondary Major.

Student Learning Outcomes

Upon graduation, students should be able to:

- Demonstrate a broad understanding and appreciation for a range of environmental issues spanning natural and human systems.
- Demonstrate an understanding and appreciation of different perspectives regarding environmental issues.
- Demonstrate an understanding of approaches used in addressing environmental problems including data analysis and problem-solving.

Secondary Major

The Environmental Studies secondary major is taken in addition to a primary major and provides the breadth of preparation and integrated perspective necessary to understand environmental issues. See the university-wide requirements for an explanation of secondary majors in the context of degree planning.

Students seeking a major in Environmental Studies complete 24 credits of ENVS coursework including:

At least one general survey course chosen from:

ENVS 1010	Environmental Geology: Earth in Crisis
ENVS 1200	Introduction to Renewable Resources
ENVS 1730	Environmental Biology
ENVS 2010	Introduction to Environmental Issues

At least one integrative/issues course chosen from:

ENVS 1600	Water Resources of the World
ENVS 2040	Biodiversity
ENVS 3240	Energy and the Environment
ENVS 3420	World Food Issues: Past and Present
ENVS 4040	Global Change
ENVS 4240	Sustainable and Environmental Horticulture Systems
ENVS 4500	Issues in Sustainable Agriculture

At least two human/societal perspectives courses chosen from:

ENVS 2700	Foundations in Natural Resource Policy and History
ENVS 2830	Introduction to Environmental Politics and Policies
ENVS 2930	Environmental Planning
ENVS 3200	Ecofeminism
ENVS 3340	Environmental Ethics
ENVS 3450	Population and Society
ENVS 3550	Literature and the Environment
ENVS 3630	U. S. Environmental History
ENVS 3800	Energy, Environmental and Resource Economics
ENVS 3820	Environmental Sociology
ENVS 4840	Sustainable Communities
ENVS 4910	Environmental Law and Planning

Beyond these three requirements, any Environmental Studies course and up to six credits of approved environmental coursework outside of Environmental Studies may be applied toward the 24-credit total for the major. Regardless of their home college, Environmental Studies majors must complete at least 9 credits in natural sciences from the LAS General Education approved course list. Unless prohibited by program or college rules, courses used to fulfill requirements of the Environmental Studies major may also be used to satisfy general education and other requirements of departments and colleges. A combined average grade of C or higher is required in courses applied to the major.

Minor

The minor in Environmental Studies requires a total of 15 credits, including 1 course from the list of general survey courses, 1 course from the list of integrative/issues courses, and 2 courses from the list of human/societal perspectives courses. At least 9 credits must be numbered 2000 level or above, of which at least 6 credits are in courses numbered 3000 level or above. At least 3 credits must be earned at ISU. At least 3 credits must be used only in the minor, the additional 12 credits can be used to satisfy other university, college, or major requirements. A

combined average grade of C or higher is required in courses applied to the minor,

Students will choose from the list of approved courses:

At least one general survey course chosen from:

ENVS 1010	Environmental Geology: Earth in Crisis
ENVS 1200	Introduction to Renewable Resources
ENVS 1730	Environmental Biology
ENVS 2010	Introduction to Environmental Issues

At least one integrative/issues course chosen from:

ENVS 1600	Water Resources of the World
ENVS 2040	Biodiversity
ENVS 3240	Energy and the Environment
ENVS 3420	World Food Issues: Past and Present
ENVS 4040	Global Change
ENVS 4240	Sustainable and Environmental Horticulture Systems
ENVS 4500	Issues in Sustainable Agriculture

At least two human/societal perspectives courses chosen from:

ENVS 2700	Foundations in Natural Resource Policy and History
ENVS 2830	Introduction to Environmental Politics and Policies
ENVS 2930	Environmental Planning
ENVS 3200	Ecofeminism
ENVS 3340	Environmental Ethics
ENVS 3450	Population and Society
ENVS 3550	Literature and the Environment
ENVS 3630	U. S. Environmental History
ENVS 3800	Energy, Environmental and Resource Economics
ENVS 3820	Environmental Sociology
ENVS 4840	Sustainable Communities
ENVS 4910	Environmental Law and Planning

Elective Environmental Studies Courses:

ENVS 1080	Introduction to Oceanography	3
ENVS 1110	Geological Disasters	1
ENVS 1300	Natural Resources and Agriculture	3
ENVS 1400	Climate and Society	3
ENVS 2200	Globalization and Sustainability	3
ENVS 2500	Environmental Geography	3
ENVS 3190	Analysis of Environmental Systems	3
ENVS 3900	Internship in Environmental Studies	1-30
ENVS 4070	Watershed Management	4

ENVS 4600	Controversies in Natural Resource Management	3
ENVS 4900	Independent Study	1-30

The Environmental Studies Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

Genetics

Genetics is the scientific study of heredity. Understanding the basis of heredity is fundamental to all aspects of the life sciences, from the most basic molecular study to applied studies of agricultural species. At Iowa State University the study of the life sciences is interdepartmental, involving faculty in the basic, agricultural, and veterinary sciences. Faculty in 20 different departments are involved in genetics research. This large group of faculty presents a broad range of possibilities for students to learn from faculty who are at the forefront of research in many areas of genetics.

UNDERGRADUATE STUDY

Undergraduate study in genetics is jointly administered by three departments: the Roy J. Carver Department of Biochemistry, Biophysics, and Molecular Biology; the Department of Genetics, Development, and Cell Biology; and the Department of Ecology, Evolution, and Organismal Biology. Undergraduate degrees are offered through both the College of Agriculture and Life Sciences and the College of Liberal Arts and Science. Programs of study for genetics majors leading to a B.S. degree are available.

Training in genetics may lead to employment in teaching, research, or a variety of health-related professions. Although some students find employment directly after their baccalaureate training, many students continue their education in graduate or professional programs. Students with the B.S. degree may find employment in the biotechnology, health, or food industries. Recent graduates have also developed careers in conservation biology, technical writing, science journalism, technical sales, and business.

The required course work and associated electives provide students with the foundation in basic life sciences, mathematics, chemistry, and physics that is essential for professions involving modern biological/ biomedical sciences. As part of these courses, students develop skills in problem solving, critical thinking, writing, and research-related activities in the biological sciences.

Specific entrance requirements for medical and health-related professions are established by the professional schools. Students interested in fulfilling pre-professional requirements for such professions as dentistry, human medicine, genetic counseling, optometry, pharmacy,

physical therapy, physician assistant, and veterinary medicine can major in genetics while fulfilling the pre-professional requirements.

Student Learning Outcomes:

Upon graduation, students earning the BS degree in Genetics are expected to have achieved the following skills and capabilities:

- Comprehensive, detailed understanding of the chemical basis of heredity.
- Comprehensive and detailed understanding of genetic methodology and how quantification of heritable traits in families and populations provides insight into cellular and molecular mechanisms.
- Understanding of how genetic concepts affect broad societal issues including health and disease, food and natural resources, environmental sustainability, etc.
- Understanding the role of genetic mechanisms in evolution.
- The knowledge required to design, execute, and analyze the results of genetic experimentation in animal and plant model systems.
- The ability to recognize the experimental rationale of genetic studies as they are described in peer-reviewed research articles and grant proposals to federal and other funding agencies.
- The ability to evaluate conclusions that are based on genetic data.
- Insight into the mathematical, statistical, and computational basis of genetic analyses that use genome-scale data sets in systems biology settings.
- Understanding the role of genetic technologies in industries related to biotechnology, pharmaceuticals, energy, and other fields.
- Communication skills required in the discipline including oral presentations of research data, published research articles, grant proposals, and poster presentations at conferences.
- Teamwork and leadership skills including group analysis of data, working together in the research laboratory, joint compositions of written reports, substantive participation in research group meetings, etc.

CURRICULUM IN GENETICS - REQUIREMENTS

Total Degree Requirement: 120 cr.

A maximum of 65 cr. from a two-year institution can be applied that may include up to 16 technical cr.; up to 9 Pass-Not Pass cr. of free electives can be applied; a cumulative GPA of at least 2.0 is required for graduation. Program-approved lists can be found on the Genetics website.

1. Genetics and Life Sciences

A grade of C- or better is required in all Genetics and Life Science courses.

A. Courses required of all Genetics majors

GEN 1100	Genetics Orientation	1
BIOL 2110	Principles of Biology I	3
BIOL 2110L	Principles of Biology Laboratory I	1
BIOL 2120	Principles of Biology II	3
BIOL 2120L	Principles of Biology Laboratory II	1
GEN 3130	Principles of Genetics	3
GEN 3130L	Genetics Laboratory	1
BIOL 3140	Principles of Molecular Cell Biology	3
BIOL 3150	Biological Evolution	3
One of the following:		3-4
GEN 3220	Introduction to Bioinformatics and Computational Biology	
GEN 3490	The Genome Perspective in Biology	
BCBIO 4060	Bioinformatics of OMICS	
GEN 4090	Molecular Genetics	3
GEN 4100	Analytical Genetics	3
One of the following:		3
GEN 4620	Evolutionary Genetics	
EEOB 5610	Evolutionary and Ecological Genomics	
EEOB 5630	Molecular Phylogenetics	
GEN 4910	Undergraduate Seminar, Professional Practice in Genetics Disciplines	1
MICRO 3020	Biology of Microorganisms	3
Total Credits		35-36

B. Course required of majors in the College of Agriculture and Life Sciences only

A minimum of 3 cr. of coursework in the area of environmental science from program approved list	3
Total Credits	3

2. Advanced Sciences Electives: 6 cr. from program approved list

A grade of C- or better is required in each course. No more than 3 cr. of GEN 4900, 4900R, 4900H, 4920, 4960, 4990, or 4990H may be used to meet this requirement.

3. Mathematical Sciences

Complete at least one calculus course from MATH, minimum of 4 credits.		4
MATH 1600	Survey of Calculus	
MATH 1650	Calculus I	
Complete at least one course from STAT, minimum of 3 credits.		3-4
STAT 1010	Principles of Statistics	

STAT 1040	Introduction to Statistics	
Complete at least one additional course from MATH or STAT, minimum of 4 credits.		4
MATH 1660	Calculus II	
STAT 3010	Intermediate Statistical Concepts and Methods	

Total Credits 11-12

4. Supporting Sciences

CHEM 1770	General Chemistry I	4
CHEM 1770L	Laboratory in General Chemistry I	1
CHEM 1780	General Chemistry II	3
CHEM 1780L	Laboratory in College Chemistry II	1
CHEM 3310	Organic Chemistry I	3
CHEM 3310L	Laboratory in Organic Chemistry I	1
CHEM 3320	Organic Chemistry II	3
CHEM 3320L	Laboratory in Organic Chemistry II	1
PHYS 1310	General Physics I	4
PHYS 1310L	General Physics I Laboratory	1
PHYS 1320	General Physics II	4
PHYS 1320L	General Physics II Laboratory	1

Choose one of the following options 6-7

Option 1

BBMB 4040	Biochemistry I	
And one of the following:		
BBMB 4050	Biochemistry II	
BBMB 4110	Techniques in Biochemical Research	
CHEM 2110 & 2110L	Quantitative and Environmental Analysis and Quantitative and Environmental Analysis Laboratory	
CHEM 3250	Chemical Thermodynamics	

Option 2

BBMB 4200	Mammalian Biochemistry	
And one of the following:		
BBMB 4110	Techniques in Biochemical Research	
CHEM 2110 & 2110L	Quantitative and Environmental Analysis and Quantitative and Environmental Analysis Laboratory	
CHEM 3250	Chemical Thermodynamics	

Total Credits 33-34

5. International Perspectives: 3 cr. from university approved list

This course can satisfy **both** the university requirement for International Perspectives and the college requirement for a General Education elective (item 8) if the selection appears on both lists of approved courses.

6. U.S. Cultures and Communities: 3 cr. from university approved list

This course can satisfy **both** the university requirement for U.S. Cultures and Communities and the college requirement for a General Education elective (item 8) if the selection appears on both lists of approved courses.

7. Communications/Information Literacy

A. Courses required of all Genetics majors

Grades of C or better are required in ENGL 2500 and advanced writing. (The College of Agriculture and Life Sciences requires a C or better in ENGL 1500, as well.)

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
or ENGL 2500H Written, Oral, Visual, and Electronic Composition: Honors		
LIB 1600	Introduction to College Level Research	1
One advanced English writing course from program approved list		3

Total Credits 10

B. Course required of majors in the College of Agriculture and Life Sciences only.

A grade of C or better is required by the college.

SPCM 2120	Fundamentals of Public Speaking	3
or AGEDS 3110 Presentation and Sales Strategies for Agricultural Audiences		

Total Credits 3

C. Course required of majors in the College of Liberal Arts and Sciences only.

LAS 2030	Professional Career Preparation	1

8. General Education electives

Courses from college approved lists that also appear on university approved lists of U.S. Cultures and Communities or International Perspectives courses can be used to satisfy both requirements.

A. College of Agriculture and Life Sciences

Humanities course from college approved list		3
Social Science course from college approved list		3

Ethics course from college approved list	3
Total Credits	9

B. College of Liberal Arts and Sciences

Humanities courses from college approved list; one of these should be a Science/Humanities bridge course from program approved list

Social Science courses from college approved list	9

Students must have completed 3 years of a single world language in high school or take 4-8 credits of World Languages at the university level.

Total Credits	21

As majors in the College of Liberal Arts and Sciences, Genetics (LAS) students must meet College of Liberal Arts and Sciences and University-wide requirements for graduation in addition to those stated above for the major.

LAS majors require a minimum of 120 credits, including a minimum of 45 credits at the 300/400 level. You must also complete the LAS world language requirement and career proficiency requirement.

Students in all ISU majors must complete a three-credit course in U.S. Cultures and Communities and a three-credit course in International Perspectives. Check (<http://www.registrar.iastate.edu/courses/div-ip-guide.html>) for a list of approved courses. Discuss with your advisor how the two courses that you select can be applied to your graduation plan.

Genetics, B.S.

Freshman

Fall	Credits	Spring	Credits
GEN 1100		1 BIOL 2110	3
BIOL 2120		3 BIOL 2110L	1
BIOL 2120L		1 CHEM 1780	3
CHEM 1770		4 MATH/ STAT or college requirement choice	3-4
CHEM 1770L		1 ENGL 2500 or college requirement choice	3
MATH/ STAT choice		3-4 LIB 1600	1

ENGL 1500
or 2500

3 (or
semester 1
with ENGL
2500)

LIB 1600

1 Consider
Research

(if taking
ENGL
2500)

17-18

15-17

Sophomore

Fall	Credits	Spring	Credits	Summer	Credits
BIOL 3130		3 BIOL 3140		3 Consider Internship, Study Abroad	
BIOL 3130L		1 CHEM 3320		3	
CHEM 3310		3 CHEM 3320L		1	
CHEM 3310L		1 MICRO 3020 or BIOL 3150 (or Bioinformatics/ Genomics Choice)		3	
College requirement or Elective		3 MATH/ STAT or college requirement choice		3-4	
MATH/ STAT choice		3-4 College Requirement or Elective		3	

14-15

16-17

0

Junior

Fall	Credits	Spring	Credits
GEN 4090		3 GEN 4100	3
BBMB 4040*		3 PHYS 1320 or 2320*	4
PHYS 1310 or 2310*		4 PHYS 1320L or 2320L*	1
PHYS 1310L or 2310L*		1 BBMB 4050*	3

MICRO 3020 or BIOL 3150 (or Bioinformatics/ Genomics Choice)	3 MICRO 3020 or BIOL 3150 (or Bioinformatics/ Genomics Choice)	3
College Requirement or Elective	3 GEN 4910	1

17 15

Senior

Fall	Credits	Spring	Credits
GEN 4620		3 Advanced Science Elective(s)	3-6
Advanced science elective or STAT 3010		3-4 College Requirement or Elective	3
College Requirement or Elective		1-6 Elective or STAT 3010	3-4
Advanced Writing (ENGL 3020-316)		3 College Requirement or Elective	3
10-16		12-16	

Total Credits: 116-131

* Summer: Students taking the MCAT need to have completed biochemistry and physics by this time. Others can complete during the senior year.

Undergraduate Minor

The minor in Genetics may be earned by completing the following courses. At least 3 cr. must be used **only** to fulfill the requirements of the minor and not be applied to any other major, college, or university requirement.

GEN 3130	Principles of Genetics	3
GEN 3130L	Genetics Laboratory	1
BIOL 3140	Principles of Molecular Cell Biology	3
GEN 4100	Analytical Genetics	3
GEN 4090	Molecular Genetics	3

Two or more additional credits in Genetics at the 3000 level or above. 2

Total Credits 15

Geology

The Bachelor of Science major in Geology prepares students for a professional career and/or graduate study in the geological sciences. Graduates work to understand natural processes on Earth and other planets. They are able to apply their knowledge of physical and chemical processes that shape the Earth to reconstruct past environments and anticipate future problems. Graduates provide essential information for solving problems for resource management, environmental protection, and public health, safety, and welfare. They work as consultants on engineering and environmental problems, explorers for new minerals, hydrocarbon resources, and CO₂ storage, researchers, staff members in state and U.S. geological surveys, government regulators, teachers, writers, editors, and museum curators. Graduates can collect, integrate, interpret, and communicate complex data from the field and laboratory.

Geology as an Additional Major: Geology as an additional major is available to all students on campus. The Geology program has identified the core of 30 credits of geology and 27 credits of required supporting courses to earn an additional major in geology. Supporting course substitutions can be made for students whose primary program of study includes courses similar in nature. Students should work closely with their advisors in each department to ensure that all requirements are met. Geology as an additional major prepares students for careers or graduate study in the geosciences.

Student Learning Outcomes

Upon graduation, students should be able to:

- Demonstrate the ability to think critically.
- Exhibit a broad understanding of Earth systems and processes.
- Demonstrate scientific literacy and its application to scientific inquiry and societal concerns.
- Demonstrate proficiency in data collection, management, and analysis including understanding sources of error and/or uncertainty.
- Demonstrate competency with geoscience-specific techniques and field methods.
- Read and critically evaluate relevant literature and information.
- Use appropriate tools from chemistry, physics, biology, mathematics, and data science to solve discipline-specific problems.
- Present information effectively in written and oral forms.
- Work in a team environment in alignment with the ISU principles of community.
- Work independently.

- Attain employment in the geosciences or related fields or pursue graduate studies.

Combined Degrees: A concurrent program is offered which combines a Bachelor of Science degree in geology and a Master of Science degree in geology.

Geology

Required courses for B.S. in Geology include:

GEOL 1000	How the Earth Works	3
or GEOL 1010	Environmental Geology: Earth in Crisis	
or GEOL 2010	Geology for Engineers and Environmental Scientists	
GEOL 1000L	How the Earth Works: Laboratory	1
GEOL 3020	Summer Field Studies	6
GEOL 2020	History of the Earth	3
GEOL 2020L	History of the Earth: Laboratory	1
GEOL 3150	Mineralogy and Earth Materials	3
GEOL 3150L	Laboratory in Mineralogy and Earth Materials	1
GEOL 3560	Structural Geology and Tectonics	4
GEOL 3570	Geological Mapping and Field Methods	1
GEOL 3650	Igneous and Metamorphic Petrology	3
GEOL 3680	Sedimentary Geology	4
GEOL 4790	Surficial Processes	3
And 9 credits of geology electives at the 3000+ level.		9
Total Credits		42

No more than 9 credits in 4900 may be counted toward a degree in Geology.

Required supporting courses include:

MATH 1650	Calculus I	4
MATH 1660	Calculus II	4
CHEM 1770	General Chemistry I	4
CHEM 1770L	Laboratory in General Chemistry I	1
CHEM 1780	General Chemistry II	3
CHEM 1780L	Laboratory in College Chemistry II	1
PHYS 1310	General Physics I	4
PHYS 1310L	General Physics I Laboratory	1
PHYS 1320	General Physics II	4
PHYS 1320L	General Physics II Laboratory	1
And 3 additional credits of either geology electives or courses from an approved departmental list of science, engineering, and mathematical disciplines outside of geology.		3
Total Credits		30

Communication Proficiency requirement: According to the university-wide Communication Proficiency Grade Requirement, students must demonstrate their communication proficiency by earning a grade of C or better in ENGL 2500. The department requires a grade of C or better in ENGL 3090 or ENGL 3140.

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
or ENGL 2500H	Written, Oral, Visual, and Electronic Composition: Honors	
One of the following:		3
ENGL 3090	Proposal and Report Writing	
ENGL 3140	Technical Communication	
Total Credits		9

As majors in the College of Liberal Arts and Sciences, Geology students must meet College of Liberal Arts and Sciences and University-wide requirements for graduation in addition to those stated above for the major.

Students in all ISU majors must complete a three-credit course in U.S. Cultures and Communities and a three-credit course in International Perspectives. Check (<http://www.registrar.iastate.edu/courses/div-ip-guide.html>) for a list of approved courses. Discuss with your advisor how the two courses that you select can be applied to your graduation plan.

LAS majors require a minimum of 120 credits, including a minimum of 45 credits at the 3000/4000 level. At least 8 credits in the major from 3000+ courses must earn grade C or better. The average GPA of all courses in the major must be 2.0 or higher. You must also complete the LAS world language requirement and LAS career proficiency requirement.

Geology as an Additional Major: The requirements for the Geology Additional Major are the required courses in geology listed below including the required supporting courses. The additional major is available to all students. Supporting course substitutions can be made for students whose primary program of study includes courses similar in nature. Sample four-year plans for Geology as an additional major with primary majors in materials engineering, civil engineering, environmental science, meteorology, or biology are available. Please consult the department website or contact the current program head for more information.

Required courses in Geology as an Additional Major:

GEOL 1000	How the Earth Works	3
or GEOL 1010	Environmental Geology: Earth in Crisis	
or GEOL 2010	Geology for Engineers and Environmental Scientists	
GEOL 1000L	How the Earth Works: Laboratory	1
GEOL 3020	Summer Field Studies	6

GEOL 2020	History of the Earth	3
GEOL 2020L	History of the Earth: Laboratory	1
GEOL 3150	Mineralogy and Earth Materials	3
GEOL 3150L	Laboratory in Mineralogy and Earth Materials	1
GEOL 3560	Structural Geology and Tectonics	4
GEOL 3570	Geological Mapping and Field Methods	1
GEOL 3650	Igneous and Metamorphic Petrology	3
GEOL 3680	Sedimentary Geology	4
Total Credits		30

At least 8 credits in the major from 3000+ courses must earn grade C or better. The average GPA of all courses in the major must be 2.0 or higher.

Required supporting courses include:

MATH 1650	Calculus I	4
MATH 1660	Calculus II	4
CHEM 1770	General Chemistry I	4
CHEM 1770L	Laboratory in General Chemistry I	1
CHEM 1780	General Chemistry II	3
CHEM 1780L	Laboratory in College Chemistry II	1
PHYS 1310	General Physics I	4
PHYS 1310L	General Physics I Laboratory	1
PHYS 1320	General Physics II	4
PHYS 1320L	General Physics II Laboratory	1
Total Credits		27

FOUR YEAR PLAN

Below is a suggested pathway for new majors. This plan is an example only; students should discuss their graduation plan with their advisor.

Geology, B.S.

Freshman

Fall	Credits	Spring	Credits
GEOL 1120	1	GEOL 1130	1
GEOL 1000 or 1010	3	GEOL 2020	3
GEOL 1000L	1	GEOL 2020L	1
CHEM 1770	4	CHEM 1780	3
CHEM 1770L	1	CHEM 1780L	1
ENGL 1500	3	MATH 1650	4
Social Science Choice	3	Arts & Humanities Choice	3
16		16	

Sophomore

Fall	Credits	Spring	Credits
GEOL 3150	3	GEOL 3650	3
GEOL 3150L	1	PHYS 1310	4
MATH 1660	4	PHYS 1310L	1
ENGL 2500	3	Advanced Geology Elective Choice	3
LIB 1600	1	LAS 2030	1
International Perspectives Choice	3	U.S. Cultures and Communities Choice	3
15		15	

Junior

Fall	Credits	Spring	Credits	Summer	Credits
GEOL 3680	4	GEOL 3560	4	GEOL 3020	6
GEOL 3570	1	Advanced Geology Elective Choice ¹	3		
PHYS 1320	4	ENGL 3090 or 3140	3		
PHYS 1320L	1	Social Science Choice	3		
Arts & Humanities Choice	3				
13		13		6	

Senior

Fall	Credits	Spring	Credits
GEOL 4790	3	Advanced Geology Elective Choice ¹	3
Advanced Geology Elective Choice ¹	3	Social Science Choice (3000+ level)	3

Arts & Humanities Choice (3000+ level)	3 Arts & Humanities Choice	3
World Language 1010 Choice	4 World Language 1020 Choice/Elective	4
13		13

Total Credits: 120

¹ Choose from list of approved courses available from an advisor or the departmental office.

Students may double-count some courses to complete the degree requirements in 120 credits.

Minor - Geology

A minor in Geology may be earned by taking 15 credits of geology coursework, including:

GEOL 1000	How the Earth Works	3
or GEOL 2010	Geology for Engineers and Environmental Scientists	
or GEOL 1010	Environmental Geology: Earth in Crisis	
GEOL 1000L	How the Earth Works: Laboratory	1
GEOL 2020	History of the Earth	3
GEOL 2020L	History of the Earth: Laboratory	1

The remainder of the coursework should be at the 3000 level or above. The minor must include at least 3 credits that are not used to meet any other department, college, or university requirement.

The Geology Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

Concurrent Undergraduate and Graduate Programs

A concurrent program is offered which combines a Bachelor of Science degree in geology and a Master of Science degree in geology. This program gives well-qualified Iowa State juniors and seniors the opportunity to begin working on the M.S. degree before completing the B.S. degree, reducing by at least one year the normal time period necessary to complete both degrees separately. Additionally, a concurrent program exists that gives highly motivated and career-focused students the opportunity to receive a Bachelor of Science in geology and an

M.B.A. (Master of Business Administration). Review the department website (<https://ge-at.iastate.edu/>) or contact Dr. Cinzia Cervato for more information regarding these programs.

Graduate Study

The department offers programs leading to the Master of Science and Doctor of Philosophy with majors in Geology, Earth Science, and Meteorology. Students desiring a major in the above fields normally will have a strong undergraduate background in the physical and mathematical sciences. Individuals desiring to enter a graduate program are evaluated by considering their undergraduate preparation and performance along with their expressed goals in the statement of purpose. All prospective students should reach out to individual faculty members who they wish to work with prior to applying.

Programs of study are designed on an individual basis in accordance with requirements of the Graduate College and established requirements for each departmental major. Additional coursework is normally taken in complementary areas such as aerospace engineering, agronomy (soil science), chemistry, civil and construction engineering, computer engineering, computer science, engineering mechanics, environmental science, materials engineering, mathematics, mechanical engineering, microbiology, physics, or statistics. Departmental requirements provide a strong, broad background in the major and allow considerable flexibility in the program of each individual.

A dissertation is required of all Ph.D. candidates.

M.S. students in Geology are required to complete a thesis. The M.S. in Earth Science is available to students electing the non-thesis (Creative Component) option in Geology or Meteorology.

Graduates in Geology specialize in a subdiscipline, but they comprehend and can communicate the basic principles of geology and supporting sciences. They possess the capacity for critical and independent thinking. They are able to write a fundable research proposal, evaluate current relevant literature, carry out the proposed research, and communicate the results of their research to peers at national meetings and to the general public. They work as consultants on engineering and environmental problems, explorers for new minerals and hydrocarbon resources, researchers, teachers, writers, editors, and museum curators.

History Overview

The History department offers Bachelor of Arts and Bachelor of Science degrees in History, a Master of Arts degree in History, and a Ph.D. in Rural, Agricultural, Technological and Environmental History. Many history majors also pursue a minor in another discipline, a second major, or secondary teacher certification.

The department offers a variety of survey courses (2000 series) for first- and second-year students as either general education courses or as introductions to advanced courses in history or other subject areas. In addition to 2000-level survey courses, it offers advanced undergraduate courses in the history of Europe, Asia, Africa, Latin America, the United States, technology and science, agriculture, and other selected topics.

Student Learning Outcomes

Upon graduation, students should be able to:

- 1. Display the appropriate level of cognitive knowledge of historical themes and events based upon the student’s course of study.
- 2. Display an understanding of past cultures and social organizations, based on the course of study.
- 3. Develop the fundamental methodological skills of the historical craft: the ability to contextualize and analyze primary source evidence; familiarity with the concepts of historical argument and interpretation, and the ability to formulate effective argumentation in written and oral forms; awareness of the basic historiography in selected research area; and the ability to conduct research and to write a historical essay based upon primary and secondary source research. Students receive an introduction to these concepts in HIST 3010 The Historian’s Toolbox.
- 4. Display a sophisticated understanding of the relationship between past events and the present. For purposes of outcomes assessment, History majors must complete three credits from the following list: HIST 4950 Historiography and Research Writing; if qualified and willing, one graduate-level research seminar; or if qualified and pursuing teacher certification HIST 4980 Methods of Teaching History/Social Sciences.

Requirements for the History Major

The B.S. in History requires a minimum 36 total credits of HIST with 2.0 GPA or higher *including*:

- 1. Maximum 12 credits at 2000-level HIST or below
- 2. Minimum 24 credits 3000+ level HIST *including*:
- 3. HIST 3010 (minimum grade C)
- 4. HIST 4950, HIST 4980, or HIST graduate-level research seminar (minimum grade C)
- 5. Maximum 12 credits 3000-level HIST in addition to HIST 3010
- 6. Minimum 9 credits 4000-level HIST in addition to HIST 4950, HIST 4980 or HIST graduate-level research seminar
- 7. Minimum 15 credits 3000+ level HIST taken at Iowa State University

Communication Proficiency requirement: History majors must receive a grade of C or better in ENGL 2500 (or ENGL 2500H), HIST 3010 and HIST 4950 or HIST 4980.

The B.A. in History requires the equivalent of 2 years of college-level study in the same world language. Six credits of electives may be replaced by 6 additional credits of world language.

Students in all ISU majors must complete a three-credit course in U.S. Cultures and Communities and a three-credit course in International Perspectives. Check (<http://www.registrar.iastate.edu/courses/div-ip-guide.html>) for a list of approved courses. Discuss with your advisor how the two courses that you select can be applied to your graduation plan.

LAS majors require a minimum of 120 credits, including a minimum of 45 credits at the 3000/4000 level. For a history major, 15 credits of history at the 3000/4000-level must be taken at ISU. You must also complete the LAS world language and career proficiency requirements (LAS 2030 Professional Career Preparation).

As majors in the College of Liberal Arts and Sciences, History students must meet College of Liberal Arts and Sciences and University-wide requirements for graduation in addition to those stated for the major.

Teacher Preparation Focus

History majors seeking teacher certification in History/Social Sciences Education must meet all of the requirements of the History major while taking the specific History classes required for certification by the State of Iowa. Students must also meet the requirements of the Secondary Major in Education including student teaching. Students will complete the requirements below, earning a minimum grade of B- in all content courses used for licensure and a minimum grade of C in all other required courses.

Also, students complete the requirements for one additional fifteen-credit endorsement in Political Science, Psychology, Economics, Anthropology or Sociology. Specific requirements of each endorsement are available from the history department. Teacher license requirements are established by the Iowa Department of Education and the Iowa Board of Educational Examiners and are subject to change. Recent changes may not be reflected in this catalog, but advisers and faculty will be aware.

Requirements to complete endorsements in American History and World History.

HIST 2010	Introduction to Western Civilization I	3
HIST 2020	Introduction to Western Civilization II	3
One World History pre-1500		3
HIST 3040	Cultural Heritage of the Ancient World	
	or HIST 3310History of the Islamic World to 1800	
	or HIST 3740Sex, Gender, and Culture in the Ancient Mediterranean World	
	or HIST 3840Roman Italy: An Introduction	
	or HIST 3850Study Abroad: Roman Italy: Building the Empire	

or HIST 4020	Greek Civilization	
or HIST 4030	Roman Civilization	
or HIST 4050	Transformations of the Early Medieval World	
or HIST 4060	The Birth of Europe in the High Middle Ages	
or HIST 4070	Crises of the Late Middle Ages	
or HIST 4210	History of Russia I	
One European World post-1500		3
HIST 3200	History of Modern Europe, 1789 to Present	3-4
or HIST 3250	Society and Politics in England, 1525-1700	
or HIST 3820	History and Philosophy of the Scientific Revolution	
or HIST 3830	Technology, Public Science, and European Culture, 1715-Present	
or HIST 3900	World Military History	
or HIST 4100	The Holocaust in History	
or HIST 4140	European Cultural and Intellectual History	
or HIST 4190	History of Modern France	
or HIST 4200	France's Revolutionary Century, 1715-1815	
or HIST 4220	History of Russia II	
or HIST 4230	The Russian and Soviet Mind: Intellectual and Cultural Life, 1762-1991	
or HIST 4240	History of Modern Germany	
or HIST 4270	Crime and Policing in England 1550-1850	
or HIST 4280	Punishment, Mentalities, and Society in England, 1550-1868	
or HIST 4290	Monstrous London: London's Histories 1500-1800	
or HIST 4310	Modern England	
or HIST 4890	The World at War	
One Non-European World post-1500		3
HIST 3110	Africa under Colonial Rule	
or HIST 3100	Africa to 1880	
or HIST 3310	History of the Islamic World to 1800	
or HIST 3360	Ancient China	
or HIST 3370	Modern China	
or HIST 3390	US-Asian Relations	
or HIST 3400	Colonial Latin America	
or HIST 3410	Modern Latin America	
or HIST 4350	History of the Modern Middle East	
or HIST 4410	History of Modern Mexico and Central America	
or HIST 4420	Rebellions and Revolutions in Latin America	
or HIST 4790	China and the Cold War	
or HIST 4960	Advanced Topics in History: Global	
HIST 2210	Survey of United States History I	3
HIST 2220	Survey of United States History II	3

Nine additional credits of U.S. History at the 3000 level and above		9
HIST 3070	American Popular Culture	
or HIST 3390	US-Asian Relations	
or HIST 3530	History of African Americans I	
or HIST 3540	History of African Americans II	
or HIST 3570	American Family History	
or HIST 3630	U. S. Environmental History	
or HIST 3650	American Agriculture I: The Maya to McCormick's Reaper	
or HIST 3660	American Agriculture II: Homestead Act to GMOs	
or HIST 3670	America Eats	
or HIST 3700	History of Iowa	
or HIST 3710	Mexican American History	
or HIST 3720	Latina/o History	
or HIST 3800	History of Women in Science, Technology, and Medicine	
or HIST 3860	History of Women in America	
or HIST 3870	First Ladies in U.S. History	
or HIST 3890	American Military History	
or HIST 3910	American Diplomatic History	
or HIST 3960	Topics in History: U.S. and North America	
or HIST 4490	US Gilded Age, 1877-1900	
or HIST 4500	Colonial America	
or HIST 4510	American Revolutionary Era	
or HIST 4530	Law and Society in U.S. History: Crime, Race, Family, Work and Property	
or HIST 4540	Early American Republic	
or HIST 4550	U.S. Civil War and Reconstruction Era	
or HIST 4570	History of American Sexualities	
or HIST 4580	U.S. 1900 to 1945	
or HIST 4590	U.S. 1945 to the Present	
or HIST 4600	The Great Plains	
or HIST 4610	The American South	
or HIST 4650	The American West	
or HIST 4730	Civil Rights and Ethnic Power	
or HIST 4820	Birth, Death, Medicine, and Disease	
or HIST 4880	American Stuff, Colonial Times to the Present	
or HIST 4890	The World at War	
or HIST 4960	Advanced Topics in History: U.S. and North America	
HIST 3010	The Historian's Toolbox	3
EDUC/HIST 4980	Methods of Teaching History/Social Sciences	3
Total Credits		39-40

Complementary Coursework for History Social Studies Teacher Preparation

EDUC 4260	Principles of Secondary Education	3
PSYCH 2300	Developmental Psychology	3
POLS 1110	Introduction to American Government	3
POLS 1210	Introduction to International Politics	3
or POLS 1250	Democracy and Dictatorship: Introduction to Comparative Politics	

Four Year Plans
History, B.S.

Freshman

Fall	Credits	Spring	Credits
ENGL 1500	3	History Choice - 2000-Level	3
History Choice - 2000-Level	3	Natural Science Choice	3
Social Science Choice	3	Humanities Choice	3
Humanities Choice	3	Math Choice	3
Natural Science Choice	3	Social Science Choice	3
		LIB 1600	1
	15		16

Sophomore

Fall	Credits	Spring	Credits
ENGL 2500	3	HIST 3010	3
History Choice - 2000-3000-Level	3	History Choice - 2000/3000-Level	3
World Language/Elective	4	3-4 World Language/Elective	4
Humanities Choice	2	Natural Science Choice	2
Social Science Choice	3	Elective	3
LAS 2030	1		
	16-17		15

Junior

Fall	Credits	Spring	Credits
History Choice - 3000/4000-Level	3	History Choice - 3000/4000-Level	3
History Choice - 3000/4000-Level	3	History Choice - 4000-Level	3
Elective	8	9 Elective	8
	15		14

Senior

Fall	Credits	Spring	Credits
History Choice - 4000-Level	3	HIST 4950	3
History Choice - 4000-Level	11	Elective	11

Elective	9
	15
	14

Total Credits: 120-121

History, B.A.

Freshman

Fall	Credits	Spring	Credits
ENGL 1500	3	History Choice - 2000-Level	3
History Choice - 2000-Level	3	Math Choice	3
Humanities Choice	3	Humanities Choice	3
Natural Science Choice	3	Natural Science Choice	3
Social Science Choice	3	Social Science Choice	3
		LIB 1600	1
	15		16

Sophomore

Fall	Credits	Spring	Credits
ENGL 2500	3	HIST 3010	3
History Choice - 2000/3000-Level	3	History Choice - 2000/3000-Level	3
Elementary World Language - 1000-Level ¹	4	Social Science Choice	3
Humanities Choice	4	Elementary World Language - 1000-Level ¹	4
Elective	2	Natural Science Choice	2
LAS 2030	1		
	15		15

Junior

Fall	Credits	Spring	Credits
History Choice - 3000/4000-Level	3	History Choice - 3000/4000-Level	3
History Choice - 3000/4000-Level	3	History Choice - 4000-Level	3
Interemmediate World Language - 2000-Level	4	Intermediate World Language - 2000-Level	4
Electives	4	5 Electives	4
	15		14

Senior

Fall	Credits	Spring	Credits
History Choice - 4000-Level	3	HIST 4950	3
History Choice - 4000-Level	12	Electives	12
Electives	9		
	15		15

Total Credits: 120

¹ The BA in History requires the equivalent of 2 years of college-level study in the same world language. Six credits of electives may be replaced by 6 additional credits of world language.

Minor

The department offers an undergraduate minor in History. It is available to any student.

A minor in History requires 15 credits.

HIST 1000- to 4000-level courses	6

Plus 9 credits from the following list:	9

HIST 3040	Cultural Heritage of the Ancient World
HIST 3070	American Popular Culture
HIST 3100	Africa to 1880
HIST 3110	Africa under Colonial Rule
HIST 3180	History of Early Modern Europe, 1450-1789
HIST 3200	History of Modern Europe, 1789 to Present
HIST 3250	Society and Politics in England, 1525-1700
HIST 3270	History of the British Empire
HIST 3310	History of the Islamic World to 1800
HIST 3360	Ancient China
HIST 3370	Modern China
HIST 3390	US-Asian Relations
HIST 3400	Colonial Latin America
HIST 3410	Modern Latin America
HIST 3450X	History of American Business
HIST 3500	Global History of Aviation
HIST 3530	History of African Americans I
HIST 3540	History of African Americans II
HIST 3570	American Family History
HIST 3620	Global Environmental History
HIST 3630	U. S. Environmental History
HIST 3640	The Mythic Wild West
HIST 3650	American Agriculture I: The Maya to McCormick's Reaper
HIST 3660	American Agriculture II: Homestead Act to GMOs
HIST 3670	America Eats
HIST 3700	History of Iowa
HIST 3710	Mexican American History
HIST 3720	Latina/o History
HIST 3740	Sex, Gender, and Culture in the Ancient Mediterranean World

HIST 3800	History of Women in Science, Technology, and Medicine
HIST 3820	History and Philosophy of the Scientific Revolution
HIST 3830	Technology, Public Science, and European Culture, 1715-Present
HIST 3860	History of Women in America
HIST 3870	First Ladies in U.S. History
HIST 3890	American Military History
HIST 3900	World Military History
HIST 3910	American Diplomatic History
HIST 3960A	Topics in History: Europe
HIST 3960B	Topics in History: U.S. and North America
HIST 3960C	Topics in History: Global
HIST 4020	Greek Civilization
HIST 4030	Roman Civilization
HIST 4050	Transformations of the Early Medieval World
HIST 4060	The Birth of Europe in the High Middle Ages
HIST 4070	Crises of the Late Middle Ages
HIST 4100	The Holocaust in History
HIST 4140	European Cultural and Intellectual History
HIST 4190	History of Modern France
HIST 4200	France's Revolutionary Century, 1715-1815
HIST 4210	History of Russia I
HIST 4220	History of Russia II
HIST 4230	The Russian and Soviet Mind: Intellectual and Cultural Life, 1762-1991
HIST 4240	History of Modern Germany
HIST 4270	Crime and Policing in England 1550-1850
HIST 4280	Punishment, Mentalities, and Society in England, 1550-1868
HIST 4290	Monstrous London: London's Histories 1500-1800
HIST 4310	Modern England
HIST 4350	History of the Modern Middle East
HIST 4410	History of Modern Mexico and Central America
HIST 4420	Rebellions and Revolutions in Latin America
HIST 4490	US Gilded Age, 1877-1900
HIST 4500	Colonial America
HIST 4510	American Revolutionary Era
HIST 4530	Law and Society in U.S. History: Crime, Race, Family, Work and Property
HIST 4540	Early American Republic
HIST 4550	U.S. Civil War and Reconstruction Era
HIST 4570	History of American Sexualities

HIST 4580	U.S. 1900 to 1945
HIST 4590	U.S. 1945 to the Present
HIST 4600	The Great Plains
HIST 4610	The American South
HIST 4650	The American West
HIST 4680	History of Rural America
HIST 4730	Civil Rights and Ethnic Power
HIST 4790	China and the Cold War
HIST 4810	Public History
HIST 4820	Birth, Death, Medicine, and Disease
HIST 4880	American Stuff, Colonial Times to the Present
HIST 4890	The World at War

Total Credits**15**

History is an LAS minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

Graduate Study

The History Department offers two graduate degrees: an M.A. in History and a Ph.D. in Rural, Agricultural, Technological and Environmental History.

Most history graduate courses are either readings seminars or research seminars. Readings seminars acquaint students with the historical literature of a field and prepare them for careers in teaching and research. Research seminars require students to conduct original historical research and to write research papers reporting the results.

The M.A. in history includes both thesis and non-thesis options. See the departmental website on the M.A. in History for a full discussion of the options and requirements. An M.A. in History serves as the basis for continued study in history, as well as preparation for careers in law, education, business, and government service. Throughout world history human beings have depended on rural and agricultural communities as well as on the technologies developed and employed by these communities to sustain lives. Iowa State's Doctoral Program in Rural, Agricultural, Technological and Environmental History offers a scholarly community and learning environment dedicated to the close examination of pervasive and enduring questions about these basic aspects of human history. Such questions can best be answered through the multi-faceted perspectives provided by rural, agricultural, technological, and environmental history. The result is a dynamic learning experience that leads to comparative and transnational analysis shaped by a broad range of methods drawn from the humanities and social/physical sciences. The Program's aim is to produce students who are excellent researchers

and engaging teachers, capable of succeeding in a broad variety of professional positions, both inside and outside of academia.

The Ph.D. in Rural, Agricultural, Technological and Environmental History is designed for students who have completed an M.A. in history. Those who have not yet completed an M.A. will be expected to complete the degree while progressing toward the Ph.D. Thirty semester hours of graduate credit are required for the M.A. and 72 for the Ph.D. Students who continue beyond the M.A. are expected to pass preliminary examinations in four areas of specialization, complete a dissertation, and defend it orally in the Ph.D. final examination. See the departmental website on the program for a full description of requirements.

International Studies Overview

Interdepartmental Undergraduate Secondary Major and Minor, Administered by the College of Liberal Arts and Sciences

Through a combination of coursework and study abroad, students who complete a secondary major or minor in International Studies can prepare for careers or advanced study in the international arena, such as foreign service, journalism, advocacy organizations, scientific or research institutions, business, nongovernmental development organizations (NGOs), humanitarian agencies, environmental organizations, human rights organizations, think tanks, international agriculture, and international engineering. Students in International Studies gain an understanding of global issues, learn to communicate across cultures, develop awareness of cultural ideas and attitudes, and are well positioned to become global leaders in their chosen field.

A secondary major and a minor in International Studies are available for undergraduates. The program requirements are structured around a combination of a designated Topical Module and a Geographic Region, both selected by the student. Each student's program of study is designed to reflect opportunities at Iowa State University as well as the academic, intellectual, and professional interests of the student.

Student Learning Outcomes

Upon completion of the second major in International Studies, students will be able to:

1. Read, write and speak a language other than their native language at an intermediate level to effectively communicate with people from other cultures.
2. Understand factual knowledge about world economic and political systems, events, cultures, and geography and to critically analyze global issues, especially as they relate to globalization.
3. Understand, interpret, and articulate the major processes, theories, and problems of a selected contemporary global issue within a selected

world region to also recognize interconnections between local and global issues and events.

4. Live, study, work, and/or volunteer in a selected world region in order to understand, interpret and articulate major cultural values and issues and to appreciate the impact of one's own cultural and educational experience on their perception of the world.

Secondary Major

A student seeking a secondary major in International Studies must successfully complete two core courses plus courses in a selected Geographic Region and Topical Module; demonstrate proficiency in a language relevant to the selected geographic region (see below); and participate in a required study, service, or work abroad program (see below).

Requirements for the Secondary Major in International Studies:

- INTST 2350 Introduction to International Studies
- INTST 4300 Seminar in International Studies
- 9 credits of coursework (at least 6 of which are numbered 3000 or above) from one of the following Geographic Regions:
 - Africa and the Middle East
 - Asia
 - Latin America
 - Western Europe
 - Russia, East Europe and Central Asia
- 9 credits of coursework (at least 6 of which are numbered 3000 or above) from one of the following Topical Modules:
 - Global Environmental Issues
 - Globalization and Economic Development
 - International Issues in Science and Technology
 - International Communication
 - International Conflict
 - Social and Cultural Change

The list of courses approved for credit for the Geographic Regions and Topical Modules is on the International Studies webpage (<https://intst.las.iastate.edu/academics/second/>).

- 3 additional credits of coursework selected from either the Geographic Region or Topical Module.

Language Proficiency

- Proficiency in a world language that is relevant to the selected geographic region. This can be achieved by completing the 2020 level (or higher) of the language. Students whose first language is not

English must still meet this requirement if their first language is not relevant to their selected geographic region.

Study/Service/Work Abroad Experience

- Study, service, or internship abroad for a minimum of 3 weeks, earning a minimum of 3 credits. The credits must be transferable to Iowa State.

The major must include a minimum of 12 credits not used to meet any other department, college, or university requirement.

Minor

A student seeking a minor in International Studies must successfully complete two core courses plus courses in a selected Geographical Region and Topical Module; demonstrate proficiency in a language relevant to the selected geographic region (see below); and participate in a required study, service, or work abroad program (see below).

Requirements for the Minor in International Studies:

- INTST 2350 Introduction to International Studies
- INTST 4300 Seminar in International Studies
- 6 credits of coursework (at least 3 of which are numbered 3000 or above) from one of the following Geographic Regions:
 - Africa and the Middle East
 - Asia
 - Latin America
 - Western Europe
 - Russia, East Europe and Central Asia
- 6 credits of coursework (at least 3 of which are numbered 3000 or above) from one of the following Topical Modules:
 - Global Environmental Issues
 - Globalization and Economic Development
 - International Issues in Science and Technology
 - International Communication
 - International Conflict
 - Social and Cultural Change
- Proficiency in a world language that is relevant to the selected geographic region. This can be achieved by completing the 2020 level (or higher) of the language.
- Study, service, or internship abroad for a minimum of 3 weeks, earning a minimum of 3 credits. The credits must be transferable to Iowa State.

The list of courses approved for the Geographic Regions and Topical Modules is on the International Studies webpage (<https://intst.las.iastate.edu/academics/second/>).

The minor must include a minimum of 3 credits not used to meet any other department, college, or university requirement.

The International Studies Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

Language Proficiency

- Proficiency in a world language that is relevant to the selected geographic region. This can be achieved by completing the 2020 level (or higher) of the language or by passing an approved exam. Students whose first language is not English must still meet this requirement if their first language is not relevant to their selected geographic region.

Study/Service/Work Abroad Experience

- Study, service, or internship abroad for a minimum of 3 weeks, earning a minimum of 3 credits. The credits must be transferable to Iowa State.

Journalism and Mass Communication

<http://www.greenlee.iastate.edu> (<http://www.greenlee.iastate.edu/>)

The journalism and mass communication major prepares students for careers that involve all aspects of news and information. Emphasis is placed on generating ideas, organizing, writing, editing, and presenting information for various media platforms and audiences. Students work with advisors to develop a program of study that prepares them for work in communication-specific areas including broadcast media, magazines and/or newspapers, photojournalism, science communication, visual communication, and digital media. Coursework in this major focuses on writing, research, digital and emerging media, and professional abilities. Students are required to complete a capstone internship experience to practice and refine their skills.

The Greenlee School of Journalism and Communication prepares students for communication fields. The school offers four majors:

- Advertising Bachelor of Arts (ADVRT)
- Journalism and Mass Communication Bachelor of Science (JLMC)
- Public Relations Bachelor of Science (PR)
- Sports Media Communication Bachelor of Arts (SMC)

In addition, the Greenlee School offers a 4+1 program allowing students to complete their B.A. or B.S. and earn an M.S. in journalism and mass communication in fewer semesters.

Professional skills are taught and practiced alongside academic requirements using the latest technology and leading-edge communication trends and methods.

Founded in 1905, the unit was one of the first journalism programs to be accredited in 1948 and continues to be one of the longest continuously accredited programs in the country. Accreditation is based on the principle that students need a broad-based, liberal arts education and solid core courses within the discipline. Students taking one major at the school may not seek an additional major or a minor in the school. All students are required to take an additional major or a minor outside the school as an area of expertise.

Student Learning Outcomes

Students who major in programs of the Greenlee School of Journalism and Communication are expected to develop competencies in 10 key areas:

- Apply the principles and laws of freedom of speech and press, in a global context, and for the country in which the institution that invites ACEJMC is located.
- Demonstrate an understanding of the multicultural history and role of professionals and institutions in shaping communications.
- Demonstrate culturally proficient communication that empowers those traditionally disenfranchised in society, especially as grounded in race, ethnicity, gender, sexual orientation and ability, domestically and globally, across communication and media contexts.
- Present images and information effectively and creatively, using appropriate tools and technologies.
- Write correctly and clearly in forms and styles appropriate for the communications professions, audiences and purposes they serve.
- Demonstrate an understanding of professional ethical principles and work ethically in pursuit of truth, accuracy, fairness and diversity.
- Apply critical thinking skills in conducting research and evaluating information by methods appropriate to the communications professions in which they work.
- Effectively and correctly apply basic numerical and statistical concepts.
- Critically evaluate their own work and that of others for accuracy and fairness, clarity, appropriate style and grammatical correctness.
- Apply tools and technologies appropriate for the communications professions in which they work.

The Journalism and Mass Communication Major

To receive a Bachelor of Science degree in journalism and mass communication, a student must earn at least 120 credits. A minimum of 72 credits must come from courses other than ADVRT, JLMC, PR, or SMC.

At least 50 of these credits must come from the liberal arts and sciences. Overall, at least 45 credits must be from 3000-level or above.

The degree requirements allow for a minimum of 34 credits and a maximum of 48 credits to be taken in ADVRT, JLMC, PR or SMC. These include:

JLMC 1100	Orientation to Journalism and Communication	1
JLMC 2400	Principles of Journalism	3
JLMC 2010	Reporting and Writing for the Mass Media (C+ or better)	3
One of the following two courses with C+ or better:		
JLMC 3020	Intermediate Reporting and Writing for the Mass Media	3
or JLMC 3030	Writing for Electronic Media	
3000-level ADVRT, JLMC, PR or SMC Electives		9
JLMC 4600	Law of Mass Communication	3
JLMC 4620	Media Ethics, Freedom, Responsibility	3
4000-level ADVRT, JLMC, PR or SMC Electives		6
JLMC 4990A	Professional Media Internship: Required	3
Total Credits		34

Journalism and mass communication majors are also required to take:

STAT 1010	Principles of Statistics (or another approved statistics course)	4

As majors in the College of Liberal Arts and Sciences, journalism and mass communication students must meet College of Liberal Arts and Sciences and University-wide requirements for graduation in addition to those stated above for the major.

University Requirement: Students in all ISU majors must complete a three-credit course in U.S. Cultures and Communities, as well as a three-credit course in International Perspectives. The approved course lists are found at the following web addresses: (U.S. Cultures and Communities) <http://www.registrar.iastate.edu/students/div-ip-guide/usdiversity-courses> (http://www.registrar.iastate.edu/students/div-ip-guide/usdiversity-courses/) and (International Perspectives) <http://www.registrar.iastate.edu/students/div-ip-guide/IntlPerspectives-current> (http://www.registrar.iastate.edu/students/div-ip-guide/IntlPerspectives-current/). Students must also demonstrate their communication proficiency by earning a grade of C or better in ENGL 2500.

College of LAS Requirement: Minimum of 120 credits, including a minimum of 45 credits at the 3000-level and above. You must also complete the LAS world language requirement, LAS career proficiency requirement, and any unmet ISU admission requirements.

Greenlee majors and minors cannot take ADVRT, JLMC, PR or SMC courses pass/not pass.

Minor or Additional Major: Students are required to fulfill a secondary area of expertise. This requirement can be met by declaring a minor or an additional major outside of the Greenlee School of Journalism and Communication. Students taking one major at the school may not seek an additional major or a minor in the school.

Juniors can apply to a concurrent degree program and earn a B.S. and an M.S. in journalism and mass communication in fewer semesters. Contact the Director of Graduate Education for more information on the Greenlee School's 4+1 Program.

Journalism and Mass Communication, B.S.

Freshman

Fall	Credits	Spring	Credits
JLMC 1100	1	JLMC 2010	3
JLMC 2400	3	STAT 1010	4
ENGL 1500	3	Social Science	3
Arts and Humanities	3	Natural Science	3
Natural Science	3	Arts and Humanities	3
LIB 1600	1		
14		16	

Sophomore

Fall	Credits	Spring	Credits
ADVRT, JLMC, PR or SMC	3	JLMC 3020 or 3030	3
3000-level choice			
ENGL 2500	3	U.S. Cultures and Communities	3
Social Science	3	World Language or Elective	4
World Language or Elective	3-4	Arts and Humanities	3
Natural Science	2	Social Science	3

LAS 2030	1				
	15-16		16		
Junior					
Fall	Credits	Spring	Credits	Summer	Credits
ADVRT, JLMC, PR or SMC 3000-level choice	3	ADVRT, JLMC, PR or SMC 3000-level choice		3 JLMC 4990A	3
ADVRT, JLMC, PR or SMC 4000-level choice	3	Minor/ Additional Major Choice	3		
International Perspective	3	Minor/ Additional Major Choice 3000+ Level	3		
Minor/ Additional Major Choice	3	Minor/ Additional Major Choice 3000+ Level	3		
Minor/ Additional Major Choice	3	Arts & Humanities	3		
	15		15		3

Senior					
Fall	Credits	Spring	Credits		
JLMC 4600	3	JLMC 4620	3		
ADVRT, JLMC, PR or SMC 4000-level choice	3	Elective or Minor/ Additional Major Choice 3000+ Level	3		

ADVRT/ JLMC/PR/ SMC Short Course Intensive Elective	1 Elective or Minor/ Additional Major Choice 3000+ Level	3
Elective or Minor/ Additional Major Choice Minor/ Additional Major Choice 3000+ Level	4 Elective or Minor/ Additional Major Choice 3	3
	14	12

Total Credits: 120-121

Minor in Journalism and Mass Communication

Students cannot select more than one minor in the Greenlee School of Journalism and Communication. Minors in the Greenlee School are not available to Greenlee majors.

For a minor in journalism and mass communication, students complete 15 credits. The minor must include at least 3 credits that are not used to meet any other department, college, or university requirement.

JLMC 1010	Mass Media and Society	3
JLMC 2400	Principles of Journalism	3
9 credits from the following:		9
JLMC 4730	Social Media Strategy	
SMC 2500	Principles of Sports Media and Communication	
SMC 4230	Sports and the Media in a 24/7 Digital World	
JLMC 2420	Visual Principles for Mass Communicators	
JLMC 3070	Fundamentals of Digital Video Production	
JLMC 3470	Science Communication	
JLMC 3900	Professional Skills Development	
JLMC 4010	Mass Communication Theory	
JLMC 4060	Media Management	
JLMC 4610	History of American Journalism	
JLMC 4640	Journalism and Literature	
JLMC 4740	Communication Technology and Social Change	

JLMC 4760	World Communication Systems
JLMC 4770	Diversity and the Media
JLMC 4970	Special Topics in Communication

Total Credits**15**

Greenlee majors and minors cannot take ADVRT, JLMC, PR or SMC courses pass/not pass.

The Journalism and Mass Communication Undergraduate is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

Concurrent Undergraduate and Graduate Programs

The Greenlee School offers three concurrent degree programs:

- B.A. Advertising/M.S. Journalism and Mass Communication
- B.S. Journalism/M.S. Journalism and Mass Communication
- B.S. Public Relations/M.S. Journalism and Mass Communication

Enrollment in the Greenlee School's concurrent degree programs enables students to complete coursework for the undergraduate and graduate programs on a five-year accelerated timeline – rather than the typical six-year timeline for the two degrees. Graduates of the concurrent degree program will be prepared to face today's rapidly changing media environment and contribute to society by becoming a leader within the communication field. Upon completion of the undergraduate program (bachelor's degree), students can choose between two tracks in the master's program (master's degree): one for students who desire specialized study in communication theory and research and one for students who wish to develop or strengthen their professional and strategic communication skills. At the master's level, the school is well known for developing practitioners and scholars in science communication, political communication, multicultural communication and media industries. The ISU Graduate Handbook outlines policies and requirements for concurrent degree programs. Concurrent degree students must complete all academic requirements and required coursework for both degrees.

To be eligible for a concurrent degree program, currently enrolled Greenlee ADVRT, JLMC or PR students must 1) be defined as seniors by their number of cumulative ISU credits (90 credits or more) and 2) have successfully completed JLMC 2010 (required of all three undergraduate majors) with a C+ or better. Before beginning graduate coursework, concurrent degree candidates must formally indicate their interest by contacting the Greenlee School's Director of Graduate Education. Interested students must then apply to the master's program no later than March 1 of the year prior to taking graduate coursework. Application and admissions requirements for the master's program (<https://>

greenlee.iastate.edu/graduate/graduate-admissions/) are the same for concurrent students as those applying to the master's program after completing an undergraduate degree. A thesis or creative component is required for all concurrent degree students.

To receive a Bachelor of Science/arts degree from the Greenlee School in advertising, journalism or public relations, a student must earn at least 120 credits and complete all required courses. To receive a Master of Science degree from the Greenlee School in journalism and mass communication, a student must earn at least 32 credits and complete all required courses.

Preference for assistantships will be given to students who have completed all of their undergraduate coursework.

Student Learning Outcomes

1. To develop an understanding of the central issues and current research important to the field of journalism and communication.
2. To be familiar with the breadth and depth of the journalism and communication profession.
3. To be able to communicate acquired knowledge in the field.
4. To be aware of ethical issues that pertain to the field of journalism and communication.
5. To develop the ability to design and present an independent and meaningful research project.

Graduate Programs

Master of Science

The Greenlee School of Journalism and Communication offers work for a Master of Science degree in journalism and mass communication.

Majors plan a program of study in one of two tracks:

I. Academic track – The School offers advanced academic preparation in communication theory and research, leading to the Master of Science degree. Graduate work prepares students to use and contribute to research and scholarship in the field of communication. This track requires a thesis based on original research, which must be defended successfully before a committee at the end of the program.

Areas of research emphasis includes: science and risk communication, media effects, advertising, public relations, political communication, communication technology, law and ethics, international communication, visual communication and emerging media.

II. Professional track – The School offers advanced professional study in journalism and mass communication leading to the Master of Science degree. Graduate work prepares students for professional careers in a variety of mass communication fields. Students with limited training or experience in journalism and mass communication may include skills courses in their programs, but the credits for those courses may

not count toward the graduate degree. This track requires a creative component which must be defended successfully before a committee at the end of the program.

All graduate students must complete 32 credits for graduation, comprised of four core classes, at least two electives outside the Greenlee School, and at least four thesis or creative component credits. The following core courses account for 10 credits of the needed 32 credits.

JLMC 5010	Theories of Mass Communication	3
JLMC 5020	Fundamentals of Communication Research Methods	3
JLMC 5920	Introduction to Graduate Study in Journalism and Mass Communication	1
JLMC 5980	Seminars in Mass Communication	

Each student selects elective courses based on his/her area of emphasis and career goal, in consultation with the student's major professor and Program of Study Committee.

Student Learning Outcomes

1. To develop an understanding of the central issues and current research important to the field of journalism and communication.
2. To be familiar with the breadth and depth of the journalism and communication profession.
3. To be able to communicate acquired knowledge in the field.
4. To be aware of ethical issues that pertain to the field of journalism and communication.
5. To develop the ability to design and present an independent and meaningful research project.

Graduate Minor

The Greenlee School graduate program offers minor work for students majoring in other departments. The M.S. minor requires:

JLMC 5010 and two other courses in journalism and mass communication for a total of 9 credits taken within the Greenlee School.

Concurrent Programs

The Greenlee School's concurrent degree programs enable interested students the opportunity to complete coursework for the undergraduate and graduate programs on a five-year accelerated timeline – rather than the typical six-year timeline for the two degrees.

Latin American Studies Certificate Interdepartmental Undergraduate Program

The certificate in Latin American Studies is a cross-disciplinary course of study in the College of Liberal Arts and Sciences and is designed for undergraduates in any major who wish to enhance their degree and employment possibilities by adding expertise in Latin America and competence in the Spanish language.

Objectives

- Provide opportunities for students to develop skills and understanding about issues concerning Latin America by bringing them into contact with faculty members from many different academic backgrounds
- Provide students with an international immersion experience where they gain cultural awareness and sensitivity
- Prepare students for work or advanced study in Latin America, such as in foreign service, journalism, advocacy organizations, scientific or research institutions
- Help students acquire proficiency in one of the principal languages of Latin America (Spanish)
- Guide students in interdisciplinary study leading to an understanding of the multi-faceted picture of the past, present, and future of Latin America

Learning Outcomes

Upon Completion of the Certificate in Latin American Studies, students will be able to:

- Demonstrate understanding of key concepts pertaining to Latin American cultural, historical and political events
- Understand, interpret and articulate the major processes, theories and problems of selected contemporary and historical issues in Latin America
- Demonstrate oral, aural, and written proficiency in Spanish equivalent to the mid-advanced level
- Effectively communicate with persons of Latin American cultures
- Become effective global citizens through knowledge and comparison of the cultures and issues of the United States and Latin American countries
- Be able to read Latin American cultural, literary, and historical texts in the target language with comprehension and analytical insight
- Demonstrate awareness of cultural values, beliefs, and ideologies of the various Latin American countries
- Demonstrate a thorough knowledge of the geography of the Latin American countries

General Requirements

Requirements for the Certificate in Latin American Studies are satisfied through formal language instruction and by completing a minimum of 21 credits at the 3000 level or above. Students will take coursework in at least three different disciplines and departments (Spanish, Anthropology, and Political Science) with other possible course offerings in LAS, History, Agriculture, and Agronomy.

Course Requirements

Students will complete 6 credits of core courses:

SPAN 3220	Latin American Civilization	3
or SPAN 3240	Latin America Today	
ANTHR 3230		3

Students should consult with their advisor for alternative courses in the event a course is not available.

Other Requirements

In addition to University policies governing certificates, this certificate has the following specific requirements:

- Students will complete an additional 15 credits selected from the approved list of courses in Latin American Studies or courses approved by the Latin American Studies Certificate advisor at the 3000 level or above.
- No more than 3 credits may be taken as a 4900, independent study, and the topic must deal with Latin America.

LANGUAGE REQUIREMENT

- The minimum requirement in formal language instruction is completion of two years or the equivalent of Spanish at the university level. At ISU the completion of Spanish 2020 satisfies this requirement.
- Native speakers, or those with in-field experience of another Latin American language with a level equivalent to 2020 or higher can have the language requirement waived. Equivalence will normally be assessed by a faculty member/CLEP exam in the Dept. of World Languages and Cultures.
- While students are encouraged to enroll in language instruction courses (i.e., conversation and composition) above the 3000 level, no more than 6 credits of language study (3010,3030,3040,3050) may be applied toward fulfilling language requirements for the Certificate. Students should be aware that all 3000-level literature and culture/civilization courses in the Dept. of World Languages and Cultures have prerequisites.

Study Abroad

Students are required to participate in an ISU-approved study abroad program in a Latin American country with a minimum duration of 4

consecutive weeks. The Study Abroad Office has a list of ISU-approved programs. Students may elect to participate in other study abroad programs with the approval of the Latin American Studies Advisory Committee.

Approved courses available toward the Certificate:

The decision as to whether or not a course can be counted toward the certificate is based primarily on course title and description as it appears in the current ISU course catalog. Courses which primarily deal with Spain or Portugal and their cultures do not count toward the certificate. Students should consult with the advisor for the Latin American Studies Undergraduate Certificate program before registering to be sure a particular travel course or field school offering can apply toward the certificate.

AGEDS 4960A	International	1-3
or AGEDS 4960B	Domestic	
AGRON 4960A	International Tour	1-30
or AGRON 4960C	Domestic Tour	
ANTHR 3230		3
ANTHR 4450	Biological Field School	4-6
or ANTHR 5450	Biological Field School	
HIST 3400	Colonial Latin America	3
HIST 3410	Modern Latin America	3
INTST 3950A	Interdisciplinary Study Abroad: Pre-Departure Seminar	1
or INTST 3950B	Interdisciplinary Study Abroad: Humanities	
or INTST 3950C	Interdisciplinary Study Abroad: Communications	
or INTST 3950D	Interdisciplinary Study Abroad: Mathematics and Natural Science	
or INTST 3950E	Interdisciplinary Study Abroad: Social Sciences	
POLS 3430	Latin American Government and Politics	3
SPAN 3220	Latin American Civilization	3
SPAN 3240	Latin America Today	3
SPAN 3260	Studies in Hispanic Art or Film	3
SPAN 3320	Studies in Latin American Literature	3
SPAN 3700A	Hispanic Topics in English Translation: Agriculture	3
or SPAN 3700S	Studies in English Translation: Hispanic Topics on Women or Feminism	
SPAN 3950	Study Abroad	1-10
SPAN 4450	Seminar on the Literatures and Cultures of Latin America	3
SPAN 4630	Contemporary Spanish Linguistics	3
SPAN 4990	Internship in Spanish	1-3

Leadership Studies

Overview

The Leadership Studies Program provides a strong foundation of coursework and experiences for undergraduate students who seek to study, understand and apply the principles of leadership in their current activities and, eventually, in their careers. This interdisciplinary program, designed for students in all majors, consists of a 21-credit-hour leadership studies certificate, a 15-credit leadership studies minor, and a suite of leadership studies courses. Students earning either the certificate or minor in leadership studies will develop the knowledge and skills to effect positive change as they enter the public, nonprofit or private sectors. The certificate and minor are awarded by the College of Liberal Arts and Sciences and noted on the student’s transcript. To learn more about the program, visit our website: <https://leadership.las.iastate.edu/>.

Objectives

- Develop students’ leadership capacity—which encompasses individual-level capabilities of self-awareness, integrity and commitment; group-level capabilities of collaboration, shared purpose and handling controversy with civility; and community-level capabilities of citizenship and civic responsibility.
- Provide opportunities for students to study leadership by learning effective communication practices, organizational theories, ethical principles, an appreciation of diversity, intrapersonal development and the value of community service.
- Cultivate students’ understanding of social empowerment and social justice to create positive and sustainable change.
- Challenge students to critically examine leadership at the intrapersonal, interpersonal, team, organizational and societal levels.
- Bring students into contact with community leaders and faculty members from diverse academic departments, backgrounds and leadership experiences.
- Prepare students to undertake leadership roles in their careers and in service to their community through coursework and co-curricular engagement.

Learning Outcomes

- Upon completion of the certificate or minor in leadership studies, students will be able to:
- Recognize leadership as a set of skills, knowledge and attitudes that can be learned.
 - Understand traditional and emergent leadership theories and apply them in practice.
 - Comprehend key concepts of communication theories, organizational theories, contemporary diversity issues and ethical principles.

- Practice and evaluate their own capacity to lead effectively within teams, organizations and diverse communities.
- Develop and implement plans for continually improving their leadership capacity.
- Demonstrate proficiencies in written and oral communication.

Leadership Studies Minor

The minor in leadership studies requires the completion of 15 credit hours through three 3-credit-hour required courses in leadership and organizational theory, and an additional 6 credit hours earned from approved leadership electives. At least 9 credits must be at the 2000-level or above, of which at least 6 credits are courses numbered 3000 or above. A cumulative grade point average of at least 2.0 is required in courses taken for the Leadership Studies minor.

The Leadership Studies Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

Core Courses: 9 required credits

LDST 3010	Leadership Theory and Practice	3
LDST 3220	Leadership in a Diverse Society	3
MGMT 3720	Ethical and Responsible Management	3
or LDST 2910A Leading Change: General		

Leadership Electives: Choose 6 credits from the following:

AESHM 2110	Leadership Experiences and Development (LEAD)	3
AESHM 4210	Developing Global Leadership: Maximizing Human Potential	3
AGEDS 3150	Personal, Professional, and Entrepreneurial Leadership in Agriculture	3
COMST 2180	Communication and Conflict Management	3
COMST 3130	Leadership Communication Theories	3
ENGR 1500	Foundations of Leadership Development and Learning	1
ENGR 2500	Leadership in Engineering Teams	1
ENGR 3500	Dean's Leadership Seminar	1
LDST 1220	Leading with Purpose	1
LDST 2700	Campus Leadership Development	3
LDST 2910B	Leading Change: U.S. Diversity	4
LDST 2910C	Leading Change: International Perspectives	4
LDST 2930	Special Projects	3
LDST/WGS 3330	Women, Gender, and Leadership	3
LDST 3700	Special Topics	1-3
LDST 4220	Leadership Capstone Seminar: Theory to Practice	3

ME 4120	Ethical Responsibilities of a Practicing Engineer	3
MGMT 3720	Ethical and Responsible Management	3
MGMT 4220	Negotiation and Conflict Resolution	3
MGMT 4720	Diversity, Equity, and Inclusion in Organizations	3
PHIL 2350	Ethical Issues in a Diverse Society	3
SPCM 3120	Business and Professional Speaking	3

Leadership Studies Certificate

The certificate in leadership studies requires the completion of 21 credit hours including the 9-credit leadership studies core. The remaining 12 credit hours are earned from approved electives including 3 hours in communication, 6 hours in leadership, and 3 hours of a capstone experience through a course, internship or study abroad. The capstone course should focus on the scholarship of leadership in the student's field of study, whereas an internship or a study abroad should provide a leadership-in-practice experience.

The Leadership Studies Certificate is an LAS Certificate and must meet University-wide policies for undergraduate certificates. A cumulative grade point average of at least 2.0 is required in courses taken for the Leadership Studies certificate.

Core Courses:

9 credits of required core courses

LDST 3010	Leadership Theory and Practice	3
LDST 3220	Leadership in a Diverse Society	3
MGMT 3720	Ethical and Responsible Management	3
	or LDST 2910A Leading Change: General	

Communication Electives:

Choose 3 credits from the following:

COMST 2140	Professional Communication	3
COMST 3100	Intercultural Communication	3
COMST 3140	Organizational Communication	3
ENGL 3020	Business Communication	3
SPCM 2120	Fundamentals of Public Speaking	3
SPCM 3120	Business and Professional Speaking	3
SPCM/WGS 3230	Gender and Communication	3

Leadership Electives:

Choose 6 credits from the following:

AESHM 2110	Leadership Experiences and Development (LEAD)	3
AESHM 2220	Creativity on Demand	3
AESHM 2870	Principles of Management in Human Sciences	3

AESHM 4210	Developing Global Leadership: Maximizing Human Potential	3
AESHM 4740	Entrepreneurship in Human Sciences	3
AGEDS 3150	Personal, Professional, and Entrepreneurial Leadership in Agriculture	3
CE 3060	Project Management for Civil Engineers	3
COMST 2180	Communication and Conflict Management	3
COMST 3130	Leadership Communication Theories	3
COMST 3170	Small Group Communication	3
CRP 4290	Planning in Developing Countries	3
CRP 4320	Community Planning Studio	4-6
CRP 4350	Planning in Small Towns	3
CRP 4920	Planning Law, Administration and Implementation	3
CONE 3800	Engineering Law	3
ENGR 1500	Foundations of Leadership Development and Learning	1
ENGR 2500	Leadership in Engineering Teams	1
ENGR 3500	Dean's Leadership Seminar	1
HDFS 3950	Children, Families, and Public Policy	3
LAS 1510	Dean's Leadership Seminar I	1
LDST 1220	Leading with Purpose	1
LDST 2700	Campus Leadership Development	3
LDST 2900	Independent Study	1-3
LDST 2910A	Leading Change: General	4
LDST 2910B	Leading Change: U.S. Diversity	4
LDST 2910C	Leading Change: International Perspectives	4
LDST 2930	Special Projects	1-3
LDST/WGS 3330	Women, Gender, and Leadership	3
LDST 3700	Special Topics	1-3
LDST 4220	Leadership Capstone Seminar: Theory to Practice	3
LDST 4900	Independent Study	1-3
ME 4120	Ethical Responsibilities of a Practicing Engineer	3
MGMT 3720	Ethical and Responsible Management	3
MGMT 4220	Negotiation and Conflict Resolution	3
MGMT 4720	Diversity, Equity, and Inclusion in Organizations	3
NS 4120	Leadership and Ethics	3
PHIL 2350	Ethical Issues in a Diverse Society	3
POLS 3100	State and Local Government	3
POLS 2710	Public Organizations and Leadership	3
POLS/WGS 3850	Women in Politics	3
POLS 4750	Management in the Public Sector	3
POLS 4870	Cyberpolitics	3
SOC 3100	Community	3

SOC/POLS 3340	Politics and Society	3
SPCM 1100	Listening	3
SPCM/POLS 4170	Campaign Rhetoric	3
UST 3150	Cyclone Aide Leaders Seminar	2
WGS 3010	International Perspectives on Women and Gender	3
WGS 4350	Gender, Globalization and Development	3

Capstone Courses:

Choose 3 credits of the following:

LDST 4220	Leadership Capstone Seminar: Theory to Practice	3
LDST 4900	Independent Study (Must include a leadership focus and be pre-approved by the leadership studies faculty.)	1-3

Study abroad: Must include a leadership focus and be pre-approved by the leadership studies faculty.

Other capstones may be approved with leadership studies faculty permission if they include a significant leadership component (e.g., COMST 4040 or AESHM 4210 with a leadership-based project). Students wishing to take a capstone course not listed here must receive approval prior to registering for the course and must demonstrate in writing how the course includes a significant leadership component.

Bachelor of Liberal Studies

Bachelor of Liberal Studies Degree

The Bachelor of Liberal Studies degree (B.L.S.) is a general studies degree in the liberal arts. It was established by the three Iowa Regent universities primarily to meet the needs of Iowans who want to earn a college degree but whose circumstances present obstacles to completing a traditional on-campus degree program. While the B.L.S. does not have traditional majors focused on a specific discipline and students have more flexibility in choosing courses that apply to their program, the requirements for the degree are as rigorous as requirements for other degree programs offered by Iowa State University. With the assistance of a B.L.S. advisor, students can structure a program that meets their individual educational, vocational or personal goals. At Iowa State University, students can complete the requirements of the Bachelor of Liberal Studies either on campus or as part of the Distance Education B.L.S. For more information about completing the B.L.S. degree fully online, visit Iowa State Online (<https://iowastateonline.iastate.edu/programs-and-courses/undergraduate-degrees/bachelor-of-liberal-studies-degree-completion-program/>).

The B.L.S degree is a transfer-friendly degree. Work done in community colleges or other accredited colleges and universities can be applied

toward the degree and can often meet requirements for one of the B.L.S. majors. Up to three-fourths of the total degree requirements can be transferred from accredited institutions. Students with military or professional and technical credits with outcomes contributing to the learning outcomes of the distribution areas of either major are encouraged to submit coursework for review to potentially apply such credits to the major. The B.L.S. degree has no residence requirements, but students are expected to have 30 credits from ISU earned during the junior and/or senior year. Students who have completed an Associate of Arts degree at an Iowa, Illinois, or Minnesota community college will not have to take any additional courses to satisfy the General Education Areas for the College of Liberal Arts and Sciences. Transfer coursework will first be applied to the General Education Areas for the College and the academic advisor will mark any unmet general education credits as satisfied. Unused transfer coursework can apply in the distribution areas; an academic advisor will assist in determining course placement.

Students can earn the Bachelor of Liberal Studies Degree by choosing to major in either Liberal Studies or Professional Studies.

Declaring the B.L.S. Degree

Students must have completed at least 24 semester credits of collegiate work acceptable toward graduation at ISU to declare the B.L.S.

Student Learning Outcomes of the Liberal Studies Major

In addition to meeting the learning goals of the general education program of the College of Liberal Arts and Sciences and meeting University wide learning goals, Liberal Studies graduates should be able to:

- Use appropriate learning strategies to gain new knowledge.
- Integrate knowledge and modes of thinking from multiple disciplines.
- Apply their knowledge to evaluate issues and solve problems.
- Connect their learning to their professional goals.

Student Learning Outcomes of the Professional Studies Major

In addition to meeting the learning goals of the general education program of the College of Liberal Arts and Sciences and meeting University-wide learning goals, Professional Studies graduates should be able to:

- Apply their knowledge to evaluate issues and solve problems.
- Express thoughts and ideas clearly and effectively.
- Demonstrate awareness of the strengths of others and build collaborative relationships with diverse team members to achieve common goals.

- Demonstrate ability to select and use appropriate technology in order to accomplish a given task.
- Connect their learning to their professional goals.

Requirements for the B.L.S. Degree With a Major in Liberal Studies

All students seeking a B.L.S. degree must meet the University-wide requirements (<https://catalog.iastate.edu/collegescurricula/>) for graduation, including earning a total of 120 credits. The Liberal Studies major requires 36 credits of coursework across three of five areas of distribution according to the requirements laid out below. Students determine which distribution areas to emphasize in their degree program through consultation with their Bachelor of Liberal Studies academic advisor.

Liberal Studies students must also meet the General Education, World Languages/Cultures and Career Proficiency Requirements of the College of Liberal Arts and Sciences and earn a minimum of 39 credits at the 3000/4000 level. Courses taken at Iowa State University on a pass/not pass basis may be counted toward graduation only as electives.

University-wide Requirements

Communication Proficiency: Foundation Courses	6
ENGL 1500 Critical Thinking and Communication	
ENGL 2500 Written, Oral, Visual, and Electronic Composition (with a grade of C or better)	
or equivalent of ENGL 1500, ENGL 2500	
Communication Proficiency: Upper-level curricula (grade C- or better)	3
ENGL 3020 Business Communication	
or ENGL 305 Creative Writing: Nonfiction	
or ENGL 309 Proposal and Report Writing	
or ENGL 314 Technical Communication	
or comparable extensive writing experience	
International Perspectives*	3
U.S. Cultures and Communities*	3

*Students in all ISU majors must complete a three-credit course in U.S. Cultures and Communities and a three-credit course in International Perspectives. Check (<http://www.registrar.iastate.edu/courses/div-ip-guide.html>) for a list of approved courses. Discuss with your advisor how these courses can apply to your graduation plan.

LAS General Education, World Languages/Cultures, and Career Proficiency Requirements

Arts and humanities*	12
Mathematics, statistics, or computer science*	3
Natural sciences*	8

Social sciences*	9
World languages/Cultures**	3-8
LAS 2030 Professional Career Preparation	1

*A list of courses acceptable in the general education groups can be obtained from the college website (<http://www.las.iastate.edu/students/academics/general-education/>).

**The requirement may be met by completion of three or more years of high school study in one world language; by meeting the LAS World Language requirement; or by taking six credits from the list of International Perspectives courses, three credits of which cannot be used to satisfy another degree requirement.

Distribution Requirements and Electives

A minimum of 12 credits is required in each of three of the five distribution areas listed below. Students determine which distribution areas to include in their degree program through consultation with their Bachelor of Liberal Studies academic advisor.

Distribution Areas (Three of five below, with a minimum of 6 credits at the 3000 level or above in each of the three)

Humanities (for example, literature, philosophy, history, religion, art and music appreciation)

Communications and arts (for example, journalism, speech, writing, drama, art, world language, communication studies, advertising, public relations)

Natural sciences and computational disciplines (for example, chemistry, physics, biology, geological and atmospheric sciences, mathematics, statistics, computer science, data science, environmental science)

Social sciences (for example, sociology, psychology, economics, political science, anthropology, geography)

Professional fields (for example, business, education, family and consumer sciences, agriculture, engineering – generally courses taught outside the College of Liberal Arts and Sciences)

Electives to bring total credits to at least 120

Varies

Other Requirements

Included in the minimum of 120 credits needed for graduation must be the following:

30 credits from ISU earned during the junior/and or senior year.

39 upper-level (3000 level or above) credits from an accredited four-year college with a grade point average of 2.0 or higher.

A minimum grade point average of at least 2.00 (a C average).

No more than 9 credits of 4900 (Independent Study) courses may be counted toward graduation.

The B.L.S. program of study is not offered as an additional major, it is only offered as a full degree program.

Students in the B.L.S. program are not eligible for additional majors, but in consultation with their advisor they may earn a Certificate or [Minor](#). Minors attached to a B.L.S. [must follow University policies governing minors](#). **Note:** LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

Criteria for graduating with distinction and other academic honors with a B.L.S. degree are available under Scholastic Recognition.

Requirements for the B.L.S. Degree With a Major in Professional Studies

All students seeking a B.L.S. degree must meet the University-wide requirements (<https://catalog.iastate.edu/collegescurricula/>) for graduation, including earning a total of 120 credits. Students pursuing the Professional Studies major will take coursework across multiple areas aimed to develop broad professional competencies in critical thinking, communication, leadership/teamwork, and technology. Studies may be focused on coursework in closely related disciplines or diversified over several disciplines.

The Professional Studies major requires 33 credits that meet the distribution area requirements laid out below. Professional Studies students must also meet the General Education, World Languages/ Cultures and Career Proficiency Requirements of the College of Liberal Arts and Sciences and earn a minimum of 39 credits at the 3000/4000 level. Courses taken at Iowa State University on a pass/not pass basis may be counted toward graduation only as electives.

University-wide Requirements

Communication Proficiency: Foundation Courses		6
ENGL 1500	Critical Thinking and Communication	
ENGL 2500	Written, Oral, Visual, and Electronic Composition (with a grade of C or better)	
or equivalent of ENGL 1500, ENGL 2500		
Communication Proficiency: Upper-level curricula (grade C- or better)		3
ENGL 3020	Business Communication	
or ENGL 305 Creative Writing: Nonfiction		
or ENGL 309 Proposal and Report Writing		
or ENGL 314 Technical Communication		
or comparable extensive writing experience		
International Perspectives*		3
U.S. Cultures and Communities*		3

*Students in all ISU majors must complete a three-credit course in U.S. Cultures and Communities and a three-credit course in International Perspectives. Check (<http://www.registrar.iastate.edu/courses/div-ip-guide.html>) for a list of approved courses. Discuss with your advisor how these courses can apply to your graduation plan.

LAS General Education, World Languages/Cultures, and Career Proficiency Requirements

Arts and humanities*		12
Mathematics, statistics, or computer science*		3
Natural sciences*		8
Social sciences*		9
World languages/Cultures**		3-8
LAS 2030	Professional Career Preparation	1

*A list of courses acceptable in the general education groups can be obtained from the college website (<http://www.las.iastate.edu/students/academics/general-education/>).

**The requirement may be met by completion of three or more years of high school study in one world language; by meeting the LAS World Language requirement; or by taking six credits from the list of International Perspectives courses, three credits of which cannot be used to satisfy another degree requirement.

Distribution Requirements and Electives

Students determine which distribution areas to emphasize in their degree program through consultation with their Bachelor of Liberal Studies academic advisor. Students are encouraged to select classes that prepare them for particular labor sectors and to talk with their advisor about adding at least one minor or certificate.

Distribution Areas (Three credits in each of the four areas below, with a minimum of 9 credits in at least two of the areas. 15 of the 33 credits required for this major must be at the 3000 level or above.)		33
Critical Thinking (for example, history, philosophy, political science, psychology)		
Communication (for example, communication studies, journalism, speech, writing, world language, advertising, public relations)		
Leadership/Teamwork (for example, classes that apply to the Leadership Studies certificate or minor)		
Technology (for example, computer science, engineering, and other coursework focused on using technology)		
Electives to bring total credits to at least 120		Varies

Other Requirements

Included in the minimum of 120 credits needed for graduation must be the following:

30 credits from ISU earned during the junior/and or senior year.

39 upper-level (3000 level or above) credits from an accredited four-year college with a grade point average of 2.0 or higher.

A minimum grade point average of at least 2.00 (a C average).

No more than 9 credits of 4900 (Independent Study) courses may be counted toward graduation.

The B.L.S. program of study is not offered as an additional major, it is only offered as a full degree program.

Students in the B.L.S. program are not eligible for additional majors, but in consultation with their advisor they may earn a Certificate or [Minor](#). Minors attached to a B.L.S. [must follow University policies governing minors](#). [Note: LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.](#)

Criteria for graduating with distinction and other academic honors with a B.L.S. degree are available under Scholastic Recognition.

Linguistics Overview

Linguistics is a cross-disciplinary program designed to meet the needs of students interested in various aspects of language—its structure, history, varieties, meanings, and uses. The program includes courses in anthropology, computer science, English, psychology, and world languages and cultures, thus providing a multi-disciplinary approach to the study of human language.

Courses in linguistics serve as background for students interested in any career that involves working with language, such as teaching English as a first and as a second language, second language studies, speech-language pathology, cross-cultural communication, law, linguistic anthropology, computational linguistics, and psycholinguistics.

In the College of Liberal Arts and Sciences, courses in linguistics can be applied as electives or as part of the group requirements. They may also be used in a minor or in a major. Linguistics majors earn a Bachelor of Arts.

Learning Outcomes

Students who major in Linguistics at Iowa State University will be able to

- display extensive knowledge of the primary areas of linguistics, especially syntax, morphology, and phonology/phonetics.
- identify and analyze descriptive and prescriptive approaches to language description.
- display a sophisticated understanding of the hierarchical and systematic nature of human language.

- demonstrate skills in the intersection of language analysis and technology.
- develop methodological skills for carrying out linguistic analysis, including;
 - analyzing organized and unorganized linguistic data.
 - conducting research, including carrying out literature searches and reviews, formulating testable questions, developing protocols for collecting data, and drawing conclusions based on research goals.
 - formulating effective linguistic arguments in spoken and written form.
- display understanding of how languages change over time by appealing to examples of change in at least three languages.

Linguistics Degree Requirements

Majors in linguistics complete a minimum of 36 hours in linguistics with a grade of C or better in each linguistics course. Courses specifically required are:

LING 1190	Introduction to World Languages	3
LING 2070	Introduction to Symbolic Logic	3
LING 2190	Introduction to Linguistics	3
LING 2200	Descriptive English Grammar	3
LING 3710	Phonetics and Phonology	3
LING 4130	Psychology of Language	3
LING 4200	History of the English Language	3
LING 4370	Grammatical Analysis	3

In addition, linguistics majors must choose 12 credits of elective courses. Discuss choices with the advisor. Suggested areas of further study are:

Computers and Linguistics

LING 3200	Topics in Linguistic Structure	3
LING 3310	Theory of Computing	3
LING 4100	Language as Data	3

Second Language Studies

ENGL 3220	Language and Society	3
ENGL 3240	Introduction to Teaching ESL Literacy	3
ENGL 3250	Teaching Methods for ESL Learners: Oral Communication Skills	3
LING 4250	Second Language Learning and Teaching	3

Sociolinguistics and Language

ENGL 3190	Studies in Language and Diversity	3
ENGL 3220	Language and Society	3
LING 4220	Women, Men, and the English Language	3

Spanish Linguistics

LING 3510	Introduction to Spanish-English Translation	3
LING 3520	Spanish Pronunciation	3
LING 3540	Introduction to Spanish-English Interpretation	3
LING 4620	Contrastive Analysis of Spanish/ English for Translators	3
LING 4630	Contemporary Spanish Linguistics	3

Additional courses in linguistics include ANTHR 3090 and special topics offered through LING 3190 and LING 3200, which are repeatable for different topics. They also include courses for study abroad, especially LING 3950, and independent studies through LING 4900. Majors in linguistics must show proficiency in a second language equivalent to that achieved after two years of university-level study. Alternatively, majors in linguistics can demonstrate university-level study in two other languages of at least one year each.

Communication Proficiency requirement: According to the university-wide Communication Proficiency Grade Requirement, students must demonstrate their communication proficiency by earning a grade of C or better in ENGL 2500.

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
	or ENGL 2500H Written, Oral, Visual, and Electronic Composition: Honors	
LIB 1600	Introduction to College Level Research	1
Continuing Communication Proficiency is based on one course from ENGL 3140; WLC 3700A, 3700B or 3700C.		

For information about using linguistics courses in an interdisciplinary studies major, see Interdisciplinary Studies.

As majors in the College of Liberal Arts and Sciences, Linguistics students must meet College of Liberal Arts and Sciences and University-wide requirements for graduation in addition to those stated above for the major.

LAS majors require a minimum of 120 credits, including a minimum of 45 credits at the 3000/4000 level. You must also complete the LAS world language requirement and career proficiency requirement.

Students in all ISU majors must complete a three-credit course in U.S. Cultures and Communities and a three-credit course in International Perspectives. Check ([http://www.registrar.iastate.edu/courses/div-ip-](http://www.registrar.iastate.edu/courses/div-ip-guide.html)

[guide.html](http://www.registrar.iastate.edu/courses/div-ip-guide.html)) for a list of approved courses. Discuss with your advisor how the two courses that you select can be applied to your graduation plan.

Linguistics, B.A.

Freshman		
Fall	Credits Spring	Credits
ENGL 1500	3 LING 1010	1
LIB 1600	1 Humanities Choice	3
World Language/Elective	4 Math Choice	3
LING 1190	3 PSYCH 1010	3
Natural Science Choice	3 World Language/Elective	4
	14	14

Sophomore		
Fall	Credits Spring	Credits
ENGL 2500	3 LING 3710	3
LING 2190	3 World Language 2020	4
ANTHR 2010	3 LING 2200	3
Humanities Choice	3 Humanities Choice	3
World Language 2010	4 Social Science Choice	3
	LAS 2030	1
	16	17

Junior		
Fall	Credits Spring	Credits
LING 3090	3 LING 2070	3
LING 4370	3 LING 4130	3
ENGL 3050, 3140, WLC 3700A, WLC 3700B, or WLC 3700C	3 LING 4200	3
Natural Science Choice	3 Natural Science Choice	3
Elective	3 Elective	3
	15	15

Senior		
Fall	Credits Spring	Credits
LING Area of Concentration	3 LING Area of Concentration	3
U.S. Cultures and Communities	3 Electives	9
Electives	11	
	17	12

Undergraduate Minor in Linguistics

Minors in linguistics are individually tailored to the interests of the student, who consults with the linguistics advisor to develop the minor program of study. The minor requires 15 credits in linguistics; at least 9 credits must be numbered 2000 level or above, of which at least 6 credits

are in courses numbered 3000 level or above. The minor must include at least 3 credits that are not used to meet any other department, college, or university requirement. All programs must include LING 2190 Introduction to Linguistics.

The Linguistics Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

Minor in TESL (Teaching English as a Second Language)

Minor in Teaching English as a Second Language (Minor in TESL) is for undergraduate students.

The Minor in TESL provides concentrated coursework that prepares students to teach English to nonnative speakers of English, either in community programs in the United States or in an overseas location. Students from any program may complete the minor without further studies in linguistics.

For more information, please contact the Linguistics Undergraduate Advisor.

Concurrent B.A. in Linguistics and M.A. in TESL/Applied Linguistics

A concurrent B.A. in Linguistics and M.A. in TESL and Applied Linguistics offers well-qualified students the opportunity for accelerated study, achieving both degrees within a 5-year time frame. A student enrolled in this program pursues a graduate M.A. degree while simultaneously completing the requirements for the B.A. in Linguistics. Completing the concurrent degree program would enable students to enter the workforce one year earlier than through the traditional M.A. degree pathway. Up to six credits can be double-counted toward the requirements for both degrees. Students applying for the concurrent degree program should be motivated, focused, and able to handle a 16+ credit hour/semester schedule.

Eligibility (all qualifications must be met to apply):

1. A minimum 45 credits in undergraduate program complete
2. Two years of ISU foreign language study or bilingualism demonstrated by an approved language test (completed or in progress)
3. At least 12 credits of Linguistics courses completed with a major GPA of 3.2 or higher,
4. A minimum cumulative ISU GPA of 3.0

Timeline

Students should know by the middle of their sophomore year if they are interested in pursuing the concurrent program. We recommend that

students plan ahead, and notify the undergraduate linguistics adviser as soon as they know of their intent to apply for the concurrent degree; if possible, the linguistics adviser should be notified of intent to pursue the concurrent degrees by the end of the 4th semester.

Students should apply for concurrent enrollment by the end of the 5th semester of study (and no later than the end of the 6th semester) by filing the Request for Concurrent Enrollment form from the Graduate College and submitting the application materials (listed below).

If accepted into the concurrent enrollment program, students should begin taking graduate courses (by the onset of the fourth year of study). Students accepted into the concurrent enrollment program will continue to work with the undergraduate linguistics adviser until the B.A. degree requirements are met. By the onset of the fifth year of study, students should have identified an area for their thesis/creative component and establish a program of study committee (including a major professor).

Students become full-time graduate students upon acceptance into the concurrent degree program. Students are eligible for research assistantships upon entry into the concurrent degree program, although it should be noted that these opportunities are rare. Student are eligible to apply for a teaching assistantship once all requirements for the B.A. degree are met; TA selection will follow the standard procedures for the department (including GRE scores).

How to Apply

The following components make up your application:

1. Fill out the Request for Concurrent Enrollment form from the Graduate College.
2. Write a statement of purpose, usually 1-2 pages, explaining why you want to pursue the M.A. degree.
3. Obtain three letters of recommendation.
4. Create a curriculum plan with the undergraduate linguistics adviser, who works closely with members of the graduate faculty.
5. Writing sample (which can be a paper written for an undergraduate course at ISU).
6. Submit your materials by e-mail to Teresa Smiley in the Graduate English Office at englgrad@iastate.edu.
7. GRE scores (not required for initial application; required if applying for a teaching assistantship).

The admission criteria are generally the same as those required for all graduate students in the department. Application materials are reviewed by the graduate faculty in linguistics, the department's Director of Graduate Education (DOGE), and the department chair; their recommendations are forwarded on to the ISU Graduate College.

BA in Linguistics

120 credits

- 45 credits at 3000+
- 36 credits in major (6 graduate credits can double count with graduate degree requirements)
- 9 credits English communication (such as ENGL 3140 Technical Communication)
- 12-16 credits of foreign language
- 29 credits in general education: 9 in A&H, 9 in SS, 8 in NS, 3 in math
- Possible linguistics electives:
 - LING 3090, LING 3180, LING 3190, LING 3200, LING 3220, LING 3240, LING 3250, LING 4220, LING 4250, 3000-level Spanish LING courses

MA in TESL/Applied Linguistics

**6 credits (including 5100) can count as an elective in the B.A. degree

Graduate Minor

A graduate minor in linguistics permits students to investigate various aspects of linguistics, emphasizing the ability to think about language in a systematic and disciplined way and to apply the methods of the field to research problems in their own disciplines. Graduate courses for the minor may be cross-listed with courses in Anthropology, Communication Disorders, Computer Science, English, Psychology, and World Languages and Cultures.

For those pursuing a master’s degree, a declared minor in linguistics consists of 9 credits in linguistics including two foundation courses:

LING 5110	Introduction to Linguistic Analysis	3
One of the following:		3
LING 5140	Sociolinguistics	
LING 5270	Discourse Analysis	
LING 5370	Corpus Approaches to Grammatical Analysis	
And one elective from the list of courses approved for graduate credit		3
Total Credits		9

For those pursuing a Ph.D. degree, the minor consists of 12 credits in linguistics including:

LING 5110	Introduction to Linguistic Analysis	3
LING 5370	Corpus Approaches to Grammatical Analysis	3
And two electives from the list of courses approved for graduate credit		6
Total Credits		12

Additional courses beyond those listed below may be used as electives. The chair of the supervisory committee can provide information about these.

At least one member of the linguistics faculty will serve on a student’s program of study committee. A list of faculty members may be obtained from the Linguistics program website. Ph.D. candidates will write one section of the preliminary examination on an area of linguistics. Students in the Master’s in Teaching English as a Second Language/Applied Linguistics are not eligible for a graduate minor in linguistics.

Mathematics

The program in mathematics offers training for students planning to work in mathematics and computation for industry, planning to continue their studies in graduate school, or planning to enter secondary education teaching. Students may satisfy the major requirements in several ways, which are designed to meet these various career objectives.

Student Learning Outcomes

Our graduates will:

- Demonstrate proficiency with the techniques and applications of calculus.
- Demonstrate problem solving skills, critical thinking, and analytical reasoning as applied to mathematical problems and modeling.
- Read and write mathematical proofs, producing arguments that are logically and syntactically correct.
- Effectively communicate mathematical facts in oral or written formats.
- Demonstrate an in-depth understanding of some area of mathematics.

Curriculum

As majors in the College of Liberal Arts and Sciences, Math students must meet College of Liberal Arts and Sciences and University-wide requirements for graduation in addition to those stated below for the major.

Mathematics Core

All Math majors are required to earn credit for the following core courses:

MATH 1010	Orientation in Mathematics	1
MATH 1650	Calculus I	4
MATH 1660	Calculus II	4
MATH 2010	Introduction to Proofs	3
MATH 2650	Calculus III	4
MATH 3170	Theory of Linear Algebra	3-4

or MATH 4070 Applied Linear Algebra

Total Credits 19-20

To complete the major, leading to a Bachelor of Science degree, students must choose from one of the following four pathways:

Standard Mathematics Major

This degree program is designed for students planning to work in industry or those who plan to continue their studies mathematics at the graduate level. Students are required to earn credit for the following courses:

MATH 2660	Elementary Differential Equations	3-4
or MATH 2670	Elementary Differential Equations and Laplace Transforms	
MATH 3010	Abstract Algebra I	3
MATH 4140	Analysis I	3
Additional MATH courses at the 3000, 4000, or 5000 level		15
Total Credits		24-25

Additionally, the courses must include one of the following sequences:

MATH 3010	Abstract Algebra I	6
& MATH 4030	and Intermediate Abstract Algebra	
MATH 3040	Combinatorics	6
& MATH 3140	and Graph Theory	
MATH 3730	Introduction to Scientific Computing	6
& MATH 4810	and Numerical Methods for Differential Equations	
MATH 4140	Analysis I	6
& MATH 4150	and Analysis II	
MATH 4350	Geometry I	6
& MATH 4360	and Geometry II	

Mathematics Major with Actuarial Science Certificate

This degree program is designed for students pursuing a career as an actuary or in the financial sector. Students are required to earn credit for the following courses:

MATH 2400	Mathematics of Investment and Credit	3
MATH 3410	Introduction to the Theory of Probability and Statistics I	4
MATH 4140	Analysis I	3
MATH 4410	Life Contingencies I	3
MATH 4420	Life Contingencies II	3
Total Credits		16

Additionally, students must meet the requirements for the Actuarial Science Certificate (see www.catalog.iastate.edu/collegeofbusiness/actuarialscience/#certificatetext).

Mathematics Major with Applications

This degree program is for students who want to specialize in the application of mathematics to an area of study. It is recommended for those who plan to work in industry or those who plan to continue studying their specialization area at the graduate level. Students are required to earn credit for the following courses:

MATH 2660	Elementary Differential Equations	3-4
or MATH 2670	Elementary Differential Equations and Laplace Transforms	
Four of the following:		12-13
MATH 3010	Abstract Algebra I	
MATH 3040	Combinatorics	
MATH 3140	Graph Theory	
MATH 3410	Introduction to the Theory of Probability and Statistics I	
MATH 3500	Number Theory	
MATH 3650	Complex Variables with Applications	
MATH 3730	Introduction to Scientific Computing	
MATH 3850	Introduction to Partial Differential Equations	
MATH 4140	Analysis I	
MATH 4210	Logic for Mathematics and Computer Science	
MATH 4230	Mathematical Modeling in Biology	
MATH 4240	Introduction to High Performance Computing	
MATH 4690	Introduction to Discrete Mathematics	
MATH 4810	Numerical Methods for Differential Equations	

Courses at the 3000, 4000, or 5000 level from one of the following 12 designations: ABE, AERE, ASTRO, BBMB, BCB, BCBIO, BIOL, BME, BMS, CHE, CHEM, CE, COMS, CONE, CPRE, CYBE, DS, ECON, EE, EM, ENSCI, ENVE, FIN, GEN, GEOL, IE, MATE, ME, MICRO, MIS, MTEOR, NUCE, PHIL, PHYS, PSYCH, SE, SOC, STAT

Total Credits 27-29

Mathematics Major for Teacher Preparation

This degree program prepares students for a career in secondary education.

All students preparing to become teachers need to complete the core Math classes required of all Math majors, the courses laid out below, and the requirements of the Secondary Major in Education including Student Teaching.

Note: Teacher license requirements are established by the Iowa Department of Education and the Iowa Board of Educational Examiners

and are subject to change. Recent changes may not be reflected in this catalog, but advisers and faculty will be aware.

COMS 1040	Brief Introduction to Computer Programming for Non-Majors	2-4
or COMS 1060 Introduction to Web Programming		
or COMS 1270 Introduction to Computer Programming		
or COMS 2070 Fundamentals of Computer Programming		
or COMS 2270 Object-oriented Programming		
STAT 2010	Introduction to Statistical Concepts and Methods	4
MATH 2660	Elementary Differential Equations	3-4
or MATH 2670 Elementary Differential Equations and Laplace Transforms		
MATH 3010	Abstract Algebra I	3
MATH 3410	Introduction to the Theory of Probability and Statistics I	4
MATH 4140	Analysis I	3
MATH 4350	Geometry I	3
MATH 4360	Geometry II	3
MATH 3970	Teaching Secondary Mathematics Using University Mathematics	3
MATH 4970	Teaching Secondary School Mathematics	3
Total Credits		31-34

Complementary Coursework for Teacher Preparation

In addition to the courses required for the Math Major and those required for the Secondary Major in Education, the complementary coursework below is required for those seeking licensure in mathematics. Some of these courses, and some of the required coursework for the Secondary Major in Education, can also apply to LAS general education requirements.

PSYCH 2300	Developmental Psychology	3
or HDFS 1020 Human Development		
And one course in American History or Government		3
Total Credits		6

University and College Requirements

In addition to the core and pathway courses, students are also required to earn credit for the following courses:

Courses from General Education Area I - Arts and Humanities ¹	12
Courses from General Education Area IIB - Natural Sciences ¹	8
Courses from General Education Area III - Social Sciences ¹	9
LAS Career Proficiency Requirement (LAS 2030)	1
Courses meeting the International Perspectives requirement ²	3

Courses meeting the U.S. Cultures and Communities requirement ²		3
LIB 1600	Introduction to College Level Research	1
ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition ³	3
One of the following: ⁴		3
ENGL 3020	Business Communication	
ENGL 3030	Free-Lance Writing for Popular Magazines	
ENGL 3050	Creative Writing: Nonfiction	
ENGL 3090	Proposal and Report Writing	
ENGL 3140	Technical Communication	
MATH 3920X	Mathematical Communication	
MATH 4910	Undergraduate Thesis ⁵	

¹ Possible choices can be found here: <https://las.iastate.edu/students/academics/general-education/>

² Courses used to meet the International Perspectives and U.S. Cultures and Communities requirements can also be used to fulfill general education requirements.

³ Students must earn a grade of C or better.

⁴ Students must earn a grade of C- or better.

⁵ With departmental approval.

Furthermore, students must earn a minimum of 120 credits, including a minimum of 45 credits at the 3000 or 4000 level, and including at least 8 credits in the major at the 3000/4000 level with a grade of C or better. At least 55 of these credits must be earned at a four-year institution, and the last 32 credits must be earned at Iowa State University. A maximum of 16 technical credits are allowed, and a maximum of 9 P-NP credits of free electives may apply. Students must also meet the LAS World Language requirement and have a minimum 2.00 ISU cumulative Grade Point Average.

Four Year Plans
Mathematics Major

Freshman			
Fall	Credits Spring		Credits
MATH 1010	1	MATH 1660	4
MATH 1650	4	Arts & Humanities Choice	3
ENGL 1500	3	Natural Science Choice	4
LIB 1600	1	Social Science Choice	3
Natural Science Choice	4		
Electives	3		
		16	14

Sophomore

Fall	Credits Spring	Credits
MATH 2010	3 MATH 2660 or 2670	3-4
MATH 2650	4 MATH 3170	4
Arts & Humanities Choice	3 ENGL 2500	3
Social Science Choice	3 Social Science Choice	3
Electives	3 LAS 2030	1
	16	14-15

Junior

Fall	Credits Spring	Credits
MATH Sequence Course I	3 MATH Sequence Course II	3
MATH 3010 or 4140	3 MATH 4140 or 3010	3
Arts & Humanities Choice	3 Communication Choice	3
Electives/World Language	6 Electives/World Language	6
	15	15

Senior

Fall	Credits Spring	Credits
MATH 3000+	3 MATH 3000+	6
Arts & Humanities Choice	3 Electives	9
Electives	9	
	15	15

Total Credits: 120-121**Mathematics Major with Actuarial Science Certificate****Freshman**

Fall	Credits Spring	Credits
MATH 1010	1 MATH 1660	4
MATH 1650	4 ECON 1020	3
ENGL 1500	3 STAT 2260	3
LIB 1600	1 ACCT 2840	3
ECON 1010	3 Electives	3
Electives	3	
	15	16

Sophomore

Fall	Credits Spring	Credits
MATH 2010	3 MATH 2400	3
MATH 2650	4 MATH 3170	4
FIN 3010	3 ENGL 2500	3
Arts & Humanities Choice	3 FIN 3200	3
Electives	3 Arts & Humanities Choice	3
LAS 2030	1	
	17	16

Junior

Fall	Credits Spring	Credits
STAT 3410	4 FIN 4240	3
STAT 3010 or 3260	3-4 STAT 3420	4
Natural Science Choice	4 Communication Choice	3
Electives/World Language	3 Natural Science Choice	4
	Electives/World Language	3
	14-15	17

Senior

Fall	Credits Spring	Credits
MATH 4140	3 MATH 4420	3
MATH 4410	3 Social Science Choice	3
Arts & Humanities Choice	3 Electives	9
Electives	6	
	15	15

Total Credits: 125-126**Mathematics Major with Applications****Freshman**

Fall	Credits Spring	Credits
MATH 1010	1 MATH 1660	4
MATH 1650	4 Arts & Humanities Choice	3
ENGL 1500	3 Natural Science Choice	4
LIB 1600	1 Social Science Choice	3
Natural Science Choice	4 Specialization Area Prereq.	3
Specialization Area Prereq.	3	
	16	17

Sophomore

Fall	Credits Spring	Credits
MATH 2010	3 MATH 2660 or 2670	3-4
MATH 2650	4 MATH 3170	4
Arts & Humanities Choice	3 ENGL 2500	3
Social Science Choice	3 Social Science Choice	3
Specialization Area Prereq.	3 LAS 2030	1
	16	14-15

Junior

Fall	Credits Spring	Credits
MATH 3000+ or MATH 3040	3 MATH 3000+ or MATH 3140	3
Specialization Area 3000+	3 Specialization Area 3000+	3
Arts & Humanities Choice	3 Communication Choice	3
Electives/World Language	6 Electives/World Language	6
	15	15

Senior		
Fall	Credits Spring	Credits
MATH 3000+	3 MATH 3000+	3
Specialization Area 3000+	3 Specialization Area 3000+	3
Arts & Humanities Choice	3 Electives	9
Electives	6	
	15	15
Total Credits: 123-124		

Mathematics Major for Teacher Preparation

Freshman		
Fall	Credits Spring	Credits
MATH 1010	1 MATH 1660	4
MATH 1650	4 STAT 2010	4
ENGL 1500	3 EDUC 2190	1
LIB 1600	1 EDUC 2800L	0.5
PSYCH 2300 or HDF5 1020	3 EDUC 2020	3
Arts & Humanities Choice	3 Arts & Humanities Choice	3
	15	15.5

Sophomore		
Fall	Credits Spring	Credits
MATH 2010	3 MATH 2660 or 2670	3-4
MATH 2650	4 MATH 3170	4
ENGL 2500	3 PSYCH 3330	3
EDUC 2040	3 COMS 1040, 1060, 1270, 2070, or 2270	2-4
Natural Science Choice	4 Natural Science Choice	4
LAS 2030	1	
	18	16-19

Junior		
Fall	Credits Spring	Credits
MATH 3010	3 MATH 3970	3
MATH 3410	4 MATH 4360	3
MATH 4350	3 EDUC 3800A	1-2
EDUC 4060	3 SPED 4010	3
Communication Choice	3 Social Sciences Choice	3
	Arts & Humanities Choice	3
	16	16-17

Senior		
Fall	Credits Spring	Credits
MATH 4140	3 EDUC 4170C	16
MATH 4970	3	
EDUC 3950	3	

EDUC 4800C	0.5-2
Arts & Humanities Choice	3
	12.5-14
	16

Total Credits: 125-130.5

Undergraduate Minors

The department offers a minor in mathematics, and a minor in applied mathematics.

The mathematics undergraduate minors are LAS minors. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher. At least 3 credits must apply exclusively towards the minor and cannot be used to meet any other department, college, or university requirement.

Mathematics Minor

Students are required to earn credit for the following courses:

MATH 2010	Introduction to Proofs	3
MATH 2650	Calculus III	4
MATH 2660	Elementary Differential Equations	3-4
	or MATH 2670 Elementary Differential Equations and Laplace Transforms	
MATH 3170	Theory of Linear Algebra	3-4
	or MATH 4070 Applied Linear Algebra	
One of the following:		3-4
MATH 3010	Abstract Algebra I	
MATH 3040	Combinatorics	
MATH 3140	Graph Theory	
MATH 3410	Introduction to the Theory of Probability and Statistics I	
MATH 3500	Number Theory	
MATH 3650	Complex Variables with Applications	
MATH 3730	Introduction to Scientific Computing	
MATH 3850	Introduction to Partial Differential Equations	
MATH 4140	Analysis I	
MATH 4210	Logic for Mathematics and Computer Science	
MATH 4230	Mathematical Modeling in Biology	
MATH 4350	Geometry I	
MATH 4360	Geometry II	
MATH 4690	Introduction to Discrete Mathematics	

Total Credits
16-19

Applied Mathematics Minor

Students are required to earn credit for the following courses:

MATH 2650	Calculus III	4
MATH 2070	Matrices and Linear Algebra	3-4
or MATH 3170	Theory of Linear Algebra	
MATH 2660	Elementary Differential Equations	3-4
or MATH 2670	Elementary Differential Equations and Laplace Transforms	
One of the following:		3-4
MATH 3140	Graph Theory	
MATH 3650	Complex Variables with Applications	
MATH 3850	Introduction to Partial Differential Equations	
MATH 4070	Applied Linear Algebra	
MATH 4230	Mathematical Modeling in Biology	
MATH 4810	Numerical Methods for Differential Equations	
One of the following:		3-4
MATH 3040	Combinatorics	
MATH 3140	Graph Theory	
MATH 3410	Introduction to the Theory of Probability and Statistics I	
MATH 3650	Complex Variables with Applications	
MATH 3730	Introduction to Scientific Computing	
MATH 3850	Introduction to Partial Differential Equations	
MATH 4070	Applied Linear Algebra	
MATH 4210	Logic for Mathematics and Computer Science	
MATH 4230	Mathematical Modeling in Biology	
MATH 4240	Introduction to High Performance Computing	
MATH 4690	Introduction to Discrete Mathematics	
MATH 4810	Numerical Methods for Differential Equations	
Total Credits		16-20

Graduate Study

The department offers programs leading to a Master of Science or Doctor of Philosophy degree in mathematics or applied mathematics, as well as minor work for students whose major is in another department.

Students desiring to undertake graduate work leading to the M.S. or Ph.D. degree should prepare themselves by taking several upper division mathematics courses.

The M.S. degree requires a student to take at least 30 credit hours and to write a creative component or thesis. Additionally, students must pass a comprehensive oral examination over their coursework and their creative component or thesis. See the online Mathematics Graduate Handbook for specific requirements.

The Ph.D. degree requires a student to take 42 credit hours of coursework in addition to research hours, pass written qualifying examinations,

pass an oral preliminary exam, and perform an original research project culminating in a dissertation which is defended by an oral exam. Ph.D. candidates must have at least one year of supervised teaching experience. See the online Mathematics Graduate Handbook for specific requirements.

Meteorology Overview

Offered by the Department of the Earth, Atmosphere, and Climate. (<https://earth-atmosphere-climate.iastate.edu>)

The Bachelor of Science Major in Meteorology: The study of meteorology involves the description of the earth's atmosphere and the processes responsible for its behavior. Students majoring in Meteorology earn a Bachelor of Science. The major satisfies guidelines specified by the American Meteorological Society and meets education requirements for employment with the National Weather Service and the World Meteorological Organization. Successful preparation for professional or graduate work in Meteorology requires that the student develop and integrate a diverse range of skills and knowledge bases. These include weather observing, the physics and dynamics of the global atmosphere, application of new weather technologies, advanced mathematical tools, computer programming and modeling, and effective oral and written communication. The faculty view the senior thesis (MTEOR 4990 Senior Research), in particular, as a capstone experience in which students demonstrate they have achieved this integration. Also, contemporary meteorology is an earth-system science with ties to a variety of human experiences. The electives and general education requirements of the college are further experiences that the meteorology student must integrate with their core meteorology knowledge in order to function effectively in a globally oriented profession.

Meteorology as an Additional Major: The Meteorology program allows students in academic programs with affinity to meteorology to complete an additional major in meteorology through an accelerated pathway. Students earning a B.S. degree in electrical or aerospace engineering who complete the designated Meteorology coursework of at least 25 credit hours can earn an additional major in Meteorology. Students should work closely with their advisors in each department to ensure that all requirements are met. Please review the information on the department website or contact the current program head for more information and sample four-year plans to earn an additional major in Meteorology.

Student Learning Outcomes

Upon graduation, students should be able to:

- Demonstrate the ability to think critically.
- Exhibit a broad understanding of atmospheric systems and processes.

- Demonstrate scientific literacy and its application to scientific inquiry and societal concerns.
- Demonstrate proficiency in data collection, management, and analysis including understanding sources of error and/or uncertainty.
- Read and critically evaluate relevant literature and information.
- Use appropriate tools from chemistry, physics, biology, mathematics, and data science to solve discipline-specific problems.
- Present information effectively in written and oral forms.
- Work in a team environment in alignment with the ISU principles of community.
- Work independently.
- Attain employment in meteorology, atmospheric science or related fields, or pursue graduate studies.

Degree Requirements

The program requires the following courses:

MTEOR 1110	Synoptic Applications	1
MTEOR 2010	Introductory Seminar	R
MTEOR 2060	Introduction to Weather and Climate	3
MTEOR 2270	Computational Meteorology I	3
MTEOR 3010	General Meteorology	4
MTEOR 3110	Introduction to Synoptic Meteorology	2
MTEOR 3410	Atmospheric Physics I	3
MTEOR 3420	Atmospheric Physics II	3
MTEOR 3990	Writing for Research	2
MTEOR 4110	Synoptic Meteorology	3
MTEOR 4170	Mesoscale Forecasting Laboratory	3
MTEOR 4320	Instrumentation and Measurements	3
or MTEOR 4350	Radar Applications in Meteorology	
MTEOR 4430	Dynamic Meteorology I	3
MTEOR 4540	Dynamic Meteorology II	3
MTEOR 4990	Senior Research	2
Total Credits		38

An additional 9 credits must be chosen from:

GEOL 4020	Watershed Hydrology	3
MTEOR 3600	Ocean-Atmosphere Interactions	3
MTEOR 4040	Global Change	3
MTEOR 4050	Soil-Plant-Animal-Atmosphere Physics	3
MTEOR 4060	World Climates	3
MTEOR 4070	Mesoscale Meteorology	3
MTEOR 4080	Numerical Weather and Climate Prediction	3
MTEOR 4160	Hydrologic Modeling and Analysis	3

MTEOR 4350	Radar Applications in Meteorology	3
MTEOR 4400	Tropical Meteorology	3
MTEOR 4520	Climate Modeling	3
MTEOR 4890	Survey of Remote Sensing Technologies	3
MTEOR 4890L	Satellite Remote Sensing Laboratory	1
MTEOR 4900	Independent Study	1-3
GEOL 4150	Paleoclimatology	3
GEOL 4520	Intro GIS for Geoscientists	3
CE 3720	Engineering Hydrology and Hydraulics	3

Supporting work is required in areas at least equivalent to:

One of the following sequences	5
CHEM 1630 & 1630L	College Chemistry and Laboratory in College Chemistry

Or

CHEM 1770 & 1770L	General Chemistry I and Laboratory in General Chemistry I
PHYS 2310 & 2310L	Introduction to Classical Physics I and Introduction to Classical Physics I Laboratory
PHYS 2320	Introduction to Classical Physics II
MATH 1650	Calculus I
MATH 1660	Calculus II
MATH 2650	Calculus III
MATH 2660	Elementary Differential Equations
STAT 3050	Engineering Statistics

Total Credits **32**

A grade of C or better (not C-) is required in each of the following courses to meet minimum graduation requirements for a bachelor of science degree in Meteorology:

MTEOR 2060	Introduction to Weather and Climate	3
MTEOR 3010	General Meteorology	4

Several co-op programs are available for upper-division undergraduates. Although a range of opportunities exists for men and women who terminate their studies with a Bachelor of Science, students who meet the necessary academic standards are encouraged to continue their studies in a graduate program. For these students, additional coursework is recommended in mathematics or physical science. Other students can choose a wide range of supporting courses that will contribute to their particular area of interest in meteorology.

Communication Proficiency requirement: According to the university-wide Communication Proficiency Grade Requirement, students must

demonstrate their communication proficiency by earning a grad of C or better in ENGL 2500.

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
	or ENGL 2500H Written, Oral, Visual, and Electronic Composition: Honors	
MTEOR 3990	Writing for Research	2
MTEOR 4990	Senior Research	2

As majors in the College of Liberal Arts and Sciences, Climate Science students must meet College of Liberal Arts and Sciences and University-wide requirements for graduation in addition to those stated above for the major.

Liberal Arts and Sciences (LAS) majors require a minimum of 120 credits, **including a minimum of 45 credits at the 3000/4000 level**. You must also complete the Communication Proficiency, LAS world language requirements, and LAS career proficiency requirement. Six semesters of one foreign language in high school satisfies the World Language requirement.

Students in all ISU majors must complete a 3-credit course in U.S. Cultures and Communities and a 3-credit course in International Perspectives. Discuss with your advisor how the two courses that you select can be applied to address general education requirements. Check for a list of approved courses at: <http://www.registrar.iastate.edu/courses/div-ip-guide.html>.

Four Year Plans

These plans are examples only; students should discuss their graduation plans with their advisor.

Path 1 for students prepared to start in calculus

Freshman

Fall	Credits Spring	Credits
MTEOR 1110	1 MTEOR 1130	1
MTEOR 1120	1 MTEOR 2060	3
MATH 1650	4 MATH 1660	4
CHEM 1630 or 1770 ¹	4 PHYS 2310	4
CHEM 1630L or 1770L ¹	1 PHYS 2310L	1
ENGL 1500	3 Humanities/Social Science Choice	3
LIB 1600	1	
	15	16

Sophomore

Fall	Credits Spring	Credits
MTEOR 2010	R MTEOR 3010	4

MTEOR 2270	3 MATH 2660	3
ENGL 2500	3 STAT 3050	3
MATH 2650	4 LAS 2030	1
PHYS 2320	4 Humanities/Social Science Choice	3
	Humanities/Social Science Choice	3
	14	17

Junior

Fall	Credits Spring	Credits
MTEOR 3110	2 MTEOR 3420	3
MTEOR 3410	3 MTEOR 3990	2
MTEOR 4430	3 MTEOR 4540	3
World Language/Elective	3-4 World Language/Elective	3-4
Humanities/Social Science Choice	3 Humanities/Social Science Choice	3
	Humanities/Social Science Choice	3
	14-15	17-18

Senior

Fall	Credits Spring	Credits
MTEOR 4110	3 MTEOR 4170	3
MTEOR 4990	2 MTEOR 4320 or 4350	3
Meteorology Elective/ elective Choice ^{2,3}	3 Meteorology Elective/ Elective Choice ^{2,3}	1-3
Meteorology Elective/ Elective choice ^{2,3}	3 Meteorology Elective/ Elective Choice ^{2,3}	3
Humanities/Social Science Choice	3 Humanities/Social Science Choice	3
	14	13-15

Total Credits: 120-124

- ¹ Students taking CHEM 1770 should plan to take CHEM 1780 as well.
² Students must select at least 9 credits from a list of optional courses.
³ Students should select a humanities or social science course based on need. If these LAS requirements have been satisfied, students may select a meteorology elective or alternate course. Students should discuss possible alternate course options with their advisor.

Path 2 for students needing preparatory mathematics

Freshman

Fall	Credits Spring	Credits
MTEOR 1120	1 MTEOR 1130	1
MATH 1430	4 MATH 1650	4

ENGL 1500	3 MTEOR 2060	3
CHEM 1630	4 Humanities/Social Science Choice	3
CHEM 1630L	1 Humanities/Social Science Choice	3
LIB 1600	1	
		14

Sophomore

Fall	Credits Spring	Credits
MTEOR 1110	1 MATH 2650	4
MTEOR 2010	R MTEOR 3010	4
MTEOR 2270	3 STAT 3050	3
ENGL 2500	3 PHYS 2320	4
MATH 1660	4 LAS 2030	1
PHYS 2310	4	
PHYS 2310L	1	
		16

Junior

Fall	Credits Spring	Credits
MTEOR 3110	2 MTEOR 3420	3
MTEOR 3410	3 MTEOR 3990	2
MTEOR 4430	3 MTEOR 4540	3
MATH 2660	3 World Language/Elective	3-4
World Language/Elective	3-4 Humanities/Social Science Choice	3
	Humanities/Social Science Choice	3
		14-15

Senior

Fall	Credits Spring	Credits
MTEOR 4110	3 MTEOR 4170	3
MTEOR 4990	2 MTEOR 4320 or 4350	3
Meteorology Elective/ Elective Choice ^{2,3}	3 Meteorology Elective/ Elective Choice ^{2,3}	3
Meteorology Elective/ Elective Choice ^{2,3}	3 Meteorology Elective/Elective Choice ^{2,3}	0-3
Humanities/Social Science Choice	3 Humanities/Social Science Choice	3
		14

Total Credits: 117-122

³ Students should select a humanities or social science course based on need. If these LAS requirements have been satisfied, students may select a meteorology elective or alternate course. Students should discuss possible alternate course options with their advisor.

Minor

The department offers a minor in Meteorology which may be earned by completing 15 credits including MTEOR 1110 Synoptic Applications (only 1 credit may count toward the minor), MTEOR 2060 Introduction to Weather and Climate and MTEOR 3010 General Meteorology. The minor must include at least 9 credits in courses numbered 2000 or above of which at least 6 credits are in the courses numbered 3000 or above. At least 3 credits have to be taken at Iowa State University. At least 3 credits are not used to meet any other department, college or university requirement. Further information concerning programs of study, including sample degree programs, is available from the department.

The Meteorology Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

Concurrent Programs

Combined Degrees: A concurrent program is offered which combines a Bachelor of Science degree in meteorology and a Master of Science degree in meteorology. This program gives well-qualified Iowa State juniors and seniors the opportunity to begin working on the M.S. degree before completing the B.S. degree, reducing by at least one year the normal time period necessary to complete both degrees separately. Additionally, a concurrent program exists that gives students the opportunity to receive a B.S. in meteorology and an M.B.A. (Master of Business Administration) within five years. Review the department website or contact the current program head for more information regarding these options.

Graduate Meteorology

The department offers programs leading to the master of science (M.S.) and doctor of philosophy (Ph.D.) in Meteorology. Students desiring a major in Meteorology normally will have a strong undergraduate background in the physical and mathematical sciences. Individuals desiring to enter a graduate program are evaluated by considering their undergraduate preparation and performance along with their expressed goals in the statement of purpose. Prospective students are encouraged to reach out to individual faculty members who they wish to work with prior to applying.

Programs of study are designed on an individual basis in accordance with the requirements of the Graduate College and established requirements for each departmental major. Additional coursework is normally taken in complementary areas such as aerospace engineering, agronomy (soil science), chemistry, civil and construction engineering, computer engineering, computer science, engineering mechanics, environmental

¹ Students taking CHEM 1770 should plan to take CHEM 1780 as well.

² Students must select at least 9 credits from a list of optional courses.

science, materials engineering, mathematics, mechanical engineering, microbiology, physics, or statistics. Departmental requirements provide a strong, broad background in the major and allow considerable flexibility in the program of each individual.

A thesis is required of all M.S. candidates, and a dissertation is required of all Ph.D. candidates.

Course requirements for the M.S. degree include the completion of at least 6 courses from the list of graduate Meteorology courses (MTEOR 5020, MTEOR 5040, MTEOR 5050, MTEOR 5070, MTEOR 5160, MTEOR 5180, MTEOR 5350, MTEOR 5400, MTEOR 5520, MTEOR 5540, MTEOR 5680, MTEOR 5890, or MTEOR 6050) or from outside the department according to the students' professional goals and interests, in consultation with their advisor and POS committee. Students without prior synoptic meteorology course work must complete MTEOR 5110 and may substitute these credits in place of other elective courses.

Students without prior Dynamic Meteorology course work must take our two-course undergraduate dynamic sequence, but at the graduate level.

Graduates in Meteorology have a good comprehension of basic principles, a capacity for critical and independent thought, and an ability to communicate effectively with scientific colleagues. They have an appropriate breadth in their understanding of meteorology with a suitable specialization. Graduates are able to undertake thorough research and explain the results in a scientifically reasonable fashion.

Middle Eastern Studies Minor

Overview

The cross-disciplinary Middle Eastern Studies Minor is designed for students who seek to explore the cultures, languages, history, politics, economy, and environment of the Middle East, including the Arab world, North Africa, Turkey, and Iran. The Middle Eastern Studies Minor's courses provide the background and training for students whose major fields of study might include Anthropology, History, Philosophy and Religious Studies, Political Science, and World Languages and Cultures. The minor should be of special interest to students with interests in graduate studies or career interests in international business, education, translation, law, diplomacy, national security, non-governmental organizations, and/or international organizations.

Student Learning Outcomes

After completing the minor in Middle Eastern Studies, students will demonstrate:

- Some proficiency in oral and written Arabic with an ability to comprehend authentic Arabic texts.
- Knowledge of the history of the Middle East from classical to modern times.

- Knowledge of the geographic features of the Middle East and of the major political boundaries, alliances, and power struggles that characterize the contemporary Middle East.
- An understanding of cultural diversity issues in the Middle East in the context of the prevalent political, social, and cultural institutions and structures.

The minor in Middle Eastern Studies requires 15 credit hours

Required course work in core courses (9 credits total)

ARABC 3750	Arab Culture	3
or HIST 3310	History of the Islamic World to 1800	
POLS 3500	Politics of the Middle East	3
RELIG 3580	Islam	3

At least 6 additional credits of elective courses from the following list (this list may change/be updated as new elective courses become available)

ARABC 2010	Intermediate Arabic I	4
ARABC 2020	Intermediate Arabic II	4
ARABC 3710	The Arabian Nights	3
ARABC 3750	Arab Culture	3
ARTH 3840	Art of Islam	3
ECON 4960	Economics International Travel Course	1-3
HIST 3310	History of the Islamic World to 1800	3
RELIG 2420	History of Christianity: Early to Medieval	3
RELIG 3590	The Quran	3
WLC 3700B	Topics in World Languages and Cultures in English Translation: Middle East	3

Students may count Model Arab League (via specified POLS 4900 section) toward the minor.

The Middle Eastern Studies Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

Language co-requisite: All students pursuing the minor in Middle Eastern Studies must complete and receive a passing grade in:

ARABC 1010 Elementary Arabic I and ARABC 1020 Elementary Arabic II. Completion of the beginning level of other languages spoken in the Middle East (e.g., Hebrew, Farsi, Kurdish, Turkish, Pashto, etc.) will be accepted in lieu of beginner Arabic upon petition to the Program Director. Native speakers of Arabic (or other languages spoken in the Middle East) can petition for a waiver of the language requirement.

Military Science Program

Overview

The Military Science Department is embedded within the College of Liberal Arts and Sciences as an interdisciplinary program, but does not offer an academic degree. The mission of the department is derived directly from regulations governing Army Reserve Officers' Training Corps (AROTC), which are issued by the U.S. Army Cadet Command and U.S. Army Training and Doctrine Command and cannot be modified by this department.

Freshmen Year Learning Outcomes

The student will have a working knowledge of the following areas: The Role of the Army, Roles and Origins of the Army, Army Customs and Traditions, Branches (Jobs) in the Army and Military Operations and Tactics, U.S. Army leadership and character development.

Sophomore Year Learning Outcomes

The student will have a working knowledge of the following areas: The Role of an Officer, Role of the Officer and Noncommissioned Officer, communications, code of conduct, first aid, principles of war and military operations and tactics, and begin to apply U.S. Army leadership through observed activities and demonstrate character development traits.

Junior Year Learning Outcomes

The student will have a working knowledge of the following areas: Small Unit Training, Command and Staff Functions, Nuclear, Biological and Chemical Warfare, Law of War, Weapons, Human Behavior, Math Reasoning, Computer Science and Military Operations and Tactics; Cadets will actively analyze character development and assess leadership skills.

Senior Year Learning Outcomes

The student will have a working knowledge of the following areas: Transition to Becoming an Officer, Military Justice, Intelligence and Electronic Warfare, Army Personnel Management, Army Logistics, Post and Installation Support and Military Operations and Tactics; Cadets will internalize and adhere to the U.S. Army's profession through active leadership and congruence of character development.

The mission of the Army Reserve Officers' Training Corps (AROTC) is to commission the future leaders of the United States Army. Since ROTC produces over 65 percent of the Army's Officer Corps, our task is one of the most important undertakings in the Army and our country today. We seek top quality college students. We train these potential leaders, assess their abilities, and challenge them with the highest standards of profession/professionalism. Those who successfully complete the program, receive a commission as a second lieutenant in the U.S. Army. A commission as an Army officer affords the opportunity to pursue a profession in one or several of the 300 different jobs held by Army

officers. Students may request to serve as an officer in either the active army, or part time in the Army Reserve or National Guard. Regardless of the method of service, officers in today's Army can be proud to know that they are doing their share in the defense of the United States of America.

The ISU Military Science program is divided into two segments, the basic program and the advanced program. The basic program (courses numbered 1010-2900) is designed primarily for freshmen and sophomores. No military obligation is incurred by a person participating in the basic program. The basic program is designed to be informative and to acquaint students with the military as a profession. The basic program or an allowed substitute is a prerequisite for the advanced program. Financial assistance is available on a competitive basis.

Persons interested in Military Science should visit the department located on the second floor of the Armory (east side).

Basic Program

The basic program courses are primarily for freshmen and sophomore students and, except for persons with prior military service and basic training graduates, are required for entry into the advanced program. Each scholarship cadet in the Basic Program receives a monthly allowance for up to 10 months. The curriculum is designed to train freshmen and sophomores in individual and team skills. It also helps the Professor of Military Science identify individual leader developmental needs.

Advanced Program

The advanced program courses are for students who have completed the basic program (or received equivalent credit) and are mandatory for potential commissioning upon contracting at the beginning of their junior year. Each cadet receives a monthly allowance for up to 10 months. These courses are primarily taught to academic juniors and seniors.

Successful completion normally obligates the student to military service on active or reserve duty. In addition to the advanced program of study, a student (cadet) will be expected to pass the Army Physical Fitness Test (precondition for commissioning) each semester and continually maintain military appearance standards in both personal grooming and uniform. Physical fitness training is regularly conducted outside of class and laboratory hours in a separate course, MS 1500 Army Physical Readiness. Students are encouraged to attend and participate in this class.

Professional Military Science Education (PME) coursework outside of the military science curriculum is also a precondition to commissioning. The PME component consists of Basic Academic proficiency standards. These standards are explained to prospective students as they consider enrollment in the advanced program. Army Uniforms will be worn at least once a week. The 300-level courses are designed to prepare cadets for

the Advanced Course, which is a 37 day summer internship/training program where cadets are trained to Army standards, develop leadership skills, and have their officer potential evaluated. The 400-level courses are the final preparation for commissioning as a second lieutenant in the United States Army. Students must meet academic alignment criteria and receive basic program credit before entering the advanced program.

Military Studies Minor

The College of Liberal Arts and Science offers a minor in Military Studies. Requirements for the minor include taking a minimum of 15 credits of ROTC instruction, which may be taken from one or a number of the ROTC programs.

Military Studies Minor Interdepartmental Minor

The Military Studies program is designed for students interested in learning about military skills and careers. The mission of the Reserve Officers' Training Corps (ROTC) programs is threefold. First, students are developed mentally, morally, and physically in order to make them strong leaders. Second, a desire for development in mind and character is instilled in students so they may assume the highest responsibilities of command, citizenship, and government. Finally, students are imbued with the highest ideals of duty, honor, and loyalty in order to graduate with a basic professional background and motivation toward their careers.

The Military Science, Naval Science and Air Force Aerospace departments accomplish this mission through detailed courses of instruction occurring throughout a typical student's college career. All academic courses offered by these departments focus on the development of professional military skills and their application. Each department offers courses unique to its branch of the military. Students in Army ROTC classes gain an appreciation for ground warfare and doctrine, while students in Naval Science develop an appreciation for naval surface and maritime engineering. The Air Force Aerospace Studies curriculum familiarizes students with Air Force structure and doctrine. On a broader scale, all three departments offer courses promoting leadership and sound management practices that investigate the military's role in American domestic and foreign policy, and can be employed in any career path.

Military Science, Naval Science and Air Force Aerospace courses are offered in the interdepartmental Military Studies program in the following participating departments: Military Science, Naval Science and Air Force Aerospace Studies. Students may contact any one of the three departments for additional information on the minor.

Contact Information:

Air Force Aerospace Studies

131 Armory

[airforce.iastate.edu](https://www.airforce.iastate.edu/) (<https://www.airforce.iastate.edu/>)

AFROTC@iastate.edu

515-294-1716

Military Science Department - Army

132 Armory

[armyrotc.iastate.edu](https://www.armyrotc.iastate.edu/) (<https://www.armyrotc.iastate.edu/>)

arotc@iastate.edu

515-294-1852

Naval Science Department

3 Armory

[navy.iastate.edu](https://www.navy.iastate.edu/) (<https://www.navy.iastate.edu/>)

isunrotc@iastate.edu

515-294-0650

Undergraduate Minor

Undergraduate study in this program provides the student with an opportunity to develop a minor in Military Studies. The three Iowa State University ROTC programs offer over 64 credits of specialized coursework. The minor in Military Studies is open to any Iowa State University student.

Undergraduate students may minor in Military Studies by taking 15 credits of coursework from a combination of any of the three ROTC programs - regardless of whether or not a commission in the Armed Forces is tendered. At least 9 of the 15 credits must be in courses numbered 2000 or above, of which 6 credits must be 3000 or above. The minor must include at least 3 credits that are not used to meet any other department, college, or university requirement.

The Military Studies Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

See the Military Studies Overview tab for links to the three departments.

Music

Administered by the Department of Music and Theatre

Undergraduate Study

The Department of Music and Theatre offers a strong undergraduate music program, where students study with full-time faculty professionals in a supportive environment that encourages students to become their best. Two degrees are offered in music: a Bachelor of Music, which is more specialized and contains fewer general education requirements; and a Bachelor of Arts degree with a major in music. (The Department of Music and Theatre also administers the Theatre Program, see Theatre and Performing Arts.)

The music curriculum provides:

- 1. A comprehensive program of professional studies for students who wish to prepare for careers in music, including teaching, performance, and composition, and for students who plan to pursue graduate studies in music.
- 2. Courses in music literature, theory, and areas of performance for all students, regardless of major.

The department embodies the land-grant philosophy of service to the people of the state with a faculty of active scholars, teachers, and artists committed to excellence in teaching, creative/scholarly work, and arts outreach. The department is an accredited institutional member of the National Association of Schools of Music (NASM).

Student Learning Outcomes

Music graduates will understand and demonstrate:

- 1. Knowledge of musical cultural heritage and history, including awareness of music of diverse cultures
- 2. Appreciation for musical creativity, reasoning, and the aesthetic value of music
- 3. Analytical skills necessary for listening, performing and teaching, including knowledge of musical organization and structures
- 4. Skills necessary to perform music from a variety of styles, periods, and genres
- 5. Necessary abilities to communicate ideas musically, verbally, and in writing

Assessment measures include the continuation examination, graduating senior surveys and exit interviews, public performances, senior projects, course grades, teacher certification (for music education students), and the National Association of Schools of Music accreditation review.

Curricula Available to Music Majors

Students interested in pursuing an emphasis in music theater should see Theatre and Performing Arts.

As majors in the College of Liberal Arts and Sciences, Music students must meet College of Liberal Arts and Sciences and University-wide requirements for graduation in addition to those stated below for the degree (Bachelor of Music) or major (Music Major, B.A.).

Bachelor of Music

This curriculum leads to the degree bachelor of music. This degree is more specialized and contains fewer general education requirements than the bachelor of arts degree with a major in music. Students in this curriculum choose between options in education, performance, and composition. To obtain a bachelor of music degree, a student must earn a minimum of 122 credits, including a minimum of 32 credits in residence

at Iowa State University and a minimum of 45 advanced credits in courses numbered 3000 or above and must meet all of the requirements specified below.

Students in all ISU majors must complete a three-credit course in U.S. Cultures and Communities and a three-credit course in International Perspectives. Check (<http://www.registrar.iastate.edu/courses/div-ip-guide.html>) for a list of approved courses. Discuss with your advisor how the two courses that you select can be applied to your graduation plan.

Courses taken on a pass/not pass basis may be counted toward the required total credits, and may be used to meet the advanced credit requirement, if appropriate, but may not be used to satisfy any other graduation requirement.

Degree Requirements

GENERAL EDUCATION REQUIREMENTS (Students choosing the music education option should consult their advisors.) 31 cr.

Social Science		6
Humanities		6
MUSIC 3830	History of Music I	3
MUSIC 3840	History of Music II	3
Natural Sciences		3
Mathematics, Natural Sciences		6
Electives: Educ. 2040, 4060, or any other non-music classes.		4

OTHER REQUIREMENTS 16 Cr.

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition *	3
LIB 1600	Introduction to College Level Research	1
World Languages and Cultures		8
LAS 2030	Professional Career Preparation	1

MUSIC CORE 41 CR.

MUSIC 1200	Introduction to Music Literature and Styles	3
MUSIC 2240	Music Theory I	4
MUSIC 2250	Aural Theory I	1
MUSIC 2340	Music Theory II	3
MUSIC 2350	Aural Theory II	1
MUSIC 3340	Music Theory III	3
MUSIC 3350	Aural Theory III	1
MUSIC 3440	Music Theory IV	3
MUSIC 3450	Aural Theory IV	1
MUSIC 3610	Conducting I	2

All of the following are required, 12 cr. minimum total: 12

MUSIC 1190	Applied Music for Majors
MUSIC 2190	Applied Music for Majors
MUSIC 3190	Applied Music for Majors

MUSIC 4190	Applied Music for Majors	
Ensembles: see Ensemble Requirement and Options below for details		7
MUSIC 4200	Junior/Senior Recital	R
OPTION: select from the list below		34-54.5
Total Credits		122-142.5

Select one of the following options:

- Vocal Education K-12
- Instrumental Education K-12
- Voice
- Piano
- Organ
- String instruments
- Wind or percussion instrument
- Composition

Vocal Education K-12, 54.5 Credits (Also see Index, Teacher Education.) MUSIC CLASSES TAKEN BY OTHER BACHELOR OF MUSIC STUDENTS REQUIRE MINIMUM GRADE C-, AND SUPPLEMENTAL MUSIC OPTION COURSES REQUIRE MINIMUM GRADE C.

MUSIC 2480	Technology in Music Instruction	2
MUSIC 2660	Introduction to Music Education	2
MUSIC 3270B	Functional Piano: Voice Majors	2
MUSIC 3580A	Lab Ensemble: Choral	R
MUSIC 3600	Voice Pedagogy	2
MUSIC 3620A	Conducting II: Choral Conducting Techniques	2
MUSIC 3660	Methods of Music Education	2
MUSIC 3670	Choral Literature	2
MUSIC 3740	Instrumental Methods for Vocalists	1
8 credits of each of the following:		16
MUSIC 4170R	Student Teaching: Music-Elementary	
MUSIC 4170S	Student Teaching: Music-Secondary	
MUSIC 4650	Choral Materials and Methods	2
MUSIC 4660	Program Development and Evaluation in Music Education	2
Credit in the following:		4.5
MUSIC 2800K	Pre-Student Teaching Experience I: Music	
MUSIC 4800K	Pre-Student Teaching Experience III: Music (repeatable)	
One of the following:		3
MUSIC 3010A	Opera Studio: Opera/Operetta	
MUSIC 3010B	Opera Studio: Music Theater	
THTRE 3540	Musical Theatre History and Performance	
THTRE 3550	Musical Theatre Auditions and Performance	

EDUC 4260	Principles of Secondary Education	3
SPED 4010	Teaching Secondary Students with Exceptionalities in General Education	3
Total Credits		48.5

Complementary Courses for Vocal Education K-12

EDUC 2040	Social Foundations of Education in the United States: Secondary	3
EDUC 4060	Teaching and Learning in a Pluralistic Society: Secondary	3
PSYCH 2300	Developmental Psychology	3

Instrumental Education K-12, 53.5-54.5 credits (Also see Index, Teacher Education.) MUSIC CLASSES TAKEN BY OTHER BACHELOR OF MUSIC STUDENTS REQUIRE MINIMUM GRADE C-, AND SUPPLEMENTAL MUSIC OPTION COURSES REQUIRE MINIMUM GRADE C.

MUSIC 2480	Technology in Music Instruction	2
MUSIC 2660	Introduction to Music Education	2
MUSIC 3500	Instrumental Techniques: Strings	1
MUSIC 3510	Instrumental Techniques: Clarinet, Flute, Saxophone	2
MUSIC 3520	Instrumental Techniques: Oboe, Bassoon	1
MUSIC 3530	Instrumental Techniques: Trumpet, Horn	1
MUSIC 3540	Instrumental Techniques: Trombone, Baritone, Tuba	1
MUSIC 3550	Instrumental Techniques: Percussion	1
MUSIC 3580B	Lab Ensemble: Instrumental	R
MUSIC 3620B	Conducting II: Instrumental Conducting Techniques	2
MUSIC 3660	Methods of Music Education	2
MUSIC 3750	Choral Methods for Instrumentalists	1

One of the following: 1-2

MUSIC 3680	Marching Band and Jazz Ensemble Techniques (2 cr.)	
MUSIC 3690	String Pedagogy (1 cr)	
MUSIC 4640	Instrumental Administration, Materials, and Methods	2
MUSIC 4660	Program Development and Evaluation in Music Education	2

8 credits of each of the following: 16

MUSIC 4170R	Student Teaching: Music-Elementary	
MUSIC 4170S	Student Teaching: Music-Secondary	

Credit in the following: 4.5

MUSIC 2800K	Pre-Student Teaching Experience I: Music	

MUSIC 4800K	Pre-Student Teaching Experience III: Music (repeatable)	
EDUC 4260	Principles of Secondary Education	3
SPED 4010	Teaching Secondary Students with Exceptionalities in General Education	3

Total Credits **47.5-48.5**

Complementary Courses for Instrumental Education K-12

EDUC 2040	Social Foundations of Education in the United States: Secondary	3
EDUC 4060	Teaching and Learning in a Pluralistic Society: Secondary	3
PSYCH 2300	Developmental Psychology	3

Voice, 34 credits

MUSIC 3270B	Functional Piano: Voice Majors	2
Additional credits in these courses:		8

MUSIC 3190A	Applied Music: Majors: Voice	
MUSIC 4190A	Applied Music: Voice	
MUSIC 3240	English and Italian Diction for Singing	2
MUSIC 3250	French and German Diction for Singing	2
MUSIC 3600	Voice Pedagogy	2
MUSIC 4400	Seminar in Music Theory	3
MUSIC 4460	Sound Synthesis Design for Electronic Music	3
MUSIC 4720	History of American Music	3
MUSIC 4150A	Literature and Pedagogy in Applied Music: Voice (Lit.)	2
Second world language		8
Electives		2
Total Credits		37

Piano, 34 credits

Additional credits in these courses:		12
MUSIC 1190B	Applied Music for Majors: Piano	2-3
MUSIC 2190B	Applied Music: Majors: Piano	1-3
MUSIC 3190B	Applied Music: Majors: Piano	1-3
MUSIC 4190B	Applied Music: Piano	1-3
5 credits from:		5
MUSIC 3210	Advanced Ensemble	
MUSIC 3270A	Functional Piano: Keyboard majors	2
5 credits from:		5
MUSIC 4150B	Literature and Pedagogy in Applied Music: Piano (Lit. & Ped.)	1-4
One of the following:		3
MUSIC 4400	Seminar in Music Theory	3

MUSIC 4460	Sound Synthesis Design for Electronic Music	3
MUSIC 4720	History of American Music	3
Electives		4
Total Credits		46-56

Organ, 34 credits

Credits from these courses:		4
MUSIC 1190B	Applied Music for Majors: Piano	
MUSIC 2190B	Applied Music: Majors: Piano	
Additional credits in these courses:		8
MUSIC 3190C	Applied Music: Majors: Organ	
MUSIC 4190C	Applied Music: Organ	
MUSIC 3000 level or above		3
5 credits from:		5
MUSIC 4150C	Literature and Pedagogy in Applied Music: Organ (Lit. & Ped.)	1-4
MUSIC 4720	History of American Music	3
One of the following:		3
MUSIC 4400	Seminar in Music Theory	
MUSIC 4460	Sound Synthesis Design for Electronic Music	
Second world language		8
Total Credits		35-38

String instruments, 34 credits

Additional credits in these courses:		12
MUSIC 1190D	Applied Music for Majors: Strings	
MUSIC 2190D	Applied Music: Majors: Strings	
MUSIC 3190D	Applied Music: Majors: Strings	
MUSIC 4190D	Applied Music: Strings	
Additional credits in these courses:		6
MUSIC 1810	Symphony Orchestra	
MUSIC 3210	Advanced Ensemble	
One of the following:		3
MUSIC 4400	Seminar in Music Theory	
MUSIC 4460	Sound Synthesis Design for Electronic Music	
MUSIC 4720	History of American Music	3
MUSIC 4150D	Literature and Pedagogy in Applied Music: Strings (Lit. & Ped.)	4
Electives		6
Total Credits		34

Wind or percussion instrument, 34 credits

Additional credits in these courses:		12
MUSIC 1190	Applied Music for Majors	
MUSIC 2190	Applied Music for Majors	

MUSIC 3190	Applied Music for Majors	
MUSIC 4190	Applied Music for Majors	
3 credits from:		3
MUSIC 3210	Advanced Ensemble	
MUSIC 3000 level or above		3
One of the following:		3
MUSIC 4400	Seminar in Music Theory	
MUSIC 4460	Sound Synthesis Design for Electronic Music	
MUSIC 4720	History of American Music	3
MUSIC 4150: Literature and Pedagogy in Applied Music		
Electives		6
Total Credits		30

Composition, 34 credits

4 credits from:		4
MUSIC 2900C	Special Problems: Composition	
12 credits from:		12
MUSIC 4900C	Independent Study: Composition	
MUSIC 2460	Introduction to Creative Digital Music	2
MUSIC 3620A	Conducting II: Choral Conducting Techniques	2
MUSIC 3620B	Conducting II: Instrumental Conducting Techniques	2
6 credits from the following:		6
MUSIC 3460	Computer Music Programming Design	
MUSIC 4400	Seminar in Music Theory	
MUSIC 4460	Sound Synthesis Design for Electronic Music	
MUSIC 4900B	Independent Study: Theory	
MUSIC 4900I	Independent Study: Electronic Music	
MUSIC 4720	History of American Music	3
Electives		3
Total Credits		34

Bachelor of Arts—Music Major

A more general degree than the bachelor of music, the bachelor of arts degree requires no formal specialization. It includes more general education requirements and provides a broader course of academic study.

As majors in the College of Liberal Arts and Sciences, Music Majors (Music, B.A.) students must meet College of Liberal Arts and Sciences and University-wide requirements for graduation in addition to those stated below for the major.

LAS majors require a minimum of 120 credits, including a minimum of 45 credits at the 3000/4000 level. You must also complete the LAS world language requirement and career proficiency requirement.

Students in all ISU majors must complete a three-credit course in U.S. Cultures and Communities and a three-credit course in International Perspectives. Check (<http://www.registrar.iastate.edu/courses/div-ip-guide.html>) for a list of approved courses. Discuss with your advisor how the two courses that you select can be applied to your graduation plan.

Candidates for the degree bachelor of arts with a music major will normally complete 48 credits of music including the following required courses:

MUSIC 1190	Applied Music for Majors	4
MUSIC 1200	Introduction to Music Literature and Styles	3
4 credits:		
MUSIC 2190	Applied Music for Majors	4
MUSIC 2240	Music Theory I	4
MUSIC 2250	Aural Theory I	1
MUSIC 2340	Music Theory II	3
MUSIC 2350	Aural Theory II	1
MUSIC 3190	Applied Music for Majors	2
MUSIC 3340	Music Theory III	3
MUSIC 3350	Aural Theory III	1
MUSIC 3440	Music Theory IV	3
MUSIC 3450	Aural Theory IV	1
MUSIC 3830	History of Music I	3
MUSIC 3840	History of Music II	3
4 credits from:		4
MUSIC 1110	Wind Ensemble	
MUSIC 1130	Jazz Ensemble	
MUSIC 1150	Symphonic Band	
MUSIC 1410	Lyrica Ensemble	
MUSIC 1510A	University Chorus: Cantamus Women's Choir	
MUSIC 1510B	University Chorus: Statesmen Men's Choir	
MUSIC 1610	Iowa State Singers	
MUSIC 1810	Symphony Orchestra	
MUSIC 3210	Advanced Ensemble	
MUSIC 3010A	Opera Studio: Opera/Operetta	
MUSIC 3010B	Opera Studio: Music Theater	
Music Electives		8
Total Credits		48

Bachelor of arts students whose chief professional interest lies in research are encouraged to minor in world languages and cultures, history, literature, or philosophy.

General Requirements

Entrance Audition.

In order to be accepted as a music major, a prospective student must pass an entrance audition for the applied faculty in his/her performance area (piano, organ, woodwinds, strings, percussion, brass, or voice). Passing the audition is dependent on the demonstration of performance skills appropriate for college level instruction and the potential to perform at a professional level. In addition, the number of students accepted must balance with the space available in the corresponding applied studios. Once accepted, a student must complete a placement examination in keyboard skills. This examination is normally given by members of the departmental faculty the week preceding the opening of classes for fall semester.

Seminars and Recitals.

All music majors enrolled for applied music courses will attend a weekly 1-hour seminar in their areas, departmental recitals, and 12 recitals of their choosing each semester.

Ensemble Requirement.

See the options above for additional ensemble requirements.

All Bachelor of Music students:

Enrollment in an ensemble course, chosen from the lists below, each semester of full-time enrollment (except during student teaching) is required.

Students in a music education option:

At least six semesters of large ensemble and one semester of chamber music ensemble, chosen from the lists below, are required. One semester of 1140A may count as a large ensemble.

Bachelor of Music students in options other than education:

At least 2 semesters of large ensemble and one semester of chamber music ensemble, chosen from the lists below, are required.

Large Ensembles:

MUSIC 1110	Wind Ensemble	1
MUSIC 1150	Symphonic Band	1
MUSIC 1410	Lyrical Ensemble	1
MUSIC 1510A	University Chorus: Cantamus Women's Choir	1
MUSIC 1510B	University Chorus: Statesmen Men's Choir	1
MUSIC 1610	Iowa State Singers	1
MUSIC 1810	Symphony Orchestra	1

Chamber music ensembles:

MUSIC 1130	Jazz Ensemble	1
MUSIC 1610	Iowa State Singers	1
MUSIC 3010A	Opera Studio: Opera/Operetta	1-3
MUSIC 3010B	Opera Studio: Music Theater	1-3
MUSIC 3210	Advanced Ensemble	

Continuation Examination

To be approved for continuation as a music major on the junior level, and enroll in MUSIC 3190, a student must pass a continuation examination taken normally at the end of the fourth semester as a music major. Before taking this examination, the student must complete the requisite forms as well as write an essay including:

1. his/her personal goals
2. a self-assessment of his/her progress thus far
3. an assessment of what he/she expects to accomplish before graduation

The student taking the Continuation Examination performs for a Continuation Examination Committee. Requirements include the performance of three works representing different periods or styles selected by, and studied with, the applied teacher, a self-prepared piece, and sight reading. The student must display acceptable solo ability and performance techniques in at least one of the applied areas. A written evaluation will be given each student following his/her performance. This evaluation will include a candid assessment of the student's potential to achieve his/her goals. In addition, the student may arrange to meet with members of the Continuation Examination Committee at a later date to discuss the results of his/her Continuation Examination. See Piano Proficiency below. For details and forms go to: <http://www.music.iastate.edu>

Piano Proficiency Requirement

All music majors must demonstrate proficiency in functional skills at the piano. Keyboard music majors (students whose primary instrument is piano or organ) accomplish this through courses in their curricula. All other students accomplish this by satisfactorily completing MUSIC 2280. All entering non-keyboard music majors with previous piano experience meet with the class piano instructor, usually the week before classes start in the fall semester, to determine the appropriate piano class (1270, 1280, 2270, 2280) for their initial piano enrollment. Some students are deemed to have met the piano proficiency at this time. Non-keyboard music majors with no previous piano experience should enroll in MUSIC 1270, Class Piano I. Continuous enrollment in piano classes is REQUIRED until successful completion of the piano proficiency requirement.

Graduation Proficiency

To be recommended for graduation, a music student should demonstrate to the music faculty mature acquaintance with performance styles, technique, and repertoire. All music majors will participate in departmental recitals to the satisfaction of the department. Candidates for the Bachelor of Music degree will present a graduation recital.

*** According to the university-wide Communication Proficiency Grade Requirement, Students must demonstrate their communication proficiency by earning a grade of a C or better in ENGL 2500 (or engl 2500H). In ADDITION, the Communication Proficiency must be certified through one of the following options:**

1. Certification of writing skills, by the instructor, after completion of one of the following:

MUSIC 1200	Introduction to Music Literature and Styles	3
MUSIC 3830	History of Music I	3
MUSIC 3840	History of Music II	3
MUSIC 4720	History of American Music	3

(Passing one of these courses does not automatically satisfy the requirements for Communication Proficiency.)

2. Satisfactory completion of an advanced writing course:

ENGL 3020	Business Communication	3
ENGL 3050	Creative Writing: Nonfiction	3
ENGL 3140	Technical Communication	3

Music, B.A.

B.Mus. - Organ

B.Mus. - Piano

B.Mus. - Strings

B.Mus. - Wind or Percussion Instrument

B.Mus. - Instrumental Education K-12

B.Mus. - Voice

B.Mus. - Vocal Education K-12

B.Mus. - Composition

Music, B.A.

Freshman

Fall	Credits	Spring	Credits
MUSIC 1190	2	MUSIC 1190	2
MUSIC 1270 ¹	1	MUSIC 1200	3
MUSIC 2240	4	MUSIC 1280	1
MUSIC 2250	1	MUSIC 2340	3
Music Ensemble ²	1	MUSIC 2350	1
ENGL 1500	3	Music Ensemble ²	1
LIB 1600	1	Arts & Humanities	3
MATH	3		
	16		14

Sophomore

Fall	Credits	Spring	Credits
MUSIC 2190	2	MUSIC 2190	2
MUSIC 2270 ¹	1	MUSIC 2280 ¹	1
MUSIC 3340	3	MUSIC 3440	3
MUSIC 3350	1	MUSIC 3450	1
MUSIC 3830	3	MUSIC 3840	3
Music: Ensemble ²	1	Music: Ensemble ²	1
ENGL 2500	3	Social Science	3
		Elective	2
		(Continuation Examination)	
	14		16

Junior

Fall	Credits	Spring	Credits
MUSIC 3190	2	World Language/Elective	4
Music Elective	3	Arts & Humanities	3
World Language/Elective	4	Natural Science	3
Natural Science	3	Electives	6
Social Science	3	LAS 2030	1
	15		17

Senior

Fall	Credits	Spring	Credits
Music Elective	1	Natural Science	2
Arts & Humanities	3	Electives	12
Social Science	3		
Electives	9		
	16		14

¹ A placement examination in keyboard skills determines the student's placement in the Class Study in Piano courses. Students with a concentration in piano or organ do not take Class Study in Piano. Students not required to take four semesters of class piano will take additional music elective credits.

² Four credits chosen from the following ensembles are required: 1110, 1130, 1150, 1410, 1510, 1610, 1910, 3210.

³ ENGL 1500 recommends concurrent enrollment in LIB 1600. LAS majors require a minimum of 120 credits, **including a minimum of 45 credits at the 3000/4000 level.** The LAS World Language requirements must be met. Courses which may be used for the General Education Requirements can be found at: (<https://las.iastate.edu/students/academics/general-education/>) All ISU students must complete a three-credit course in U.S. Cultures and Communities and a three-credit course in International Perspectives. A list of approved courses can be found at: (<http://www.registrar.iastate.edu/courses/div-ip-guide.html>) (<http://www.registrar.iastate.edu/courses/div-ip-guide.html>)

guide.html)) The courses taken to meet these requirements may also be used to meet other requirements.

Scheduling of the general education requirements where specific courses are not indicated can be flexible. Music courses are best kept in the order/semesters indicated. (Most music courses are offered one semester each year.)

Music, B.Mus. - Organ

Freshman

Fall	Credits Spring	Credits
ENGL 1500 ^c	3 Humanities	3
MUSIC 1190C	2 Social Science	3
MUSIC 2240	4 MUSIC 1200	3
MUSIC 2250	1 MUSIC 1190C	2
Music Ensemble	1 MUSIC 2340	3
Math/Natural Science	3 MUSIC 2350	1
Social Science	3 Music Ensemble	1
LIB 1600	1	
	18	16

Sophomore

Fall	Credits Spring	Credits
MUSIC 2190C	2 MUSIC 2190C	2
MUSIC 3340	3 MUSIC 3840	3
MUSIC 3350	1 MUSIC 3440	3
MUSIC 3830	3 MUSIC 3450	1
Music Ensemble	1 Music Ensemble	1
Natural Science	3 Humanities	3
ENGL 2500	3 General Education Elective	3
	MUSIC 3270A or 3270B	2
	(Continuation Examination)	
	16	18

Junior

Fall	Credits Spring	Credits
MUSIC 1190B	2 MUSIC 1190B	2
MUSIC 3190C	3 MUSIC 3190C	3
MUSIC 3610	2 MUSIC 4150C	2
Music Ensemble	1 Music Ensemble	1
World Language/Elective	4 World Language/Elective	4
MUSIC 4400 (even falls only)	3 Math/Natural Science	3
	MUSIC 4720	3
	LAS 2030	1
	15	19

Senior

Fall	Credits Spring	Credits
MUSIC 1190B	2 MUSIC 1190B	2
MUSIC 4190C	3 MUSIC 4190C	3
Music Elective - 3000+ Level	3 Music Ensemble	1
Music Ensemble	1 MUSIC 4150C	3
Second World Language	4 Second World Language	4
General Education Elective	2 MUSIC 4200	R
MUSIC 4400 (even falls only)	3	
	18	13

c ENGL 1500 recommends concurrent enrollment in LIB 1600.

The B.Mus. degree requires a minimum of 124.5 credits, **including a minimum of 45 credits at the 3000/4000 level.** The LAS World Language requirements must be met. Courses which may be used for the General Education Requirements can be found at: (<https://las.iastate.edu/students/academics/general-education/>) All ISU students must complete a three-credit course in U.S. Cultures and Communities and a three-credit course in International Perspectives (which is satisfied with MUSIC 3830). A list of approved courses can be found at: (<http://www.registrar.iastate.edu/courses/div-ip-guide.html>) The courses taken to meet these requirements may also be used to meet other requirements.

Flexibility in scheduling. Many general education courses can easily be taken in different semesters than indicated. Music courses are best kept in the order/semesters indicated. (Most music courses are offered one semester each year.)

* Some advanced theory and history courses are not offered every semester. Semesters of offerings are listed in the course descriptions in the catalog at: <https://www.music.iastate.edu/advising> (<https://www.music.iastate.edu/advising/>).

Music, B.Mus. - Piano

Freshman

Fall	Credits Spring	Credits
ENGL 1500 ^c	3 Humanities	3
MUSIC 1190B	3 MUSIC 1190B	3
MUSIC 2240	4 MUSIC 2340	3
MUSIC 2250	1 MUSIC 2350	1
Music Ensemble	1 MUSIC 1200	3
LIB 1600	1 Music Ensemble	1
Math/Natural Science	3	
	16	14

Sophomore

Fall	Credits Spring	Credits
MUSIC 2190B	3 MUSIC 2190B	3
MUSIC 3340	3 MUSIC 3440	3
MUSIC 3350	1 MUSIC 3450	1
MUSIC 3830	3 MUSIC 3840	3
Music Ensemble	1 Music Ensemble	1
ENGL 2500	3 Elective	2
Elective	2 MUSIC 3270A	2
	MUSIC 3210	1
	(Continuation Examination)	
	16	16

Junior

Fall	Credits Spring	Credits
MUSIC 3190B	3 MUSIC 3190B	3
MUSIC 3210	1 MUSIC 3210	1
MUSIC 3610	2 MUSIC 4150B	3
Music Ensemble	1 Natural Science	3
MUSIC 4400 (even falls only)	3 Music Ensemble	1
World Language/Elective	4 World Language/Elective	4
	MUSIC 4720	3
	LAS 2030	1
	14	19

Senior

Fall	Credits Spring	Credits
MUSIC 3210	1 MUSIC 3210	1
MUSIC 4190B	3 MUSIC 4190B	3
Music Ensemble	1 General Education Elective	3
General Education Elective	2 Math/Natural Science	3
MUSIC 4400 (even falls only)	3 Humanities	3
Social Science	3 Social Science	3
MUSIC 4150B	2 MUSIC 4200	R
	15	16

c ENGL 1500 recommends concurrent enrollment in LIB 1600.

The B.Mus. degree requires a minimum of 124.5 credits, **including a minimum of 45 credits at the 3000/4000 level**. The LAS World Language requirements must be met. Courses which may be used for the General Education Requirements can be found at: (<https://las.iastate.edu/students/academics/general-education/>) All ISU students must complete a three-credit course in U.S. Cultures and Communities and a three-credit course in International Perspectives (which is satisfied with MUSIC 3830). A list of approved courses can be found at: (<http://www.registrar.iastate.edu/courses/div-ip-guide.html>)

(<http://www.registrar.iastate.edu/courses/div-ip-guide.html>) The courses taken to meet these requirements may also be used to meet other requirements.

Flexibility in scheduling. Many general education courses can easily be taken in different semesters than indicated. Music courses are best kept in the order/semesters indicated. (Most music courses are offered one semester each year.)

* Some advanced theory and history courses are not offered every semester. Semesters of offerings are listed in the course descriptions in the catalog at: <https://www.music.iastate.edu/advising> (<https://www.music.iastate.edu/advising/>).

Music, B.Mus. - Strings**Freshman**

Fall	Credits Spring	Credits
ENGL 1500 ^c	3 Humanities	3
MUSIC 1190D	3 MUSIC 1810	1
MUSIC 1270 ¹	1 MUSIC 1190D	3
MUSIC 2240	4 MUSIC 1200	3
MUSIC 2250	1 MUSIC 1280 ¹	1
MUSIC 1810	1 MUSIC 2340	3
Math/Natural Science	3 MUSIC 2350	1
LIB 1600	1	
	17	15

Sophomore

Fall	Credits Spring	Credits
MUSIC 2190D	3 MUSIC 2190D	3
MUSIC 2270 ¹	1 MUSIC 2280 ¹	1
MUSIC 3340	3 MUSIC 3210D	1
MUSIC 3350	1 MUSIC 3440	3
MUSIC 3830	3 MUSIC 3450	1
MUSIC 1810	1 MUSIC 3840	3
ENGL 2500	3 MUSIC 1810	1
	Social Science	3
	(Continuation Examination)	
	15	16

Junior

Fall	Credits Spring	Credits
MUSIC 3210D	1 MUSIC 3210D	1
MUSIC 3190D	3 MUSIC 3190D	3
MUSIC 3610	2 MUSIC 1810	1
MUSIC 4150D	2 World Language/Elective	4

MUSIC 4400 (even falls only)	3 Math/Natural Science Choice	3
MUSIC 1810	1 MUSIC 4720	3
World Language/Elective	4 LAS 2030	1
16		16

Senior

Fall	Credits Spring	Credits
MUSIC 3210D	1 MUSIC 1810	1
MUSIC 4190	3 MUSIC 3210D	1
MUSIC 1810	1 MUSIC 4150D	2
Social Science	3 MUSIC 4190D	3
Natural Science	3 General Education Elective	3
MUSIC 4400 (even falls only)	3 Humanities	3
Elective	2 General Education Elective	2
	MUSIC 4200	R
16		15

¹ A placement examination in keyboard skills determines the student's placement in the Class Study in Piano courses. Students not required to take four semesters of class piano will take additional music elective credits.

^c ENGL 1500 recommends concurrent enrollment in LIB 1600.

The B.Mus. degree requires a minimum of 124.5 credits, **including a minimum of 45 credits at the 3000/4000 level.** The LAS World Language requirements must be met. Courses which may be used for the General Education Requirements can be found at: (<https://las.iastate.edu/students/academics/general-education/>) All ISU students must complete a three-credit course in U.S. Cultures and Communities and a three-credit course in International Perspectives (which is satisfied with MUSIC 3830). A list of approved courses can be found at: (<http://www.registrar.iastate.edu/courses/div-ip-guide.html>) The courses taken to meet these requirements may also be used to meet other requirements.

Flexibility in scheduling. Many general education courses can easily be taken in different semesters than indicated. Music courses are best kept in the order/semesters indicated. (Most music courses are offered one semester each year.)

* Some advanced theory and history courses (string major requires 1 history, 2 theory) are not offered every semester. Semesters of offerings are listed in the course descriptions in the catalog at: <https://www.music.iastate.edu/advising> (<https://www.music.iastate.edu/advising/>).

Music, B.Mus. - Wind or Percussion Instrument**Freshman**

Fall	Credits Spring	Credits
ENGL 1500 ^c	3 Arts and Humanities	3
MUSIC 1190	3 Music Ensemble	1
MUSIC 1270 ¹	1 MUSIC 1190	3
MUSIC 2240	4 MUSIC 1200	3
MUSIC 2250	1 MUSIC 1280 ¹	1
Music Ensemble	1 MUSIC 2340	3
Social Science	3 MUSIC 2350	1
LIB 1600 ^c	1	
17		15

Sophomore

Fall	Credits Spring	Credits
MUSIC 2190	3 MUSIC 2190	3
MUSIC 2270 ¹	1 MUSIC 2280 ¹	1
MUSIC 3340	3 MUSIC 3440	3
MUSIC 3350	1 MUSIC 3450	1
MUSIC 3830	3 MUSIC 3840	3
Music Ensemble	1 Music Ensemble	1
ENGL 2500	3 General Education Elective	3
(Continuation Examination)		
15		15

Junior

Fall	Credits Spring	Credits
MUSIC 3190	3 MUSIC 3190	3
MUSIC 3610	2 MUSIC 3210	1
MUSIC 4150	2 MUSIC 4150	2
Music Ensemble	1 Music Ensemble	1
MUSIC 4400 (even falls only)	3 World Language/Elective	4
World Language/Elective	4 Math/Natural Science	3
	MUSIC 4720	3
	LAS 2030	1
15		18

Senior

Fall	Credits Spring	Credits
MUSIC 3210	1 MUSIC 3210	1
MUSIC 4190	3 MUSIC 4190	3
Music Ensemble	1 Music Elective 3000+ Level	3
MUSIC 4400 (even falls only)	3 Arts & Humanities	3
Elective	2 Math/Natural Science	3
Social Science	3 MUSIC 4200	R

Natural Science	3	
General Education Elective	2	
	18	13

¹ A placement examination in keyboard skills determines the student's placement in the Class Study in Piano courses. Students with a concentration in piano or organ do not take Class Study in Piano. Students not required to take four semesters of class piano will take additional elective credits.

c ENGL 1500 recommends concurrent enrollment in LIB 1600.

The B.Mus. degree requires a minimum of 124.5 credits, **including a minimum of 45 credits at the 3000/4000 level**. The LAS World Language requirements must be met. Courses which may be used for the General Education Requirements can be found at: (<https://las.iastate.edu/students/academics/general-education/>) All ISU students must complete a three-credit course in U.S. Cultures and Communities and a three-credit course in International Perspectives (which is satisfied with MUSIC 3830). A list of approved courses can be found at: (<http://www.registrar.iastate.edu/courses/div-ip-guide.html>) The courses taken to meet these requirements may also be used to meet other requirements.

Flexibility in scheduling. Many general education courses can easily be taken in different semesters than indicated. Music courses are best kept in the order/semesters indicated. (Most music courses are offered one semester each year.)

* Some advanced theory and history courses (wind or percussion major requires 1 history, 2 theory) are not offered every semester. Semesters of offerings are listed in the course descriptions in the catalog at: <https://www.music.iastate.edu/advising> (<https://www.music.iastate.edu/advising/>) .

Music, B.Mus. - Instrumental Education K-12

Freshman

Fall	Credits Spring	Credits
MUSIC 1190:	2 MUSIC 1190	2
MUSIC 1270 ¹	1 MUSIC 1200	3
MUSIC 2240	4 MUSIC 1280 ¹	1
MUSIC 2250	1 MUSIC 2340	3
Ensemble	1 MUSIC 2350	1
ENGL 1500	3 MUSIC 3510/3540/3550**	1-2
LIB 1600	1 MUSIC 3580B	R
Gen. Ed. (Humanities)	3 Ensemble	1
Gen. Ed. (Math)	3 PSYCH 2300	3
	MUSIC 2660 ^C	2

Apply to Teacher Education Program

MUSIC 2800K 0.5

19 17.5-18.5

Sophomore

Fall	Credits Spring	Credits
MUSIC 2190	2 MUSIC 2190	2
MUSIC 2270	1 MUSIC 2280 ¹	1
MUSIC 3340	3 MUSIC 3440	3
MUSIC 3350	1 MUSIC 3450	1
MUSIC 3500/3520/3530**	1 MUSIC 3510/3540/3550**	1-2
MUSIC 3580B	R MUSIC 3580B	R
MUSIC 3830	3 MUSIC 3840	3
Ensemble	1 Ensemble	1
ENGL 2500	3 MUSIC 2480	2
Natural Science	3 MUSIC 3680/3690 (odd springs) or MUSIC 4640 (even springs)**	1-2
EDUC 2040	3	

21 15-17

Junior

Fall	Credits Spring	Credits
MUSIC 3190	2 MUSIC 3190	2
MUSIC 3500/3530**	1 MUSIC 3510/3540/3550**	1-2
MUSIC 3580B	R MUSIC 3620B	2
MUSIC 3610	2 MUSIC 3580B	R
MUSIC 3660 ^C	2 MUSIC 4800K	1
MUSIC 4800K	1 MUSIC 3680/3690 (odd springs) or MUSIC 4640 (even springs)**	1-2
Ensemble	1 Ensemble	1
SPED 4010 ^C	3 World Language	4
Natural Science/Math	3 EDUC 4060	3
World Language	4 MUSIC 3750	1
	LAS 2030	1

19 17-19

Senior

Fall	Credits Spring	Credits
MUSIC 4190	2 MUSIC 4170S	8
MUSIC 3500/3520/3530**	1 MUSIC 4170R	8
MUSIC 3580B	R	
MUSIC 4660	2	
Ensemble	1	

PSYCH 3330	3	
EDUC 4260	3	
MUSIC 4800K ^c	2	
Gen. Ed. - Humanities	3	
MUSIC 4200	R	
	17	16

¹ A placement examination in keyboard skills determines the student's placement in the Class Study in Piano courses. Students with a concentration in piano or organ do not take Class Study in Piano.

****** Students should take the major area (WW or brass) with which they are least familiar first to gain more experience in lab band. However, WW players planning to gain additional skills on a 2nd WW, might choose to take that area first. Non-WW players should take 3510 before 3520. 3580B must be taken concurrently with each tech course (3500-3550).

++ Alternate year courses. String players take 3690 and 4640. WW and brass players take 3680 and 4640.

c These courses which appear in the same semester must be taken concurrently.

The LAS world language requirement must be met. The U.S. diversity and international perspectives requirements are automatically met with courses required for this degree option (EDUC 4060 and MUSIC 3830). Many general education and education (EDUC) courses can easily be taken in different semesters than indicated as well as summer. Music courses are best kept in the order/semesters indicated (Most music courses are offered one semester each year).

Music, B.Mus. - Voice

Freshman

Fall	Credits Spring	Credits
ENGL 1500 ^c	3 Humanities	3
MUSIC 1190A	2 Social Science	3
MUSIC 1270 ¹	1 MUSIC 1190A	2
MUSIC 2240	4 MUSIC 1200	3
MUSIC 2250	1 MUSIC 1280 ¹	1
Music Ensemble	1 MUSIC 2340	3
Math/Natural Science	3 MUSIC 2350	1
LIB 1600	1 Music Ensemble	1
	16	17

Sophomore

Fall	Credits Spring	Credits
MUSIC 2190A	2 MUSIC 2190A	2
MUSIC 2270 ¹	1 MUSIC 2280 ¹	1
MUSIC 3340	3 MUSIC 3440	3
MUSIC 3350	1 MUSIC 3450	1

MUSIC 3830	3 MUSIC 3840	3
Music Ensemble	1 Music Ensemble	1
Natural Science	3 General Education Elective	3
ENGL 2500	3 (Continuation Examination)	
	17	14

Junior

Fall	Credits Spring	Credits
MUSIC 3190A	3 MUSIC 3190A	3
MUSIC 3240 or 4150A ²	2 MUSIC 3250 or 3600 ²	2
MUSIC 3610	2 MUSIC 3270A or 3270B	2
Music History - 4000 Level	3 Music Ensemble	1
MUSIC 4400 (even falls only)	3 World Language/Elective	4
Music Ensemble	1 Math/Natural Science	3
World Language/Elective	4 MUSIC 4720	3
	LAS 2030	1
	18	19

Senior

Fall	Credits Spring	Credits
MUSIC 4190A	3 MUSIC 4190A	3
MUSIC 4150A or 3240 ²	2 MUSIC 3600 or 3250 ²	2
Music Ensemble	1 Music Ensemble	1
MUSIC 4400 (even falls only)	3 Humanities	3
Second World Language	4 Social Science	3
General Education Elective	2 Second World Language	4
	MUSIC 4200	R
	15	16

¹ A placement examination in keyboard skills determines the student's placement in the Class Study in Piano courses.

² MUSIC 3240 alternate Fall (even numbered years) / MUSIC 3250 alternate Spring (odd number years – same academic year; MUSIC 3600 alternate Spring (even numbered years) when 3250 is not taught.

c ENGL 1500 recommends concurrent enrollment in LIB 1600.

The B.Mus. degree requires a minimum of 124.5 credits, **including a minimum of 45 credits at the 3000/4000 level**. The LAS World Language requirements must be met. Courses which may be used for the General Education Requirements can be found at: (<https://las.iastate.edu/students/academics/general-education/>) All ISU students must complete a three-credit course in U.S. Cultures and Communities and a three-credit course in International Perspectives (which is satisfied with MUSIC 3830). A list of approved courses can be found at: (<http://www.registrar.iastate.edu/courses/div-ip-guide.html>) (<http://www.registrar.iastate.edu/courses/div-ip-guide.html>) The courses taken to meet these requirements may also be used to meet other requirements.

Flexibility in scheduling. Many general education courses can easily be taken in different semesters than indicated. Music courses are best kept in the order/semesters indicated. (Most music courses are offered one semester each year.)

* Some advanced theory and history courses (voice major requires 1 history, 2 theory) are not offered every semester. Semesters of offerings are listed in the course descriptions in the catalog at: <https://www.music.iastate.edu/advising> (<https://www.music.iastate.edu/advising/>).

Music, B.Mus. - Vocal Education K-12

Freshman

Fall	Credits Spring	Credits
MUSIC 1190	2 MUSIC 1190	2
MUSIC 1270 ¹	1 MUSIC 1200	3
MUSIC 2240	4 MUSIC 1280 ¹	1
MUSIC 2250	1 MUSIC 2340	3
Choral Ensemble	1 MUSIC 2350	1
MUSIC 3580A ²	R Choral Ensemble	1
ENGL 1500	3 MUSIC 3580A ²	R
Humanities	3 MUSIC 2660 ^c	2
Math course	3 MUSIC 2800K	0.5
LIB 1600	1	
	19	13.5

Sophomore

Fall	Credits Spring	Credits
MUSIC 2190	2 MUSIC 2190	2
MUSIC 2270 ¹	1 MUSIC 2280 ¹	1
MUSIC 3340	3 MUSIC 2480	2
MUSIC 3350	1 MUSIC 3440	3
MUSIC 3610 (even falls) or PSYCH 2300 (odd falls) ⁺⁺	2-3 MUSIC 3450	1
MUSIC 3830	3 Choral Ensemble	1
Choral Ensemble	1 MUSIC 3600 ^{(even springs)++}	2
MUSIC 3580A ²	R MUSIC 3620A (odd springs) or MUSIC 3670 (even springs) ⁺⁺	2
ENGL 2500	3 MUSIC 3840	3
EDUC 2040	3 MUSIC 3580A ²	R
Natural Science	3 Continuation Exam	
	22-23	17

Junior

Fall	Credits Spring	Credits
MUSIC 3190: Applied Music: Majors	MUSIC 3190	2
Choral Ensemble	1 MUSIC 3270B	2
MUSIC 3660 ^c	2 Choral Ensemble	1
MUSIC 4800K ^c	1 MUSIC 3600 (even springs)	2
MUSIC 3580A ²	R MUSIC 3620A (odd springs) or MUSIC 3670 (even spring) ⁺⁺	2
MUSIC 3610 (even falls) or PSYCH 3330 (odd falls) ⁺⁺	2-3 MUSIC 3580A ⁺	R
Humanities	3 MUSIC 4800K	1
SPED 4010 ^c	3 World Language	4
World Language	4 General Education - Natural Science/Math	3
MUSIC 3740	1 LAS 2030	1
	17-18	18

Senior

Fall	Credits Spring	Credits
MUSIC 4190	2 MUSIC 4170R	8
MUSIC 4660 ^c	2 MUSIC 4170S	8
Choral Ensemble	1	
MUSIC 3010A or 3010B	1-3	
MUSIC 4650	2	
MUSIC 3580A ²	R	
PSYCH 3330	3	
EDUC 4260	3	
MUSIC 4800K ^c	2	
EDUC 4060	3	
MUSIC 4200	R	
	19-21	16

¹ A placement examination in keyboard skills determines the student's placement in the Class Study in Piano courses. Students with a concentration in piano or organ do not take Class Study in Piano.

² Lab Ensemble is required every semester offered: Fall and odd springs.

^c These courses which appear in the same semester must be taken concurrently.

⁺⁺Alternate year courses: The usual semester of offering is indicated by the calendar year (odd or even) of the semester. Consult the current catalog and the department web site for up-to-date information about semesters courses are offered. PSYCH 2300 and PSYCH 3330 are offered every semester; when they are taken is determined by the schedules of the alternate year music courses.

The LAS World Language requirements must be met. The U.S. diversity and international perspectives requirements are automatically met with courses required for this degree option (EDUC 4060 and MUSIC 3830).

Flexibility in scheduling. Many general education courses can easily be taken in different semesters than indicated. Music courses are best kept in the order/semesters indicated (Most music courses are offered one semester each year).

Music, B.Mus.-Composition

Freshman

Fall	Credits Spring	Credits
ENGL 1500	3 Math/Natural Science	3
MUSIC 1190	2 MUSIC 2900C	1
MUSIC 2900C	1 MUSIC 1190	2
MUSIC 1270	1 MUSIC 1200	3
MUSIC 2240	4 MUSIC 1280	1
MUSIC 2250	1 MUSIC 2340	3
Music Ensemble	1 MUSIC 2350	1
Social Science	3 Music Ensemble	1
LIB 1600	1	
	17	15

Sophomore

Fall	Credits Spring	Credits
MUSIC 2190	2 MUSIC 2190	2
MUSIC 2270	1 MUSIC 2280	1
MUSIC 3830	3 MUSIC 3440	3
MUSIC 3340	3 MUSIC 3450	1
MUSIC 3350	1 MUSIC 3840	3
Music Ensemble	1 Music Ensemble	1
MUSIC 2900C	1 MUSIC 2900C	1
ENGL 2500	3 MUSIC 2460	2
	General Education Elective	3
	Continuation Examination	R
	15	17

Junior

Fall	Credits Spring	Credits
MUSIC 3190	1 MUSIC 3190	1
MUSIC 3610	2 MUSIC 3620A or 3620B	2
Music Theory - 4000 Level	3 Music Ensemble	1
Music Ensemble	1 MUSIC 4900C	3
MUSIC 4900C	2 Math/Natural Science	3
World Language Elective	4 World Language Elective	4
	MUSIC 4720	3

	LAS 2030	1
	13	18
Senior		
Fall	Credits Spring	Credits
MUSIC 4190	1 MUSIC 4190	1
Music Theory - 4000 Level	3 Music ensemble	1
Music Ensemble	1 Natural Science	3
MUSIC 4900C	3 MUSIC 4900C	4
Humanities	3 MUSIC 3620A or 3620B	2
Social Science	3 Humanities	3
General Education Elective	2 MUSIC 4200	R
	16	14

¹ A placement examination in keyboard skills determines the student's placement in the Class Study in Piano courses. Students with a concentration in piano or organ do not take Class Study in Piano. Students placing out of class piano may need to take additional elective credits to earn the required 124.5 cr. for the B.Mus. degree.

² ENGL 1500 recommends concurrent enrollment in LIB 1600.

³ Alternate year course, taught in odd number years, spring semester.

Some advanced theory and history courses are not offered every semester. Semesters of offerings are listed in the course descriptions in the catalog. The B.Mus. in composition requires one advanced history course (3 cr.) and 9 credits of advanced theory from the following courses: 3460, 4400, 4460, 4900B, 5900I. Advanced theory courses must include 3460 or 4460.

* The B.Mus. degree requires a minimum of 124.5 credits, **including a minimum of 45 credits at the 3000/4000 level.** The LAS World Language requirements must be met. Courses which may be used for the General Education Requirements can be found at: (<https://las.iastate.edu/students/academics/general-education/>) All ISU students must complete a three-credit course in U.S. Cultures and Communities and a three-credit course in International Perspectives (which is satisfied with MUSIC 3830). A list of approved courses can be found at: (<http://www.registrar.iastate.edu/courses/div-ip-guide.html>) (<http://www.registrar.iastate.edu/courses/div-ip-guide.html>) The courses taken to meet these requirements may also be used to meet other requirements.

Minor in Music

Candidates for the minor in music will complete 15 credits in music including:

MUSIC 1010	Fundamentals of Music	2
	or MUSIC 2240 Music Theory I	
Three of the following		9

MUSIC 1020	Introduction to Music Listening	
MUSIC 1200	Introduction to Music Literature and Styles	
	or MUSIC 30 Masterpieces of Music and Art in Western Culture	
MUSIC 3040	History of American Rock 'n' Roll	
MUSIC 3830	History of Music I	
MUSIC 3840	History of Music II	3
MUSIC 4720	History of American Music	3
4 credits chosen from the following		4
MUSIC 1110	Wind Ensemble	
MUSIC 1130	Jazz Ensemble	
MUSIC 1140A	Marching and Pep Bands: Marching Band	
MUSIC 1140B	Marching and Pep Bands: Pep Band	
MUSIC 1140C	Marching and Pep Bands: Pep Band for Wrestling and Soccer	
MUSIC 1150	Symphonic Band	
MUSIC 1410	Lyrica Ensemble	
MUSIC 1510A	University Chorus: Cantamus Women's Choir	
MUSIC 1510B	University Chorus: Statesmen Men's Choir	
MUSIC 1610	Iowa State Singers	
MUSIC 1810	Symphony Orchestra	
MUSIC 3010A	Opera Studio: Opera/Operetta	
MUSIC 3010B	Opera Studio: Music Theater	
MUSIC 3210	Advanced Ensemble	
MUSIC 1180	Applied Music for Non-Majors	
MUSIC 3180	Applied Music for Non-Majors	
MUSIC 2900F	Special Problems: Applied Music	

At least nine of the fifteen credits must be in courses numbered 2000 and above, of which at least six credits are in courses numbered 3000 or above taken at ISU with a grade of C or better. The minor must include at least 3 credits that are not used to meet any other department, college, or university requirement.

The Music Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

Students pursuing a music minor must meet the audition requirements and/or prerequisites for all courses they wish to take.

MINOR IN MUSIC TECHNOLOGY

Candidates for the minor in music technology will complete 15 credits including:

MUSIC 2460	Introduction to Creative Digital Music	2
MUSIC 3460	Computer Music Programming Design	3

MUSIC 4460	Sound Synthesis Design for Electronic Music	3
7 credits from the following		7
COMS 1070	Windows Application Programming	
COMS 2070	Fundamentals of Computer Programming	
	or COMS 227 Object-oriented Programming	
COMS 2280	Introduction to Data Structures	
COMS 3090	Software Development Practices	
COMS 3270	Advanced Programming Techniques	
CPRE 3290	Software Project Management	
EE 2010	Electric Circuits	
EE 2240	Signals and Systems I	
EE 3240	Signals and Systems II	
ME 4510	Engineering Acoustics	
SE 3190	Construction of User Interfaces	
MUSIC 1010	Fundamentals of Music	
MUSIC 1020	Introduction to Music Listening	
MUSIC 1180	Applied Music for Non-Majors	
MUSIC 1200	Introduction to Music Literature and Styles	
	or MUSIC 30 Masterpieces of Music and Art in Western Culture	
MUSIC 2240	Music Theory I	
MUSIC 2250	Aural Theory I	
MUSIC 2340	Music Theory II	
MUSIC 2350	Aural Theory II	
MUSIC 2900F	Special Problems: Applied Music	
MUSIC 3040	History of American Rock 'n' Roll	
MUSIC 3180	Applied Music for Non-Majors	
MUSIC 3830	History of Music I	
MUSIC 3840	History of Music II	
MUSIC 4720	History of American Music	
MUSIC 4900I	Independent Study: Electronic Music	

Total Credits 15

Music courses that may be taken by music majors to meet the requirements for the Music Technology minor are limited to the following:

MUSIC 2460	Introduction to Creative Digital Music	2
MUSIC 3460	Computer Music Programming Design	3
MUSIC 4460	Sound Synthesis Design for Electronic Music	3
MUSIC 4900I	Independent Study: Electronic Music	1-30
MUSIC 5900I	Special Topics: Electronic Music	1-30

At least three of the fifteen credits must be taken at Iowa State University in courses numbered 3000 or above with a grade of C or higher. The minor must include at least three credits not used to meet any other

department, college, or university requirement. Students pursuing a minor in music technology must meet the audition requirements and/or prerequisites for all music courses they wish to take.

The Music Technology Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

Naval Science Program

The Department of Naval Science is embedded within the College of Liberal Arts and Sciences as an interdisciplinary program but does not offer an academic degree. The courses offered by the Department are developed by the Department of the Navy. The Naval Science Department and Naval ROTC (NROTC) Program develop individuals mentally, morally, and physically, and instill in them the highest ideals of duty, loyalty, and the core values of Honor, Courage, and Commitment, in order to commission them upon graduation as Navy and Marine Corps officers. Program graduates possess a basic professional background, are motivated towards careers in the Naval Service, and have a potential for future development in mind and character so as to assume the highest responsibilities of command, citizenship, and government. Emphasis is placed on the core values of courage, honor and commitment.

Naval Science courses are open to any ISU student who has met the course prerequisites. To participate in the Naval ROTC Program, students must apply through one of two programs: the NROTC Scholarship Program (full scholarship; which includes a book stipend, tuition, laboratory fees, uniforms, and a monthly stipend), or the College Program (non-scholarship, with limited financial assistance). Applicants for the Scholarship Program are selected through a comprehensive nationwide competition. Applicants for the College Program are selected by the Professor of Naval Science from among students already in attendance at, or selected for admission by, the university. The College Program involves limited financial assistance by application for a 2 or 3-year scholarship. Upon application, students choose between the Navy Option and Marine Corps Option, for the purposes of training focus. NROTC students pursue their studies like other university students except that they must meet certain additional requirements that will prepare them to serve as naval officers upon graduation.

A Marine Corps Option student incurs a minimum 4-year active duty military obligation as a commissioned officer after graduation; a Navy Option student incurs a minimum 5-year active duty obligation.

Further information is available from the Professor of Naval Science, Iowa State University, isunrotc@iastate.edu, 515-294-6050.

While in the NROTC Program, Scholarship Program students will participate (with pay) in at-sea training cruises during the summer. College Program students, accepted to receive a 2 or 3-year scholarship,

will participate in at-sea training during the summer between their Junior and Senior year based on the specifics of their scholarship. Students are also exposed to regular and extracurricular activities that teach leadership principles and help them decide which field of the Navy or Marine Corps they wish to enter. These activities also include weekly leadership laboratory periods and opportunities for involvement in several student societies.

Undergraduate Study

Naval Science courses are primarily for those students in the NROTC program, however, other university students may also enroll. Students enrolled in the NROTC program must fulfill the following requirements:

NS 1110	Introduction to Naval Science	3
NS 2120	Seapower and Maritime Affairs	3
NS 2200	Leadership and Management	3
NS 2300	Navigation	3
NS 3200	Naval Ship Systems I (Engineering)	3
NS 3300	Naval Ship Systems II (Weapons)	3
NS 4100	Naval Operations and Seamanship	3
NS 4120	Leadership and Ethics	3
NS 4400	Senior Naval Science Seminar	1

Marine option students will complete:

NS 1110	Introduction to Naval Science	3
NS 2120	Seapower and Maritime Affairs	3
NS 2200	Leadership and Management	3
NS 2400	Fundamentals of Maneuver Warfare	3
NS 3210	Evolution of Warfare	3
NS 4120	Leadership and Ethics	3
NS 4400	Senior Naval Science Seminar	1

In addition to the normal Naval Science courses, all NROTC students are required to participate in laboratory periods that supplement the various academic courses. The Leadership Lab emphasizes human relations principles, teaches basic military formations, movements, commands, courtesies, and honors, and provides practice in unit leadership. Non NROTC program students enrolled in Naval Science courses are not required to participate in laboratory periods.

Military Studies Minor

The College of Liberal Arts and Sciences offers a minor in Military Studies. Requirements for the minor include taking a minimum of 15 credits of ROTC instruction, which may be taken from one or more of the ROTC programs.

Officer Education Programs

Iowa State University offers Reserve Officers Training Corps (ROTC) programs for the professional training of officers for the Air Force, Army, Navy and Marines.

For specific programs and courses:

- Air Force Aerospace Studies
- Military Science
- Naval Science

The purpose of these programs is to provide an avenue for interested students to become reserve or regular officers in one of the United States military services, and the university regards this training as the foundation for possible careers in the military. The Air Force and the Navy require a period of active duty service upon completion of the ROTC program. Graduates from Army ROTC serve in either active Army, the Army Reserve, or the National Guard.

All students enrolled in advanced ROTC programs receive financial allowances, which are described under Student Financial Aid. Scholarships are also available for all services as outlined in the section on financial aid.

Philosophy Overview

The philosophy major (33 credits) and minor (15 credits) offer Iowa State University students the opportunity to explore fundamental human questions through reflection and argumentation. Do we have free will? Can machines think? What makes actions right or wrong? What is the nature of knowledge and what can we hope to know? What does justice require, politically and economically? Philosophy classes explore answers to deep questions such as these, encouraging each student to develop and rationally defend their own views.

Philosophy offers a structured but flexible program to help students graduate on time while pursuing their interests. 2000-level courses introduce students to essential questions and methods of philosophical thought. In 3000-level courses, students engage in close examination of central topics in both contemporary thought and the history of philosophy. Seminars at the 4000-level offer the opportunity to study topics in-depth alongside a committed team of faculty and students.

Philosophy fosters skills of communication and critical thinking that are valuable across work, family, and civic life. The program equips students to logically analyze and develop new responses to the challenges faced by humanity. It also emphasizes clarity of thought and communication as part of rigorous engagement with both abstract and applied areas of thought. These skills of logical analysis, careful reading, original thought,

and clear communication are in high demand across different fields of work and post-graduate study. Philosophy majors typically achieve some of the highest scores on standardized tests such as the LSAT and GRE and have mid-career salaries higher than many other majors.

Student Learning Outcomes

Upon graduation, students should be able to:

1. Explain central problems in key areas of philosophy, such as metaphysics, epistemology, ethics, logic, political philosophy, philosophy of language, and the philosophy of science.
2. Explain the views of historically important philosophers and place them in the context of significant philosophical movements.
3. Identify and critically evaluate arguments by developing objections and replies.
4. Communicate ideas and arguments, both orally and in writing, with clarity and precision.
5. Engage with different points of view with open-mindedness, intellectual curiosity, and a willingness to learn from the ideas and arguments of others.

Philosophy Degree Requirements

As majors in the College of Liberal Arts and Sciences, Philosophy students must meet College of Liberal Arts and Sciences and university-wide requirements for graduation in addition to those stated below for the major.

The degree program in philosophy requires a minimum of 33 credits, plus the zero credit PHIL 4920 course. The following courses compose the core program of the major from which 15 credits shall be chosen. Additionally, two courses at the 4000 level or above (other than PHIL 4900 and PHIL 4920) are required.

Ethical Theory: At least one course required.		3
PHIL 3300	Ethical Theory	
PHIL 3350	Social and Political Philosophy	
PHIL 5350	Contemporary Political Philosophy	
History: Two courses required.		6
PHIL 3100	Ancient Philosophy	
PHIL 3140	17th Century Philosophy	
	or PHIL 315018th Century Philosophy	
Metaphysics: One course required.		3
PHIL 3640	Metaphysics: God, Minds, and Matter	
PHIL 3660	Knowledge, Rationality, and Evidence	
PHIL 3800	Philosophy of Science	
Logic: One course required.		3

PHIL 2070	Introduction to Symbolic Logic	
Graduating Senior Survey.		
PHIL 4920	Graduating Senior Survey	R
Additional courses in philosophy.		18
Total Credits		33

Students in all ISU majors must complete a three-credit course in U.S. Cultures and Communities and a three-credit course in International Perspectives. Check <http://www.registrar.iastate.edu/courses/div-ip-guide.html> for a list of approved courses. Discuss with your advisor how the two courses that you select can be applied to your graduation plan.

LAS majors require a minimum of 120 credits, **including a minimum of 45 credits at the 3000/4000 level**. Three of the required 45 3000+ level credits must be earned in a general education group outside the group of the major. You must also complete the LAS world language requirement and LAS career proficiency requirement.

According to the university-wide Communication Proficiency Grade Requirement, students must demonstrate their communication proficiency by earning a grade of C or better in ENGL 2500.

Philosophy, B.A.

Freshman

Fall	Credits Spring	Credits
PHIL 2010	3 Philosophy Choice	3
ENGL 1500	3 Social Science Choice	3
LIB 1600	1 Humanities Choice	3
Humanities Choice	3 Math Choice	3
Social Science Choice	3 World Language/Elective	4
World Language/Elective	4	
17		16

Sophomore

Fall	Credits Spring	Credits
PHIL 3100	3 PHIL 2070	3
ENGL 2500	3 PHIL 3140 or 3150	3
Philosophy Choice	3 Natural Science Choice	4
Humanities Choice	3 Social Science Choice	3
Natural Science Choice	4 Elective	2-3
	LAS 2030	1
16		16-17

Junior

Fall	Credits Spring	Credits
PHIL 3300	3 Philosophy Choice - 3000/4000 Level	3
PHIL 3640 or 3800	3 Electives	12

Philosophy Choice	3	
Electives	6	
15		15

Senior

Fall	Credits Spring	Credits
Philosophy Choice - 4000 Level	3 PHIL 4920	R
Philosophy Choice - 3000/4000 Level	3 Philosophy Choice - 4000 Level	3
Electives	6 Electives	10
12		13

Minor in Philosophy

The department offers a minor in philosophy which may be earned by completing a total of 15 credits in philosophy. At least 9 credits must be in courses numbered 3000 or above (only 3 credits of which may be in PHIL 4900), and at least 3 credits must be taken at Iowa State University. The minor must include at least 3 credits that are not used to meet any other department, college, or university requirement.

The Philosophy Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

MINOR IN ETHICS

The Department Philosophy and Religious Studies offers a minor in ethics. Ethics is the branch of human thought that addresses questions of human morality. It seeks to define right and wrong at the theoretical level and to guide action across diverse fields of practice. An ethics minor provides opportunities for students to develop an understanding of both the theoretical foundations and the practical applications of ethics. It serves students who wish to understand how ethical thought complements their chosen majors, but also students who have an interest in learning about ethics more generally.

The minor in ethics requires 15 credits; at least 6 credits must be in courses numbered 3000 or above. The minor must include at least 3 credits that are not used to meet any other department, college, or university requirement.

All students pursuing the minor in ethics must complete either PHIL 2300 Moral Theory and Practice or PHIL 3300 Ethical Theory. In addition, students must complete 6 credits of courses chosen from a list of Core Ethics courses, as well as 6 credits of Additional Ethics courses chosen from either the core ethics courses or a broader list of courses with a significant ethics focus. At least 3 credits must be taken at Iowa State University.

The Ethics Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

Students must take PHIL 2300 or PHIL 3300, or both. 3

6 credits from Core Ethics courses: 6

PHIL 2300	Moral Theory and Practice
PHIL 2350	Ethical Issues in a Diverse Society
PHIL 3200	Existentialism
PHIL 3300	Ethical Theory
PHIL 3310	Moral Problems in Medicine
PHIL 3320	Philosophy of Law
PHIL 3340	Environmental Ethics
PHIL 3350	Social and Political Philosophy
or PHIL 535C	Contemporary Political Philosophy
PHIL 3360	Bioethics and Biotechnology
PHIL 3430	Philosophy of Technology
PHIL 4300	Value Theory
PHIL 4500	Agency and Free Will

6 credits additional ethics courses from the Core Ethics courses or from the Additional Ethics courses below: 6

ACCT 4890	Corporate Social Responsibility Reporting
ANTHR 2200	Globalization and Sustainability
ANTHR 2300	Globalization and the Human Condition
CPRE 2340	Legal, Professional, and Ethical Issues in Cyber Systems
ECON 3210	Economics of Discrimination
EDUC 2050	Social Foundations of Education in the United States: Early Childhood and Elementary Education
EDUC 4050	Teaching and Learning in a Pluralistic Society: Early Childhood and Elementary
EDUC 4810	Philosophy of Education
or EDUC 5810	Philosophy of Education
EE 3880	Sustainable Engineering and International Development
ENGR 3270	Voices of Public Policy
ENTSP 4100	Social Entrepreneurship
GLOBE 2200	Globalization and Sustainability
JLMC 4620	Media Ethics, Freedom, Responsibility
MGMT 3720	Ethical and Responsible Management
NREM 4600	Controversies in Natural Resource Management
NS 4120	Leadership and Ethics
PHIL 3380	Feminist Philosophy
PHIL 3390	Liberty and Law in America

POLS 2350	Introduction to Ethics and Politics
POLS 4800	Ethics and Public Policy
RELIG 3600	Religion and Ethics
RELIG 3700	Religion and Politics
RELIG 3800	Catholic Social Thought
SOC 3340	Politics and Society
SOC 3620	Applied Ethics in Agricultural and Rural Development
WGS 1600	Gender Justice

Total Credits 15

Philosophy - Graduate Study

The department offers work for a graduate minor in philosophy. For those taking the M.A. or M.S., the minor requirement is two courses above 3000 (but not PHIL 4900), each taken in conjunction with PHIL 5900. For those taking the Ph.D., the requirement is four courses above 3000, at least one of which is above 4000 (but not PHIL 4900), each taken in conjunction with PHIL 5900. Interested students should ask the chair to assign a minor advisor.

The department participates in the interdepartmental program in general graduate studies.

Physics and Astronomy

The Physics Major

Physics and astronomy are basic natural sciences which attempt to describe and provide an understanding of both our world and our universe. Physics serves as the underpinning of many different disciplines including the other natural sciences and technological areas. Graduates are proficient in the methods of rigorous scientific analysis, relevant mathematical techniques, and modern computational and laboratory methods. They have a broad knowledge of physics, including mechanics, electricity and magnetism, thermodynamics, and modern physics. They are able to communicate clearly and effectively at general and technical levels. They are prepared to pursue a wide range of careers as a professional physicist, astronomer, or science educator. They are also prepared to pursue advanced studies and careers in areas as diverse as engineering, medicine, law, and business administration. Many opportunities exist for students who terminate their studies with a bachelor's degree, especially when combined with technology studies in other areas. Students who meet the necessary scholastic standards often continue their studies in a graduate college, exploring and contributing to new developments in the field.

Faculty have approved a variety of completion pathways for the physics major for students who wish to establish a clear strength in a field of application of physics, such as computer science, science education,

mechanical engineering, or even science writing. These pathways make double majors more feasible and are appropriate for students planning to enter the job market with their bachelor's degree.

Student Learning Outcomes

The expected outcomes for students in the program are:

1. Problem solving and critical thinking skills
2. Knowledge of physics
3. Laboratory skills/experimental methodologies
4. Communication and professional skills

DEGREE REQUIREMENTS

All Physics students complete 49 credits of required classes in Physics and Math and additional credits of Advanced Coursework. For the Advanced Coursework, students choose one of three focus areas selected based on the career goals of the student: Standard Physics, Teacher Preparation, or Physics Applications.

Physics Core

PHYS 1990	Introductory Seminar	1
PHYS 2410	Principles and Symmetries in Classical Physics I *	5
PHYS 2420	Principles and Symmetries in Classical Physics II *	5
PHYS 3210	Introduction to Modern Physics I	3
PHYS 3210L	Introductory Laboratory in Modern Physics I	1
PHYS 3610	Classical Mechanics	3
PHYS 3640	Electricity and Magnetism I	3
PHYS 3040	Thermal Physics	3
PHYS 4800	Quantum Mechanics I	3

* PHYS 2310/PHYS 2310L and PHYS 2320/PHYS 2320L may be substituted for PHYS 2410 and PHYS 2420.

Total Credits 27

Math Core

MATH 1650	Calculus I	4
MATH 1660	Calculus II	4
MATH 2650	Calculus III	4
MATH 2670	Elementary Differential Equations and Laplace Transforms	4
MATH 3850	Introduction to Partial Differential Equations	3
MATH 2070	Matrices and Linear Algebra	3-4
or MATH 3170	Theory of Linear Algebra	

All physics majors are encouraged to take STAT 3410.

Total Credits 22-23

Advanced Coursework

In addition to the 49-credit core, students choose one of three focus areas: Standard Physics, Teacher Preparation, or Physics Applications.

Standard Physics Focus

Students with the Standard Physics focus will complete these additional 19 credits.

PHYS 3220 & 3220L	Introduction to Modern Physics II and Introductory Laboratory in Modern Physics II	4
PHYS 3620	Intermediate Mechanics	3
PHYS 3650	Electricity and Magnetism II	3
PHYS 3100	Electronic Instrumentation for Experimental Physics	4

A minimum of 2 additional lab credits from the following: 2

ASTRO 3440L	Astronomy Laboratory
ASTRO 4500L	Undergraduate Research
PHYS 3110	Intermediate Laboratory
PHYS 3110T	Intermediate Laboratory for Secondary Physics Teachers
PHYS 4500L	Undergraduate Research
PHYS 4700L	Applied Physics Laboratory

And at least 3 credits from: 3

ASTRO 3420	Introduction to Solar System Astronomy
ASTRO 3460	Introduction to Astrophysics
ASTRO 4050	Astrophysical Cosmology
PHYS 4210	Ultrafast Laser Science and Spectroscopy
PHYS 4220	Foundations of Quantum Computing
PHYS 4320	Molecular and Cell Biophysics
PHYS 4810	Quantum Mechanics II *
PHYS 4960	Modern Optics
PHYS 5110	Condensed Matter Physics I
PHYS 5260	Particle and Nuclear Physics
PHYS 5280	Mathematical Methods for the Physical Sciences
PHYS 5310	Statistical Mechanics
PHYS 5340	Symmetry and Group Theory in Physics
PHYS 5410	General Relativity

*Students intending to pursue graduate study in physics or astronomy/astrophysics should choose the option PHYS 4810 Quantum Mechanics II.

Total Credits 19

Optional Minor

Students completing the Standard Physics Focus who plan to continue their studies in Astronomy and Astrophysics should complete the Astronomy minor by using the following courses. The department has

created a sample four-year plan (<https://www.physastro.iastate.edu/undergraduate-programs/>) for those who want to add this minor to their Physics major.

ASTRO 1500	Stars, Galaxies, and Cosmology	3
ASTRO 3420	Introduction to Solar System Astronomy	3
ASTRO 3440L	Astronomy Laboratory (*)	3
ASTRO 3460	Introduction to Astrophysics	3
ASTRO 4050	Astrophysical Cosmology	3

*ASTRO 3440L can be applied to meet the requirements for the ASTRO Minor and to meet the additional 2 credit lab experience requirement of the major.

Total Credits 15

Teacher Preparation Focus

Students who are preparing to become a teacher meet the advanced coursework requirement of the Physics Major by completing the following 20 credits and meeting the requirements of the Secondary Major in Education. Note: Teacher license requirements are established by the Iowa Department of Education and the Iowa Board of Educational Examiners and are subject to change. Recent changes may not be reflected in this catalog, but advisers and faculty will be aware.

STAT 2010	Introduction to Statistical Concepts and Methods	4
PHYS 3220	Introduction to Modern Physics II	3
PHYS 3110T	Intermediate Laboratory for Secondary Physics Teachers	3
ASTRO 1500	Stars, Galaxies, and Cosmology	3
	or ASTRO 1200 The Sky and the Solar System	
PHYS 3990	Seminar on Secondary School Physics	1-2
EDUC 4180	Secondary Science Methods I	3
EDUC 4190	Secondary Science Methods II	3

Total Credits 20-21

Complementary Coursework for Physics Teaching Preparation Focus

In addition to the courses required for the Physics Major and those required for the Secondary Major in Education, the complementary coursework below is required for those seeking licensure in physics. Some of these courses, and some of the required coursework for the Secondary Major in Education, can also apply to LAS general education requirements.

PSYCH 2300	Developmental Psychology	3
	One course in American History or American Government	3

Total Credits 6

Students who are seeking to add a Math endorsement to their Teacher Preparation program in Physics will also need to complete the following courses in Mathematics.

MATH 3970	Teaching Secondary Mathematics Using University Mathematics	3
MATH 4970	Teaching Secondary School Mathematics	3
MATH 4350	Geometry I	3

Physics Applications Focus

Students who are not planning to attend graduate school in Physics or become teachers, can meet the advanced coursework requirements of the Physics major by completing one of several approved completion pathways for the physics major. This coursework can help a Physics graduate establish a clear strength in a field of application of physics, such as computer science, mechanical engineering, data science, or even science writing. These pathways, ranging from 16 to 24 additional credits, also make double majors with physics more feasible. Contact the Physics advisor for further information concerning programs of study in Physics Applications. Sample Physics with applications programs are listed at the department web site (<https://www.physastro.iastate.edu/undergraduate-programs/>).

Additional Requirements

As majors in the College of Liberal Arts and Sciences, Physics students must meet College of Liberal Arts and Sciences and University-wide requirements for graduation in addition to those stated above for the major. This includes meeting the university-wide Communication Proficiency Grade Requirement, by earning credit for ENGL 1500, a grade of C or better in ENGL 2500 (or ENGL 2500H) and a grade of C- or better in ENGL 3020, ENGL 3050, ENGL 3090 or ENGL 3140.

Students in all ISU majors must complete a three-credit course in U.S. Cultures and Communities and a three-credit course in International Perspectives. Check (<http://www.registrar.iastate.edu/courses/div-ip-guide.html>) for a list of approved courses. Discuss with your advisor how the two courses that you select can be applied to your graduation plan.

LAS majors require a minimum of 120 credits, **including a minimum of 45 credits at the 3000/4000 level**. You must also complete the LAS world language and career proficiency requirements (LAS 2030 Professional Career Preparation).

Physics, B.S

The plan below is a sample program of study for a student completing the Standard Physics Focus.

Freshman

Fall	Credits Spring	Credits
ENGL 1500	3 PHYS 2420	5
PHYS 1990	R MATH 2650	4
PHYS 2410	5 Social Science Choice	3
MATH 1660	4 Natural Science Choice	5
Humanities Choice	3	
LIB 1600	1	
	16	17

Sophomore

Fall	Credits Spring	Credits
ENGL 2500	3 PHYS 3610	3
PHYS 3210	3 PHYS 3220	3
PHYS 3210L	1 PHYS 3220L	1
MATH 2670	4 MATH 3850	3
Humanities Choice	3 LAS 2030	1
Natural Science Choice	3 Social Science Choice	3
	Humanities Choice	3
	17	17

Junior

Fall	Credits Spring	Credits
PHYS 3620	3 PHYS 3040	3
PHYS 3640	3 PHYS 3650	3
ENGL 3020, 3050, 3090, or 3140	3 Social Science Choice	3
MATH 3170 or 2070	3-4 Humanites Choice	3
World Language (or Elective)	4-3 World Language (or Elective)	4-3
	16	16-15

Senior

Fall	Credits Spring	Credits
PHYS 3100	4 PHYS 3110 ¹	2
PHYS 4800	3 PHYS 4810 ²	3
Elective	3 Elective	3
ASTRO 3440L ¹	3 Elective	3
	Elective	3
	13	14

¹ Students must earn a minimum of two laboratory credits from PHYS 3110, 3110T, 4500L, 4700L; ASTRO 3440L, 4500L.

² Recommended but not required. Highly recommended for those students planning gradate study.

Four year plans for advanced coursework options to complete the Physics major are listed at <https://www.physastro.iastate.edu/undergraduate-programs> (<https://www.physastro.iastate.edu/undergraduate-programs/>).

Students in all ISU majors must complete a three-credit course in U.S. Cultures and Communities and a three-credit course in International Perspectives. Check (<http://www.registrar.iastate.edu/courses/div-ip-guide.html>) for a list of approved courses. Discuss with your advisor how the two courses that you select can be applied to your graduation plan.

Minor in Physics

The department offers a minor in physics which may be earned by completing 20 credits in physics courses chosen as follows:

PHYS 2410	Principles and Symmetries in Classical Physics I *	5
PHYS 2420	Principles and Symmetries in Classical Physics II *	5
PHYS 3210	Introduction to Modern Physics I	3

At least one of the following

PHYS 3210L	Introductory Laboratory in Modern Physics I	
PHYS 3220L	Introductory Laboratory in Modern Physics II	
PHYS 3100	Electronic Instrumentation for Experimental Physics	
PHYS 3110	Intermediate Laboratory	
PHYS 3110T	Intermediate Laboratory for Secondary Physics Teachers	

Other acceptable courses

PHYS 3040	Thermal Physics	
PHYS 3220	Introduction to Modern Physics II	
PHYS 3610	Classical Mechanics	
PHYS 3620	Intermediate Mechanics	
PHYS 3640	Electricity and Magnetism I	
PHYS 3650	Electricity and Magnetism II	
PHYS 4210	Ultrafast Laser Science and Spectroscopy	
PHYS 4320	Molecular and Cell Biophysics	
PHYS 4800	Quantum Mechanics I	
PHYS 4810	Quantum Mechanics II	
PHYS 4960	Modern Optics	

*PHYS 2310/231L and PHYS 2320/232L may be substituted for PHYS 2410 and PHYS 2420

The Physics Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

Minor in Astronomy

The department offers a minor in astronomy which may be earned by completing 15 credits as laid out below. Note that only ASTRO 3440L may be used to satisfy both the requirements of a physics major and an astronomy minor.

ASTRO 1200	The Sky and the Solar System	3
or ASTRO 1500 Stars, Galaxies, and Cosmology		
ASTRO 3420	Introduction to Solar System Astronomy	3
ASTRO 3460	Introduction to Astrophysics	3
ASTRO 3440L	Astronomy Laboratory	3
An additional 3 credits from the following:		3
ASTRO 4050	Astrophysical Cosmology (preferred)	
PHYS 3040	Thermal Physics	
PHYS 3210	Introduction to Modern Physics I	
PHYS 3610	Classical Mechanics	
PHYS 3620	Intermediate Mechanics	
PHYS 3640	Electricity and Magnetism I	
PHYS 3650	Electricity and Magnetism II	
PHYS 4800	Quantum Mechanics I	
PHYS 4810	Quantum Mechanics II	
PHYS 4960	Modern Optics	
AERE 3510	Astrodynamics I	
Graduate-level ASTRO courses may be substituted with approval.		
The department has a set of recommended courses for Physics students interested in pursuing graduate school in Astronomy and Astrophysics.		
Total Credits		15

The minor must include at least 3 credits that are not used to meet any other department, college, or university requirement.

The Astronomy Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

Graduate Study

The department offers studies for the degrees Master of Science and Doctor of Philosophy with majors at both levels in astrophysics, condensed matter physics, high energy physics, nuclear physics, and physics; and minor credit courses for students majoring in other departments.

Facilities of various research groups of the department and the Ames Laboratory are available for research.

Students with bachelor's degrees in physics or astronomy from other institutions ordinarily will qualify for graduate study at Iowa State

University provided they have satisfactorily completed course work similar to that suggested for undergraduate majors here intending to go on to graduate school. In some cases, additional instruction at the intermediate level may be required.

Graduates have a broad understanding of physical science, as well as mastery of state-of-the-art methods in their area of specialization. They are able to communicate effectively to a wide range of audiences, from the general public to research colleagues. Their skills in rigorous scientific thinking prepare them for leadership in the broader community. They are skilled in carrying out research, communicating research results, and soliciting research support. They have considerable teaching experience. They have developed problem solving skills that prepare them for careers in either industry or academia.

All candidates for an advanced degree in physics are expected to complete:

PHYS 5310	Statistical Mechanics	3
PHYS 5640	Advanced Classical Mechanics	3
PHYS 5710	Electricity and Magnetism I	3
PHYS 5720	Electricity and Magnetism II	3
PHYS 5910	Quantum Physics I	4
PHYS 5920	Quantum Physics II	4

Candidates for an advanced degree in astrophysics should complete:

PHYS 5310	Statistical Mechanics	3
or PHYS 5640 Advanced Classical Mechanics		
PHYS 5710	Electricity and Magnetism I	3
PHYS 5910	Quantum Physics I	4
ASTRO 5050	Astrophysical Cosmology	3
ASTRO 5100	Observational Astrophysics	3

Astrophysics Ph.D. candidates must take at least three of the 5800 level Astro courses, while candidates for the M.S. must take at least two 5800 level Astro courses.

A thesis is always required for all Ph.D. majors. The degree Master of Science is offered both with and without thesis. For all graduate majors the basic requirements for the M.S. are the same: at least 30 credits of acceptable graduate work must be completed, not less than 21 of which must be in physics or astronomy. Students choosing a M.S. degree with thesis may apply up to 8 credits of 6990 but no credits of 5990 toward the minimum 30 credits. Students choosing a degree without thesis should apply 2 credits of 5990, but may not apply any credits of 6990, toward the minimum 30 credits.

In addition to course work in the major area of study, all candidates for the Ph.D. degree must complete 9 credits of graduate course work

outside this area including at least one 5000 or 6000 level introductory course in another area of physics. Each candidate for the Ph.D. degree is required to teach one year of elementary physics or astronomy.

Graduate students interested in a physics minor should contact the department for requirements.

Political Science

Overview of Political Science

The study of political science is designed to enable students to understand the nature of politics, public values, and policy, as well as the institutions and processes that produce these outcomes.

Students completing a major in Political Science will understand and be able to interrelate the leading theories, literature, and approaches in the subfields of American government, political theory, international relations, comparative politics, and public policy. Graduates can analyze and formulate effective argumentation in written and oral forms, with the ability to appreciate and accommodate diverse political ideas and to collect and critique information and ideas of others in support of original arguments. Graduates appreciate the knowledge and civic responsibilities required for effective participation in political life. Students completing a major in Political Science have the opportunity to complete courses providing one or more career paths from among Law, Justice and Politics; Public Policy and Political Action; Global Engagement; Politics and Business; and Environmental Politics and Policy.

The Political Science major is often chosen by students preparing for a career in law. Students with this goal should consult with the department in selecting courses.

Several internship options are available to the Political Science major, offering students the opportunity to experience practical application of the knowledge learned in academic courses.

Expected Student Learning Outcomes

Upon graduation, students should be able to:

- Effectively communicate political ideas and information.
- Formulate original arguments while drawing appropriately on others' ideas.
- Use major theoretical concepts of political science to answer questions of interest.
- Connect knowledge from political science to participation in civic life.
- Collect, and evaluate the quality of, information relating to politics and policy.
- Apply social-science methodologies to data about politics and policy.

Political Science, B.A.

All Political Science majors must satisfactorily complete 34 credits of Political Science, including at least 18 credits of Political Science courses numbered 3000 or above and at least 9 credits of Political Science courses numbered 4000 or above. No more than 3 credits of POLS 4900, POLS 4960, POLS 4970, or POLS 4990, alone or in combination, may count towards the major. Only Political Science courses in which a student earns a grade of C- or higher will count for the major. At least 15 credits of Political Science coursework must be earned at Iowa State University.

POLS 1010	Exploring Political Science	1
At least two subfield-introduction courses		6
POLS 1110	Introduction to American Government	
POLS 1210	Introduction to International Politics	
POLS 1250	Democracy and Dictatorship: Introduction to Comparative Politics	
At least two career-gateway courses		6
POLS 2220X	Global Engagement	
POLS 2320X	Politics of Business	
POLS 2350	Introduction to Ethics and Politics	
POLS 2710	Public Organizations and Leadership	
POLS 2830	Introduction to Environmental Politics and Policies	
At least one research-methods course		3
POLS 2610	Thinking Like a Political Scientist: Qualitative Approaches	
POLS 2620	Thinking Like a Political Scientist: Quantitative Approaches	
POLS 4010	Political Analysis and Research	
Additional POLS 3000-level and above coursework to complement other course choices and to meet the minimums required for the major		18
At least 18 credits of POLS courses numbered 3000 or above, of which at least 9 credits are numbered 4000 or above		
As part of the 3000-level and above coursework, a capstone experience		
POLS 4910	Senior Thesis (3 cr. minimum)	
POLS 4990	Internship in Political Science (3 cr. minimum)	
POLS course numbered 5000 or above (3 cr. minimum)		
Study-abroad experience approved by the department		
POLS 4920	Graduating Senior Survey	R
Total Credits		34

Complementary Course Requirements

One Statistics course	3-4
STAT 1010 Principles of Statistics	
or STAT 104 Introduction to Statistics	
or STAT 226 Introduction to Business Statistics I	

Total Credits 3-4

Communication Proficiency

ENGL 1500 Critical Thinking and Communication	3
ENGL 2500 Written, Oral, Visual, and Electronic Composition	3
One Advanced Communication course	3
ENGL 3020 Business Communication	
or ENGL 309 Proposal and Report Writing	
or ENGL 314 Technical Communication	

Total Credits 9

As majors in the College of Liberal Arts and Sciences, Political Science students must meet College of Liberal Arts and Sciences (<https://catalog.iastate.edu/collegeofliberalartsandsciences/>) and university-wide requirements (<https://catalog.iastate.edu/collegescurricula/>) for graduation in addition to those stated above for the major. The university-wide Communication Proficiency Grade Requirement requires a grade of C or better in ENGL 2500. Students in all ISU majors must also complete three credits from the list of U.S. Cultures and Communities courses (<https://www.registrar.iastate.edu/students/div-ip-guide/usdiversity-courses/>) and three credits from the list of International Perspectives courses (<https://www.registrar.iastate.edu/students/div-ip-guide/IntlPerspectives-current/>). Discuss with your advisor how the two courses that you select can be applied to your graduation plan.

LAS majors require a minimum of 120 credits, **including a minimum of 45 credits at the 3000/4000 level** and completion of the LAS world-language and career-proficiency requirements.

Political Science with Teacher Preparation Focus

Students seeking teacher certification in American Government must meet all of the requirements of the Political Science or History major while taking the specific Political Science and education-related classes required for certification by the State of Iowa. This coursework must include POLS 1110, either POLS 1210 or POLS 1250, and a minimum of 9 additional credits in American Government (see options below). Students must also complete a second major in Secondary Education and at least one additional endorsement (15 credits) in either American History or World History. Most students will complete a total of three endorsement areas; the third might include American or World History, Psychology, Economics, Anthropology, or Sociology. Students must earn a minimum grade of B- in all content courses used for licensure and a minimum

grade of C in all other required courses. Specific requirements of each endorsement are available from your advisor.

Teacher license requirements are established by the Iowa Department of Education and the Iowa Board of Educational Examiners and are subject to change. Recent changes may not be reflected in this catalog, but advisors will be aware.

Political Science Course Options for American Government Teacher Certification

POLS 1110	Introduction to American Government	3
POLS 1210	Introduction to International Politics	3
or POLS 1250	Democracy and Dictatorship: Introduction to Comparative Politics	
Minimum of 9 additional credits in American Government		9
POLS 3060	Public Opinion and Voting Behavior	
POLS 3100	State and Local Government	
POLS 3180	Campaigns and Elections	
POLS 3190	Law and Politics	
POLS 3200	American Judicial Process	
POLS 3330	Democracy in America	
POLS 3340	Politics and Society	
POLS 3350	Science, Technology, and Public Policy	
POLS 3370X	Health Politics and Policy	
POLS 3390	Liberty and Law in America	
POLS 3440	Public Policy	
POLS 3530	Immigration Policy	
POLS 3580	United States Foreign Policy	
POLS 3590	Current Issues in American Foreign Policy	
POLS 3600	American Institutions: Congress	
POLS 3610	American Institutions: The Presidency	
POLS 3630	American Institutions: Media	
POLS 3640	Political Parties and Interest Groups	
POLS 3850	Women in Politics	
POLS 4100	State Government and Politics	
POLS 4190	The Judiciary	
POLS 4200	Constitutional Law	
POLS 4210	Constitutional Freedoms	
POLS 4250	Proseminar in American Political Behavior	
POLS 4600	Proseminar in American Political Institutions	

Complementary Coursework for Political Science with Teacher Preparation Program Focus

In addition to completing the requirements of the Secondary Major in Education, students will complete the following, some of which will apply to LAS General Education requirements:

PSYCH 2300	Developmental Psychology	3
EDUC 4260	Principles of Secondary Education	3
HIST 4980	Methods of Teaching History/Social Sciences	3
HIST 2010	Introduction to Western Civilization I	3
HIST 2020	Introduction to Western Civilization II	3
HIST 2210	Survey of United States History I	3
HIST 2220	Survey of United States History II	3

Four Year Plan

Political Science, B.A.

Freshman

Fall	Credits Spring	Credits
POLS 1010	1 POLS 1210 or 1250 ¹	3
ENGL 1500	3 Natural Science Choice	3
LIB 1600	1 Social Science Choice	3
POLS 1110, 1210, or 1250	3 Humanities Choice	3
Natural Science Choice	3 Elective	3
Social Science Choice	3	
	14	15

Sophomore

Fall	Credits Spring	Credits
ENGL 2500	3 STAT 1010, 1040, or 2260 ²	3-4
POLS 2350 or 2710	3 POLS 2220X, 2320X, or 2830	3
POLS 2610	3 Political Science Choice: 3000/4000 Level	3
Natural Science Choice	2-3 Humanities Choice	3
World Language/Elective	3-4 World Language/Elective	3-4
LAS 2030	1	
	16	16

Junior

Fall	Credits Spring	Credits
Political Science Choice: 3000/4000 Level	6 Political Science Choice: 4000 Level	3
ENGL 3140, 3020, or 3090	3 Humanities Choice	3
U.S. Cultures and Communities Choice ³	3 Electives	9
Humanities Choice	3	
	15	15

Senior

Fall	Credits Spring	Credits
Political Science Choice: 4000 Level	3 Political Science Choice: 5000 Level	3
Electives	11 Electives	12
	14	15

Total Credits: 120

¹ Meets International Perspectives requirement.

² Meets LAS College Mathematical Disciplines requirement.

³ May be cross-listed to fulfill other requirements. POLS 3330, POLS 3370X, POLS 3390, POLS 3530, and POLS 3850 fill this requirement.

Minor in Political Science

The department offers a minor in political science that may be earned by completing 15 credits of coursework in political science, fulfilling all of the following criteria:

- At least 9 of the credits must be in courses numbered 2000 or above, of which at least 6 credits must be numbered 3000 or above; the 6 credits at the 3000 level or above require a minimum grade of C.
- At least 3 of the credits must have been taken at Iowa State University.
- No more than 3 credits of POLS 4900 may be included.
- None of the credits may be in courses taken on a pass/not-pass or satisfactory/fail basis.
- At least 3 of the credits must not be used to meet other department, college, or university requirement.

The Political Science Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

BA/MA PROGRAM

The concurrent BA/MA (<https://pols.iastate.edu/academics/combined-b-a-m-a/>) classification offers well-qualified Iowa State juniors and seniors the opportunity to start working on a master's degree in political science before completing a bachelor's degree. Contact the department's Director of Graduate Education for more information about applying.

Graduate Study

The department offers work for a Master of Arts degree (MA) with a major in political science and minor for students in other departments. The department also offers work for a Graduate Certificate of Public Management and Policy (GCPMP) for those interested in a professional certificate program that requires less work than a full master's program. In addition, the Department of Political Science offers work for a Master

of Science in Information Assurance (MSIA) and a joint Master of Arts/Juris Doctor (MA/JD) program with the Law School of Drake University. Information with detailed requirements for all graduate degrees may be obtained at the department's web page (<https://pols.iastate.edu/academics/graduate/>).

Master of Arts (MA)

This is a 30-credit master's degree that gives students the opportunity to explore the field of political science in order to improve higher-level job opportunities, pursue a PhD, go to law school, improve research skills, or understand politics better. Top students are eligible for graduate assistantships, awarded on a merit basis, that make graduate study more affordable and provide opportunities for assisting faculty with teaching and research. The degree can also be pursued jointly with a JD at Drake Law School (see below).

MA graduates have a broad substantive understanding of the political process and the academic study of politics. They also have in-depth knowledge of one or more subfields in political science. Graduates are skilled at conducting research, able to identify and address complex political questions, and can account for ethical, legal, economic, and social issues of policy.

The prerequisites for major graduate work in the MA program normally are completion of at least 12 credits in political science or related courses. During their program of study, all students are expected to complete STAT 5101, POLS 5010, and a thesis or creative component. Additional information including detailed graduation requirements can be found on the department's web page (<https://pols.iastate.edu/academics/graduate/political-science-m-a/>).

Master of Science in Cybersecurity

The Master of Science in Cybersecurity is a multi-disciplinary program designed to provide students with diverse backgrounds and interests the opportunity to obtain professional training in the emerging field of information assurance. The core of the Cybersecurity program is built around a series of courses taught in Electrical and Computer Engineering, Mathematics, and Computer Science that introduce students to software and hardware aspects of cryptography and computer security. The program also recognizes, however, that information assurance defined in terms of security, privacy, access, and reliability is not simply a technical problem but also involves important societal dimensions, including policy, education, ethics, and management. Recognizing that political science offers many potential intersections with cybersecurity (e.g., public-sector management of information technology, forensics and computer crime, information-technology policy and law, information technology and international relations, information warfare, etc.), students with interests in these areas are encouraged to select the Department of Political Science as their home department.

Students opting to pursue a Cybersecurity degree through the Department of Political Science can expect to acquire skills and background knowledge relevant to a career in public policy or public sector management of information assurance technologies. The Cybersecurity degree can also help prepare students who wish to go on to pursue a PhD in information politics and policy.

Admission requirements generally follow the same guidelines as the MA in Political Science. Degree requirements are specified by the Cybersecurity program in cooperation with Political Science. More in-depth information on the program including detailed graduation requirements can be found on the department's web page (<https://pols.iastate.edu/academics/graduate/cyber-security-graduate-program/>).

Master of Arts/Juris Doctor Program (MA/JD)

The Drake Law School (<https://www.drake.edu/law/>) and the Department of Political Science at Iowa State University are co-sponsors of the Master of Arts/Juris Doctor degree. This degree combines courses at both Iowa State University and the Drake Law School and follows most of the same requirements as a double degree. However, the student must have full admission to both schools. Detailed information for the MA/JD can be found at the ISU Political Science web page (<https://pols.iastate.edu/academics/graduate/political-science-m-a-j-d/>).

The increasing attention being focused on the solution of social problems by state and federal governments has created a need for persons with advanced training in both law and political science. The Drake Law School and the ISU Department of Political Science jointly administer a MA/JD program to provide an opportunity for students at the Drake Law School to achieve, concurrently, a JD degree in law and a MA degree in political science, and for graduate students in political science at Iowa State University to achieve a degree in law.

Successful completion of this program will enable students at Drake Law School to receive both a JD and an MA degree within a three-year or four-year period, while graduate students in political science at Iowa State University will be able to transfer a substantial number of hours to the Drake Law School toward the fulfillment of the JD requirements in a similar amount of time. Additional information including detailed graduation requirements can be found on the department's web page (<https://pols.iastate.edu/academics/graduate/political-science-m-a-j-d/>).

Graduate Minor

Students in other graduate programs may obtain a minor in political science by completing at least 9 credits of political science courses. Interested students should consult the Graduate College Handbook for additional information on graduate minors.

THE GRADUATE CERTIFICATE OF PUBLIC MANAGEMENT AND POLICY (GCPMP)

The Political Science Department offers a Graduate Certificate of Public Management and Policy (GCPMP). The GCPMP is a 15-credit certificate. Students who are interested in public management and policy, but unsure about committing to a full master's degree, can aim for the certificate knowing that those courses will also count toward a master's degree if they choose to continue on. Iowa State graduate students in other fields may want to pursue the certificate to improve their credentials on the job market if their interest overlaps with public management and policy. For example, doctoral students in higher education and education administration can earn all 9 of their "outside" credits in the GCPMP coursework, add the 6 more elective credits, and earn a GCPMP along with their PhD.

Requirements for admission are a graduate school application, an essay stating purposes for study, college transcripts, three letters of recommendation, and the TOEFL or equivalent for international students without a prior English-language degree. More information on the program including curricular requirements can be found on the department's web page (<https://pols.iastate.edu/academics/graduate/>).

Psychology

Psychology Overview

Psychological science plays a critical role in nearly every aspect of life. At Iowa State University, distinguished psychologists share their expertise and passion with students by engaging them in cutting-edge research, addressing real-world challenges, and inspiring them to make the world a better place.

The Psychology Department ensures that students receive a comprehensive introduction to the diverse subfields of psychology while offering flexibility in course selection. Students can earn a bachelor of science or a bachelor of arts in psychology, and these degrees will open the door to numerous career paths.

Career Options with a Bachelor's Degree

Students who choose to get a job with their bachelor's degree have many employment options. Careers related to psychology include:

- Substance abuse counselor (<https://www.onetonline.org/link/summary/21-1011.00>).
- Data scientist (<https://www.onetonline.org/link/summary/15-2051.00>).
- Social and human service assistant (<https://www.onetonline.org/link/summary/21-1093.00>).
- Psychiatric technician (<https://www.onetonline.org/link/summary/29-2053.00>).

- Child life specialist (<https://college.mayo.edu/academics/explore-health-care-careers/careers-a-z/child-life-specialist/>).
- Recreational therapist (<https://www.onetonline.org/link/summary/29-2053.00>).
- Applied behavior analyst (<https://www.bacb.com/about-behavior-analysis/>).
- Correctional treatment specialist (<https://www.onetonline.org/link/summary/21-1092.00>).
- Health education specialist (<https://www.onetonline.org/link/summary/21-1091.00>).
- Human resources manager (<https://www.onetonline.org/link/summary/11-3121.00>).

Career Options Requiring Graduate School

To guide students in making informed choices about careers that require advanced training, the department provides suggested course tracks based on various career interests. While these recommendations are optional, they are designed to help students better understand their chosen careers and enhance their applications for graduate programs. Our career guides can be found here (<https://psychology.iastate.edu/career-guides/>), and they cover the careers listed below:

- Clinical (<https://www.apa.org/education-career/guide/subfields/clinical/>) or Counseling Psychology (<https://www.apa.org/education-career/guide/subfields/counseling/>).
- Clinical Mental Health Counseling (<https://www.cacrep.org/for-students/>).
- Marriage and Family Therapy (https://www.aamft.org/AAMFT/About_AAMFT/About_Marriage_and_Family_Therapists.aspx).
- Social Work (<https://socialworklicensemap.com/social-work-resources/comparing-social-service-degrees/social-work-vs-psychology/>).
- Forensic Psychology (<https://www.apa.org/education-career/guide/subfields/forensic/>).
- Health Psychology (<https://www.apa.org/education-career/guide/subfields/health/>).
- Sport and Performance Psychology (<https://www.apa.org/education-career/guide/subfields/performance/>).
- School Psychology (<https://www.apa.org/ed/graduate/specialize/school/>).
- Industrial-Organizational Psychology (<https://www.apa.org/education-career/guide/subfields/organizational/>).
- Social Psychologist (<https://www.apa.org/education-career/guide/subfields/social/education-training/>).
- Brain Science and Cognition (<https://www.apa.org/education-career/guide/subfields/brain-science/education-training/>).

- Clinical Neuropsychology (<https://www.apa.org/ed/graduate/specialize/neuropsychology/>).
- Developmental Psychology (<https://www.apa.org/education-career/guide/subfields/developmental/>).
- Experimental Psychology (<https://www.apa.org/education-career/guide/subfields/experimental/>).
- Human Factors and Engineering Psychology (<https://www.apa.org/education-career/guide/subfields/human-factors/>).
- Rehabilitation Psychology (<https://www.apa.org/education-career/guide/subfields/rehabilitation/>).

Attending Professional Schools

Psychology is an excellent degree for admission to professional school. Psychology students have proven to be competitive when applying to the professional programs listed below:

- Medical School (<https://www.iastate.edu/academics/pre-professional-programs/>).
- Law School (<https://www.iastate.edu/pre-law-preparation/>).
- Occupational Therapy (<https://www.aota.org/about/what-is-ot/>).
- Higher Education Administration (<https://www.berklee.edu/careers/roles/higher-education-administrator/>).

Our advising team is here to help you explore your academic and career goals to determine the best path for you.

Student Learning Outcomes

Following the recommendations of the American Psychological Association, the undergraduate curriculum in psychology is designed to allow each student to:

1. Develop a detailed knowledge of psychology
2. Develop an understanding of scientific inquiry and demonstrate critical thinking
3. Understand the role of ethics and diversity in human behavior
4. Be able to communicate effectively in the discourse of psychology
5. Develop skills supporting employment or graduate/professional education

Degree Requirements

Students who want to earn a bachelor's degree with a major in psychology must complete the following requirements:

- Required courses (17-18 credit hours).
- Breadth requirement (15 credit hours).
- Psychology elective courses (12 credit hours).
- Specific bachelor of arts and bachelor of science requirements.

Required Courses

Students must take all of these courses. Students must earn a minimum of C- and an overall average of 2.00 or better in all required courses.

PSYCH 1010	Introduction to Psychology	3
PSYCH 1120	Psychology Learning Community Seminar	1
PSYCH 2110	Career Opportunities in Psychology	1
PSYCH 3010	Research Design and Methodology	3
PSYCH 3020	Research Methods in Psychology (Required for BS degree. BA students may take ENGL 3020, ENGL 3090, or ENGL 3140.)	3
PSYCH 4400	Psychological Measurement I	3

Students must take one of the statistics courses listed below.

STAT 1010	Principles of Statistics	4
STAT 1040	Introduction to Statistics	3
STAT 2010	Introduction to Statistical Concepts and Methods	4
STAT 2260	Introduction to Business Statistics I	3

Breadth Requirement

Students must take at least one course from five of the following seven areas. Students must earn an overall average of 2.00 or higher in courses used to fulfill the breadth requirement.

Area A: Developmental Psychology

PSYCH 2300	Developmental Psychology
PSYCH 3350	Child and Adolescent Psychopathology
PSYCH 4130	Psychology of Language

Area B: Social and Personality Psychology

PSYCH 2800	Social Psychology
PSYCH 3270	Persuasion and Social Influence
PSYCH 3600	Personality Psychology
PSYCH 3800	Social Cognition

Area C: Biological Psychology

PSYCH 3100	Brain and Behavior
PSYCH 3150	Drugs and Behavior
PSYCH 3200	Sleep and Dreams

Area D: Cognitive Psychology

PSYCH 3120	Sensation and Perception
PSYCH 3130	Learning and Memory
PSYCH 3160	Cognitive Psychology
PSYCH 3180	Judgment and Decision Making

Area E: Mental and Physical Health

PSYCH 4220	Counseling Theories and Techniques
PSYCH 4600	General Psychopathology
PSYCH 4850	Health Psychology

Area F: Applied Psychology

PSYCH 2500	Psychology of the Workplace
PSYCH 3140	Motivation
PSYCH 3300	Forensic Psychology
PSYCH 3500	Human Factors in Technology
PSYCH 3830	Psychology and Law
PSYCH 4500	Industrial Psychology

Area G: Psychology of Culture and Identity

PSYCH 3460	Psychology of Women
PSYCH 4880	Cultural Psychology

Psychology Elective Courses

Four additional 3-credit courses in psychology must be taken. Area courses may be used to meet this requirement, but variable credit courses (PSYCH 2910, PSYCH 4900, PSYCH 4910, PSYCH 4920A, and PSYCH 4920B) may not. Course options are listed in the psychology catalog. Students must earn an overall average of 2.00 or higher in courses used to fulfill the psychology elective courses requirement.

Specific Bachelor of Science and Bachelor of Arts Requirements

There are different requirements for the bachelor of science and bachelor of arts degrees.

- In order to earn a bachelors of science degree, students must take PSYCH 3020.
- In order to earn a bachelors of arts degree, students must complete an ISU-approved minor, certificate, or second major. In addition, students may take ENGL 3020, ENGL 3090, or ENGL 3140 to fulfill their advanced composition requirement.

University and College Requirements

As majors in the College of Liberal Arts and Sciences, Psychology students must meet College of Liberal Arts and Sciences and University-wide requirements for graduation in addition to those stated above for the major.

Students in all ISU majors must complete a three-credit course in U.S. cultures and communities (formerly U.S. diversity) and a three-credit course in international perspectives. Check (<http://www.registrar.iastate.edu/courses/div-ip-guide.html>) for a list of approved courses. Discuss with your advisor how the two courses that you select can be applied to your graduation plan.

LAS majors require a minimum of 120 credits, **including a minimum of 45 credits at the 3000/4000 level**. You must also complete the LAS world language requirement and career proficiency requirement.

Four Year Plans
Psychology, B.A.

Students must earn a minimum of C- and an overall average of 2.00 or better in all required courses for the psychology degree. Students must earn an overall average of 2.00 or higher in all breadth and elective courses for the psychology degree. Students must also complete an ISU-approved minor, certificate, or second major.

Freshman

Fall	Credits Spring	Credits
ENGL 1500	3 LIB 1600	1
PSYCH 1010	3 ENGL 2500	3
Natural Science Choice	3 Psychology Choice	3
Arts and Humanities Choice	3 Social Science Choice	3
Social Science Choice	3 Arts & Humanities Choice	3
PSYCH 1120	1 PSYCH 2110	1
16		14

Sophomore

Fall	Credits Spring	Credits
Natural Science Choice	3 Natural Science Choice	3
Natural Science Choice	3 LAS 2030	1
Psychology Choice	3 STAT 1010	4
Arts & Humanities Choice	3 Psychology Choice	3
Elective	3 Psychology Choice	3
15		14

Junior

Fall	Credits Spring	Credits
PSYCH 3010	3 Elective	3
Psychology Choice	3 World Language/Elective	3-4
Philosophy Choice	3 Arts and Humanities Choice	3
World Language/Elective	3-4 Minor	3
Minor	3 PSYCH 3020, ENGL 3020, ENGL 3090, or ENGL 3140	3
15-16		15-16

Senior

Fall	Credits Spring	Credits
PSYCH 4400	3 Minor	3
Psychology Choice	3 Electives	7-10
Minor	3 Psychology Choice	3
Electives	6 Psychology Choice	3
15		16-19

Total Credits: 120-125

Psychology, B.S

Students must earn a minimum of C- and an overall average of 2.00 or better in all required courses for the psychology degree. Students must earn an overall average of 2.00 or higher in all breadth and elective courses for the psychology degree.

Freshman

Fall	Credits Spring	Credits
ENGL 1500	3 Psychology Choice	3
PSYCH 1010	3 Social Sciences Choice	3
PSYCH 1120	1 Arts & Humanities Choice	3
Arts and Humanities Choice	3 ENGL 2500	3
Social Sciences Choice	3 LIB 1600	1
Natural Science Choice	3 PSYCH 2110	1
	16	14

Sophomore

Fall	Credits Spring	Credits
Psychology Choice	3 Psychology Choice	3
Natural Science Choice	3 Psychology Choice	3
Arts & Humanities Choice	3 STAT 1010	4
Natural Science Choice	3 Electives	3
Elective	3 LAS 2030	1
	15	14

Junior

Fall	Credits Spring	Credits
PSYCH 3010	3 PSYCH 3020	3
Psychology Choice	3 World Language/Elective	3-4
World Language/Elective	3-4 Psychology Choice	3
Electives	3 Psychology Choice	3
Arts and Humanities Choice	3 Electives	3
	15-16	15-16

Senior

Fall	Credits Spring	Credits
PSYCH 4400	3 Psychology Choice	3
Psychology Choice	3 Electives	12
Electives	9	
	15	15

Total Credits: 119-121

Psychology Undergraduate Minor

The department offers a minor in psychology. The minor requires the following:

- Completing 18 credits in Psychology, including PSYCH 1010 Introduction to Psychology.
- At least 9 credits must be in 2000 level or higher courses, of which at least 6 credits must be in 3000 level or higher courses.
- No more than three credits total may be from PSYCH 2910 Introductory Research Experience, PSYCH 4900 Independent Study, PSYCH 4910 Research Practicum, PSYCH 4920A Fieldwork Practicum: Human Services, or PSYCH 4920B Fieldwork Practicum: I/O Psychology.
- At least 3 of the credits are not used to meet any other department, college, or university requirement.
- Earn at least a C- or better in each course and an overall average of C or better in these courses.

The Psychology Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

Contact the psychology advising office for more information.

Graduate Study

The department offers work for the degree of Doctor of Philosophy in psychology. A Master of Science may be earned as part of that degree.

The department offers a doctoral specialization in counseling (<https://counseling.psych.iastate.edu/>) psychology (APA accredited) and doctoral areas of concentration in cognitive (<https://psychology.iastate.edu/graduate-study/doctoral-programs/cognitive-psychology/>) psychology and social (<https://psychology.iastate.edu/graduate-study/doctoral-programs/social-psychology/>) psychology.

A basic goal of graduate study in the Department of Psychology is to provide all students with a broad base of knowledge in psychological science, as well as exposure to the content and methodological skills necessary for effective performance in teaching, research and professional practice. Accordingly, graduates have an extensive knowledge of psychological principles and the conceptual and quantitative skills to conduct psychological research and to communicate the results to the scientific community, students in the classroom, and the general public. Graduates in counseling psychology are skilled in delivering services to diverse clientele in a variety of settings.

The department also participates in the interdepartmental programs in human computer interaction (<http://www.vrac.iastate.edu/hci/>), neuroscience (<http://www.neuroscience.iastate.edu/>) (<http://www.neuroscience.iastate.edu/>) and in the interdepartmental minor in gerontology (<http://www.gerontology.iastate.edu/programs/>).

A formal class and a supervised practicum in the teaching of psychology is recommended for all doctoral students whose future plans may include teaching at the college level. A 12-month internship in a training site or agency approved by the faculty is required of all doctoral students in counseling psychology.

Public Relations

PUBLIC RELATIONS

<http://www.greenlee.iastate.edu> (<http://www.greenlee.iastate.edu/>)

The public relations major provides students with the concepts, skills and expertise needed to help organizations build mutually beneficial relationships with diverse publics. The knowledge and tools students develop through the PR curriculum ensure they can enter fields such as corporate communication, government affairs, and public relations firms. Coursework in this major focuses on writing, research, digital and emerging media, and professional abilities. Students are required to complete a capstone internship experience to practice and refine their skills.

The Greenlee School of Journalism and Communication prepares students for communication fields. The school offers four majors:

- Advertising Bachelor of Arts (ADVRT)
- Journalism and Mass Communication Bachelor of Science (JLMC)
- Public Relations Bachelor of Science (PR)
- Sports Media Communications Bachelor of Arts (SMC)

In addition, the Greenlee School offers a 4+1 program allowing students to complete their B.A. or B.S. and earn an M.S. in journalism and mass communication in fewer semesters.

Professional skills are taught and practiced alongside academic requirements using the latest technology and leading-edge communication trends and methods.

Founded in 1905, the unit was one of the first journalism programs to be accredited in 1948 and continues to be one of the longest continuously accredited programs in the country. Accreditation is based on the principle that students need a broad-based, liberal arts education and solid core courses within the discipline. Students taking one major at the school may not seek an additional major or minor in the school. All students are required to take an additional major or a minor outside the school as an area of expertise.

Student Learning Outcomes

Students who major in programs of the Greenlee School of Journalism and Communication are expected to develop competencies in 10 key areas:

- Apply the principles and laws of freedom of speech and press, in a global context, and for the country in which the institution that invites ACEJMC is located.
- Demonstrate an understanding of the multicultural history and role of professionals and institutions in shaping communications.
- Demonstrate culturally proficient communication that empowers those traditionally disenfranchised in society, especially as grounded in race, ethnicity, gender, sexual orientation and ability, domestically and globally, across communication and media contexts.
- Present images and information effectively and creatively, using appropriate tools and technologies.
- Write correctly and clearly in forms and styles appropriate for the communications professions, audiences and purposes they serve.
- Demonstrate an understanding of professional ethical principles and work ethically in pursuit of truth, accuracy, fairness and diversity.
- Apply critical thinking skills in conducting research and evaluating information by methods appropriate to the communications professions in which they work.
- Effectively and correctly apply basic numerical and statistical concepts.
- Critically evaluate their own work and that of others for accuracy and fairness, clarity, appropriate style and grammatical correctness.
- Apply tools and technologies appropriate for the communications professions in which they work.

The Public Relations Major

To receive a Bachelor of Science degree in public relations, a student must earn at least 120 credits. A minimum of 72 credits must come from courses other than ADVRT, JLMC, PR or SMC. At least 50 of these credits must come from the liberal arts and sciences. Overall, at least 45 credits must be from 3000-level or above.

The degree requirements allow for a minimum of 34 credits and a maximum of 48 credits to be taken in ADVRT, JLMC, PR or SMC. These include:

JLMC 1100	Orientation to Journalism and Communication	1
PR 2200	Principles of Public Relations	3
JLMC 2010	Reporting and Writing for the Mass Media (C+ or better)	3
PR 3010	Research and Strategic Planning for Advertising and Public Relations	3
PR 3210	Public Relations Writing (C+ or better)	3
3000-level ADVRT, JLMC, PR or SMC Electives		6
PR 4240	Public Relations Campaigns	3
JLMC 4600	Law of Mass Communication	3
JLMC 4620	Media Ethics, Freedom, Responsibility	3

4000-level ADVRT, JLMC, PR or SMC Elective	3
PR 4990A Professional Media Internship: Required	3
Total Credits	34

Public relations majors are also required to take:

STAT 1010 Principles of Statistics (or another approved statistics course)	4

As majors in the College of Liberal Arts and Sciences, public relations students must meet College of Liberal Arts and Sciences and University-wide requirements for graduation in addition to those stated above for the major.

University Requirement: Students in all ISU majors must complete a three-credit course in U.S. Cultures and Communities, as well as a three-credit course in International Perspectives. The approved course lists are found at the following web addresses:(U.S. Diversity) <http://www.registrar.iastate.edu/students/div-ip-guide/usdiversity-courses> (<http://www.registrar.iastate.edu/students/div-ip-guide/usdiversity-courses>) and (International Perspectives) <http://www.registrar.iastate.edu/students/div-ip-guide/IntlPerspectives-current> (<http://www.registrar.iastate.edu/students/div-ip-guide/IntlPerspectives-current>). Students must also demonstrate their communication proficiency by earning a grade of C or better in ENGL 2500.

College of LAS Requirement: Minimum of 120 credits, including a minimum of 45 credits at the 3000-level and above. You must also complete the LAS world language requirement, LAS career proficiency requirement, and any unmet ISU admission requirements.

Greenlee majors and minors cannot take ADVRT, JLMC, PR or SMC courses pass/not pass.

Minor or Additional Major: Students are required to fulfill a secondary area of expertise. This requirement can be met by declaring a minor or an additional major outside of the Greenlee School of Journalism and Communication. Students taking one major at the school may not seek an additional major or minor in the school.

Juniors can apply to a concurrent degree program and earn a B.S. in public relations and an M.S. in journalism and mass communication in fewer semesters. Contact the Director of Graduate Education for more information on the Greenlee School's 4+1 Program.

Public Relations, B.S.

Freshman

Fall	Credits	Spring	Credits
JLMC 1100	1	JLMC 2010	3
PR 2200	3	STAT 1010	4

ENGL 1500	3 U.S. Cultures and Communities	3
LIB 1600	1 Arts & Humanities	3
Arts & Humanities	3 Natural Science	3
Natural Science	3	
14		16

Sophomore

Fall	Credits	Spring	Credits
PR 3010	3	PR 3000-level choice	3
ENGL 2500	3	Arts & Humanities	3
Arts & Humanities	3	Social Science	3
Natural Science	2	Social Science	3
World Language or Elective	3-4	World Language or Elective	4
LAS 2030	1		
15-16		16	

Junior

Fall	Credits	Spring	Credits	Summer	Credits
PR 3210	3	PR 4240	3	PR 4990A	3
PR/JLMC/ADVRT/SMC	3	PR 4000-level Choice	3		
3000-level Choice					
Minor/Additional Major Choice	3	International Perspectives	3		
Minor/Additional Major Choice	3	Minor/Additional Major Choice	3		

Elective	3 Minor/	3	
3000-level	Additional Major Choice 3000-level		
	15	15	3
Senior			
Fall	Credits	Spring	Credits
JLMC 4600		3 JLMC 4620	3
PR/		3 ADVRT/	1
ADVRT/		JLMC/PR/	
JLMC/SMC		SMC Short	
4000-level		Course	
Choice		Intensive	
ADVRT/		1 Elective	3
JLMC/PR/		or Minor/	
SMC Short		Additional	
Course		Major	
Intensive		Choice	
Minor/		3 Elective	3
Additional		or Minor/	
Major		Additional	
Choice		Major	
3000+		Choice	
Elective		3 Elective	3
3000-level		or Minor/	
		Additional	
		Major	
		Choice	
		3000+	
	13	13	

Total Credits: 120-121

Minor in Public Relations

Students cannot select more than one minor in the Greenlee School of Journalism and Communication. Minors in the Greenlee School are not available to Greenlee majors.

For a minor in public relations, students complete 15 credits including at least 6 credits in the courses numbered 3000 or above taken at Iowa State University. The minor must include at least 3 credits that are not used to meet any other department, college or university requirement.

JLMC 1010	Mass Media and Society	3
PR 2200	Principles of Public Relations	3
9 credits from the following:		9

PR 3010	Research and Strategic Planning for Advertising and Public Relations
PR 3050	Publicity Methods
PR 4200	Crisis Communication
PR 4730	Social Media Strategy
PR 4970	Special Topics in Communication
PR 3230X	Strategic Communication in Agriculture and the Environment
JLMC 3070	Fundamentals of Digital Video Production
JLMC 4010	Mass Communication Theory
SMC 2500	Principles of Sports Media and Communication
SMC 4230	Sports and the Media in a 24/7 Digital World
JLMC 4060	Media Management
JLMC 4740	Communication Technology and Social Change
JLMC 4760	World Communication Systems
JLMC 4770	Diversity and the Media
Total Credits	15

The Public Relations Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

Greenlee majors and minors cannot take ADVRT, JLMC, PR or SMC courses pass/not pass.

Concurrent Undergraduate and Graduate Programs

The Greenlee School offers a 4+1 program allowing students to complete their B.A. or B.S. and earn an M.S. in journalism and mass communication in fewer semesters.

The Greenlee School offers three concurrent degree programs:

- B.A. Advertising/M.S. Journalism and Mass Communication
B.S. Journalism/M.S. Journalism and Mass Communication
B.S. Public Relations/M.S. Journalism and Mass Communication

Enrollment in the Greenlee School's concurrent degree programs enables students to complete coursework for the undergraduate and graduate programs on a five-year accelerated timeline – rather than the typical six-year timeline for the two degrees. See Journalism and Mass Communication Concurrent Undergraduate and Graduate Programs for more information on combining the B.S. in Public Relations and the M.S. in Journalism and Mass Communication.

GRADUATE PROGRAMS

Master of Science

The Greenlee School of Journalism and Communication offers work for a Master of Science degree in journalism and mass communication.

Concurrent Programs

The Greenlee School's concurrent degree programs enable interested students the opportunity to complete coursework for the undergraduate and graduate programs on a five-year accelerated timeline – rather than the typical six-year timeline for the two degrees.

Graduate Minor

The Greenlee School graduate program offers minor work for students majoring in other departments.

See Journalism and Mass Communication Graduate Programs for more information on the M.S. in Journalism and Mass Communication.

Religious Studies

The Religious Studies major (27 credits) and minor (15 credits) offer Iowa State University students the opportunity to expand their knowledge about diverse religions in the United States and the world. The major and minor allow students to design their own unique program of study by taking courses that spark their interest. Religious Studies teaches students to explore religion objectively, critically, and empathetically. It equips students to apply academic theories and methods to understand how religions shape and are shaped by history, politics, culture, society, and human psychology. As their religious literacy increases, students will develop their own ideas about the nature of religion, life's big questions, and the wide range of human ideas, practices, and motivations.

The major in Religious Studies provides both breadth and depth. The program's 2000-level courses introduce students to the academic study of religion, providing a foundation that students build on throughout their undergraduate career. In 3000-level courses, students closely investigate particular traditions, topics, or themes. Throughout their undergraduate career, students have opportunities to connect their program of study to their own professional and personal goals.

The Religious Studies program provides students skills relevant to building a career based on their interests and passions. Contrary to popular myths, employers in today's modern workplace value college graduates with liberal arts degrees. In Religious Studies, these include the "hard skills" of writing, reading, and conducting organized research. Students also gain so-called "soft skills." These include communication strategies, learning to adapt to new environments, and the capacity to work with and understand people from diverse backgrounds.

The flexibility of these skills opens up a wide range of career paths. Religious Studies graduates pursue careers in non-profits, community organizations, and people-focused industries. They apply to graduate

and professional schools in areas such as law, education, and ministry. A Religious Studies degree doesn't just help students *get* a job. It helps them advance and grow, both professionally and personally, well into their lives.

Student Learning Outcomes

Upon graduation, students should be able to:

1. Describe religious diversity in the United States and around the world, including diversity within traditions.
2. Identify key beliefs, doctrines, practices, and expressions of multiple religions.
3. Explain how religion has shaped and been shaped by human history, culture, and society, drawing on historical, cultural, and textual analyses.
4. Distinguish between confessional and academic understandings of religion.
5. Assess data produced by and about religious communities in an objective, critical, and empathetic manner.
6. Create and convey original insights using effective reading, research, writing, and conversation skills.

Religious Studies - Undergraduate Study

Students pursuing a major in religious studies must complete a minimum of 27 credits, including the requirements below. Students may also choose to do a senior thesis under the supervision of a religious studies faculty advisor. This option may earn 3-6 credits toward the completion of the major.

Two of the following introductory survey courses of which one must be either 2050 or 2100 6

RELIG 2050	World Religions
or RELIG 2100	Religion in America
RELIG 2150	Religion and Popular Culture
RELIG 2420	History of Christianity: Early to Medieval
RELIG 2430	History of Christianity: Modern
RELIG 2770	Religion and Society

Five of the following 3000+ level courses 15

RELIG 3220	The New Testament
RELIG 3250	Religion, Law, and Justice
RELIG 3280	Native American Religions
RELIG 3320	Catholicism
RELIG 3340	Africana Religions
RELIG 3360	Religion, Sex and Gender
RELIG 3390	Goddess Religions
RELIG 3400	Magic, Witchcraft, and Religion

RELIG 3480	Psychology of Religion	
RELIG 3490	Cognitive Science of Religion	
RELIG 3500	Philosophy of Religion	
RELIG 3520	Religions of India	
RELIG 3580	Islam	
RELIG 3590	The Quran	
RELIG 3670	Christianity in the Roman Empire	
RELIG 3680	Religions of Ancient Greece and Rome	
RELIG 3700	Religion and Politics	
RELIG 3800	Catholic Social Thought	
RELIG 3890	Exhibiting Religion	
Any other RELIG 3000- or 4000-level course		
Minimum of 6 credits of elective Religious Studies courses		6

Total Credits 27

Communication Proficiency

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3

To meet the upper-level ISU Communication requirement, Religious Studies majors choose from one of the following:

ENGL 3020	Business Communication	
or ENGL 309 Proposal and Report Writing		
or ENGL 314 Technical Communication		
or RELIG 322 The New Testament		
or RELIG 325 Religion, Law, and Justice		
or RELIG 328 Native American Religions		
or RELIG 332 Catholicism		
or RELIG 352 Religions of India		
or RELIG 355 The Quran		
or RELIG 385 Exhibiting Religion		

Total Credits 6-9

Students in all ISU majors must complete a three-credit course in U.S. Cultures and Communities and a three-credit course in International Perspectives. Check (<http://www.registrar.iastate.edu/courses/div-ip-guide.html>) for a list of approved courses. Discuss with your advisor how the two courses that you select can be applied to your graduation plan.

According to the university-wide Communication Proficiency Grade Requirement, students must demonstrate their communication proficiency by earning a grade of C or better in ENGL 2500.

LAS majors require a minimum of 120 credits, **including a minimum of 45 credits at the 3000/4000 level**. Students must also complete the LAS

College requirements, including the world language requirement and career proficiency requirement.

Religious Studies, B.A.

Freshman

Fall	Credits Spring	Credits
ENGL 1500	3 Religion Choice 2000+ or 3000+	3
LIB 1600	1 World Language/Elective	4
RELIG 2050 or 2100	3 Humanities Choice	3
World Language/Elective	4 Social Science Choice	3
Humanities Choice	3 Elective	3
Math Choice	3	
17		16

Sophomore

Fall	Credits Spring	Credits
Religion Choice 2000+ or 3000+	3 Religion Choice 3000+	3
ENGL 2500	3 Natural Science Choice ¹	4
Humanities Choice	3 Social Science Choice	3
Natural Science Choice ¹	4 Humanities Choice	3
Social Science Choice	3 Elective	2-3
	LAS 2030	1
16		16-17

Junior

Fall	Credits Spring	Credits
Religion Choice 3000+	3 Religion Choice 3000+	3
Elective	3 Elective	3
Elective	4 Elective	3
Elective	3 Elective	3
Elective	3 Elective	3
16		15

Senior

Fall	Credits Spring	Credits
Religion Choice 3000+	3 Religion Elective	3
Religion Elective	3 Elective	3
Elective	3 Elective	3
Elective	4 Elective	3
13		12

¹ Laboratory science recommended.

The program offers a minor that may be earned by completing a total of 15 credits in religious studies including either RELIG 2050 World

Religions or RELIG 2100 Religion in America. Nine credits of the minor must be numbered 2000 level or above, of which at least 6 credits are in courses numbered 3000 level or above (no more than 3 hours of seminar and no more than 3 hours of independent study). The minor must include at least 3 credits that are not used to meet any other department, college or university requirement, and 3 credits must be earned at Iowa State University.

The Religious Studies Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

Religious Studies - Graduate Study

Religious studies may be one of the three areas used for the interdisciplinary graduate studies master's degree.

Science Communication Certificate

The science communication certificate provides an opportunity for students to develop their public communication skills, to interface with students and faculty across disciplinary and science-public divides, and to give students an edge in the job market where successful communication with a multitude of stakeholders is essential. As a discipline, science communication brings together theory and practice to communicate scientific information to the public, with an emphasis on two-way and strategic communication with the public.

This certificate is designed to encourage students who are interested in the intersection of science and society to pursue coursework that provides them with the skills to practice public-facing science and effectively engage the public around complex and sometimes controversial scientific topics. In addition, the certificate is designed to facilitate convergence across disciplines and encourage team-based collaboration at the undergraduate level.

The certificate is open to students of any major, but may be of particular value to students who are planning to pursue science, environmental, health or agricultural communication as a career or students pursuing a career in a science, engineering, math and other technical fields interested in strengthening their communication skills.

Objectives

- Encourage students to engage with community members, other students and faculty across interdisciplinary boundaries, diverse backgrounds, and divergent interests.

- Prepare students to communicate scientific findings and technological advances in a clear and compelling manner while also encouraging inclusive communication that acknowledges others' values and concerns.

- Cultivate students' understanding of the origins and dynamics of science related controversies and conflicts.
- Challenge students to identify and address scientific misinformation, scientific skepticism, and science denial across social media, blogs, and other social and online networks.
- Prepare students to engage in constructive conversations with diverse audiences over contested science, environmental, health, and agricultural topics.

Student Learning Outcomes

Students who complete the proposed science communication certificate will be able to:

- Create, co-produce, and evaluate public-facing science communication
- Understand and address the ethical, social, cultural, and historical factors that influence both the public communication of science and the rise and spread of science-related controversies
- Promote public and cross-disciplinary understanding of scientific information
- Co-produce knowledge with community stakeholders through public-facing projects
- Create effective and appropriate science messages across diverse and emergent media platforms, addressed to diverse audiences
- Critically analyze science messages addressed to public audiences around science
- Identify and address misinformation across social media, blogs, and other social and online networks
- Engage in constructive conversations about contested science, environmental, health, and agricultural topics

To prepare students for the challenge of communicating effectively at the intersection of science and society, students will take a core of 12-credits from the Greenlee School of Journalism and Communication, the English Department, and the Department of Philosophy and Religious Studies and 9-credits of electives from three tracks: science in practice, science and society, and communication in practice.

The certificate requires 21 credits. Students must complete ENGL 2500 before enrolling in the certificate. To successfully complete the certificate, students must submit and receive approval for a final portfolio consisting of a minimum of three applied, public-facing projects developed during or outside of their course work. A cumulative grade point average of at least 2.0 is required in courses taken for the certificate.

Core Courses (12 credits)

JLMC 2600	Media Controversies in Science and Technology	3
PHIL 2060	Introduction to Logic and Scientific Reasoning	3

ENGL 3120	Communicating Science and Public Engagement	3
JLMC 3470	Science Communication	3

Electives (9 credits)

Students will take one course from each of the three categories of electives: Science in Practice, Science and Society, and Communication in Practice.

- 6 of the 9 credits must be at the 3000+ level.
- Students who engage in an internship or research experience (including those connected to courses) may seek approval from the steering committee to have this experience counted as an elective course. This experience must include a public-facing communication/outreach component, and the steering committee will decide which of the 3 categories of electives this experience would fulfill. Students who wish to count the internship toward the certificate must track their hours as well as complete a final paper about their experiences.

Science in Practice - select 1 course

BIOL 1730	Environmental Biology	3
BIOL 2510	Biological Processes in the Environment	3
BIOL 3550	Plants and People	3
ENSCI 2500	Environmental Geography	3
ENSCI 3180	Introduction to Ecosystems	3
ENSCI 3600	Environmental Soil Science	3
GEOL 1010	Environmental Geology: Earth in Crisis	3
GEOL 1080	Introduction to Oceanography	3
GEOL 1600	Water Resources of the World	3
GEOL 2010	Geology for Engineers and Environmental Scientists	3
GEOL 2020	History of the Earth	3
GEOL 3240	Energy and the Environment	3
MTEOR 4040	Global Change	3
MTEOR 4060	World Climates	3
NREM 1200	Introduction to Renewable Resources	3
NREM 3800	Field Ecology Research and Teaching	3

Science and Society - select 1 course

EDUC 3470	Nature of Science	3
ENGL 3550	Literature and the Environment	3
HIST 3620	Global Environmental History	3
HIST 3670	America Eats	3
HIST 3830	Technology, Public Science, and European Culture, 1715-Present	3
HIST 4820	Birth, Death, Medicine, and Disease	3
JLMC 4010	Mass Communication Theory	3
JLMC 4740	Communication Technology and Social Change	3

JLMC 4760	World Communication Systems	3
PHIL 3310	Moral Problems in Medicine	3
PHIL 3340	Environmental Ethics	3
PHIL 3360	Bioethics and Biotechnology	3
PHIL 3430	Philosophy of Technology	3
PHIL 3800	Philosophy of Science	3
PHIL 3890	Philosophy of Psychology and Psychiatry	3
PHIL 4850	Philosophy of Physics	3
POLS 2830	Introduction to Environmental Politics and Policies	3
POLS 3350	Science, Technology, and Public Policy	3
POLS 4430	Energy Policy	3
SOC 3820	Environmental Sociology	3
SOC 4640	Strategies for Community Engagement	3
WGS 3070	Women in Science and Engineering	3
ENVS 3200	Ecofeminism	3
WGS 3800	History of Women in Science, Technology, and Medicine	3
WLC 4840	Technology, Globalization and Culture	3

Communication in Practice - select 1 course

COMST 3270	Persuasion and Social Influence	3
COMST 4120	Health Communication	3
ENGL 3090	Proposal and Report Writing	3
ENGL 3140	Technical Communication	3
ENGL 3320	Visual Communication of Quantitative Information	3
ENGL 3550	Literature and the Environment	3
ENGL 4110	Technology, Rhetoric, and Professional Communication	3
ENGL 4770	Seminar in Technical Communication	3
ENGL 4870	Internship in Business, Technical, and Professional Communication	1-3
LING 1200	Computers and Language	3
NREM 3300	Principles of Interpretation	3
PR 2200	Principles of Public Relations	3
PR 3050	Publicity Methods	3
SPCM 2120	Fundamentals of Public Speaking	3
SPCM 3100	Rhetorical Analysis	3

Scientific Illustration and Visualization Overview

The interdepartmental undergraduate Scientific Illustration and Visualization major is designed for students who want to combine

their interests and aptitudes in science and art. Based on the theme of *Communicating Science Through Art*, the major prepares students for careers in biological visualization/illustration or for graduate education in medical visualization/illustration. Graduates enter fields such as biocommunications, environmental display design, freelance illustration, UX/UI and museum display design, creative technologies, instructional design, and various careers in the publishing, research and education, and visual communication industries.

Student Learning Outcomes

Throughout its over 40-year existence, the underlying philosophy of the program has been to emphasize both art and science; students take approximately equal credit hours in the two major areas. Another important guiding principle has been visual thinking and problem-solving, and a third is maintaining student proficiency in a wide range of visual communication methods and technologies so they have the skill to choose the most effective tools for a given communication objective. Upon completion of the Scientific Illustration and Visualization major, graduates will:

- Implement effective academic research methods and concept development processes for producing meaningful educational visual solutions.
- Demonstrate advanced science knowledge in a science focus area of choice (for example, pre-medical, or non-medical areas of life and earth science).
- Demonstrate the ability to deconstruct and visualize complex science in order to create accessible, accurate, aesthetic, and meaningful visual representations, including diagrammatic, realistic, and symbolic, for a range of outputs (print, modeled, online, mobile).
- Implement interdisciplinary thinking in team-based and independent projects.
- Flexibly adapt to new technology and communication challenges.
- Showcase and analyze works by articulating key visual elements in formal presentations, in written and oral format, and during assessments and critiques.
- Demonstrate effective use of design principles, problem solving skills, and visual organization.
- Demonstrate career-readiness and professional practice competencies.
- Exhibit an academic trajectory for engaging in life-long learning.

Entrance Requirements

Entrance into the Scientific Illustration and Visualization major is by application to the Scientific Illustration and Visualization Advisory Committee. Eligibility is based on an academic standard of at least 2.00 cumulative GPA on 30 credits of university level work and a consideration of artistic ability as demonstrated through submission of a portfolio

of representative drawings or another artwork. Freshman and transfer students usually declare pre-Scientific Illustration and Visualization as their major while satisfying the conditions for entrance into the major, although other majors can be declared.

Degree Requirements

The information below outlines the specific requirements for the Scientific Illustration and Visualization, B.A. degree. There are four components to the program requirements:

- Liberal arts general education
- Science core and advanced courses
- Art core and advanced courses
- Electives

Part 1. College Requirements

a. Communication Proficiency Requirements

ENGL 1500	Critical Thinking and Communication (grade of C or better)	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition (grade of C or better)	3
LIB 1600	Introduction to College Level Research	1
Any ENGL course in the range ENGL 3020 to ENGL 3160		3
Two semesters of college-level world language		0-8
Students with 3 years in high school world language are exempt		
Total Credits		10-18

B. Liberal Arts and Sciences Requirements*

Arts and Humanities **		12
Natural Sciences and Mathematical Disciplines		
MATH 1040	Introduction to Probability	3-4
or MATH 1400 College Algebra		
or MATH 1430 Preparation for Calculus		
or MATH 1650 Calculus I		
or STAT 1010 Principles of Statistics		
or STAT 1040 Introduction to Statistics		
or COMS 1070 Windows Application Programming		
or more advanced		
CHEM 1630 & 1630L	College Chemistry and Laboratory in College Chemistry	5
or CHEM 1770 General Chemistry I & 1770L and Laboratory in General Chemistry I		
CHEM 2310 & 2310L	Elementary Organic Chemistry and Laboratory in Elementary Organic Chemistry	4

Social Sciences ***	9
Total Credits	33-34

* Choose courses to meet International Perspectives & U.S. Cultures and Communities requirements

** See <https://las.iastate.edu/students/academics/general-education/>
Consider HIST 2800, HIST 2810; ARTH 2800, ARTH 2810; DSNS 1830

*** See <https://las.iastate.edu/students/academics/general-education/>

Part 2. Course Requirements for Major in Scientific Illustration and Visualization

A. Biological Sciences Core

LAS 2930D or LAS 1010	Special Projects: General (F.) Orientation	1
BIOL 2110 & 2110L	Principles of Biology I and Principles of Biology Laboratory I (F.S.)	4
BIOL 2120 & 2120L	Principles of Biology II and Principles of Biology Laboratory II (F.S.)	4
BIOL 2550 & 2550L	Fundamentals of Human Anatomy and Fundamentals of Human Anatomy Laboratory	4-5
or BIOL 2560 & BIOL 2550L	Fundamentals of Human Physiology and Fundamentals of Human Anatomy Laboratory	
or BIOL 3130 & 3130L	Principles of Genetics and Genetics Laboratory	
or BIOL 3350 & 3350L	Principles of Human and Other Animal Physiology and Principles of Human and Other Animal Physiology Laboratory	
or BIOL 3500	Comprehensive Human Anatomy	
or BIOL 3510 & 3510L	Comparative Vertebrate Anatomy and Comparative Vertebrate Anatomy Laboratory	
or BIOL 3650	Vertebrate Biology	
Note: BIOL 3500 and BIOL 3650 courses include labwork.		
BIOL 3560 or BIOL 3660 or BIOL 4510 or BIOL 4540	Dendrology Plant Systematics Plant Evolution and Phylogeny Plant Anatomy	3-4
GEOL 2020 & 2020L or BIOL 3120 or BIOL 3150	History of the Earth and History of the Earth: Laboratory Ecology Biological Evolution	3
Total Credits		19-21

B. Art Core

DSNS 1310	Drawing I (F.S.)	4
ART 2300	Drawing II (F.S.)	3
ART 2330	Watercolor Painting (F.S.)	3
ART 3080	Computer Modeling, Rendering and Virtual Photography	3
ART 3300	Drawing III: Life Drawing	3
SCIVZ 3230	Scientific Illustration Principles and Techniques	3
SCIVZ 3260	Digital Rendering	3
SCIVZ 3270	Illustration as Communication	3
SCIVZ 3370	Application of Scientific Illustration Techniques	3
SCIVZ 4970	Illustration Internship	1
Total Credits		29

Beyond the core preparation, students must take 9 credits in the advanced science area and 12 credits in the advanced art area. The courses acceptable in these areas follow. Other courses in art and biological science may be acceptable. See academic advisors and/or the Scientific Illustration and Visualization Advisory Committee.

C. Advanced Art Area

Select 12 total credits from below. At least 6 credits must be studio classes. Some courses can be considered either pre-med illustration or general art; speak with your advisor for guidance.

Pre-Med Illustration Area		
ARCH 3350	Three-Dimensional Studio	3
ART 3300	Drawing III: Life Drawing	3
ART 4080	Principles of 3D Animation	3
ART 4300	Drawing IV	3
ART 4310	Character and Scene Design	3
ART 4320	Sequential Narrative Drawing	3
ART 4750	Interactive Art	3
ART 4820	Selected Topics in Studio Art	1-3
SCIVZ 3230	Scientific Illustration Principles and Techniques	3
SCIVZ 3260	Digital Rendering	3
SCIVZ 3370	Application of Scientific Illustration Techniques	3
SCIVZ 4900	Independent Study	1-3
SCIVZ 4910	Portfolio Design and Professional Development	2
SCIVZ 4940	Special Topics in Illustration	1-3
General Art Area		
ART 2130	Studio Fundamentals: Painting	2
ART 2270	Introduction to Creative Digital Photography	3
ART 2380	Painting I	3
ART 3290	Creative Photography	3

ART 3380	Painting II	3
ART 3560	Relief Printmaking: Digital/Traditional	3
ART 3570	Intaglio and Monotype Printmaking: Digital / Traditional	3-4
ART 3580	Lithography: Digital / Traditional	3
ART 4070	Principles of Character Animation	3
ART 4090	Computer/Video Game Design and Development	3
ART 4380	Painting III	3
ART 4730	Video Art	3
SCIVZ 3950	Field Illustration	1-3
SCIVZ 4060	Introduction to 3D Organic Modeling in ZBrush	3
SCIVZ 4700	Data, Code, and Form	3
JLMC 3060	Broadcast Media Production (F.S.)	3
JLMC 3150	Digital Storytelling (F.S.)	3
STAT 3320	Visual Communication of Quantitative Information	3

D. Advanced Science Area

Select 9 credits total from below.

Medical Illustration Graduate School Preparation Science Area - required/recommended courses by most graduate schools

BBMB 3160	Principles of Biochemistry (F.)	3
BIOL 3130	Principles of Genetics (F.S.SS.)	3
BIOL 3140	Principles of Molecular Cell Biology (F.S.)	3
BIOL 3350	Principles of Human and Other Animal Physiology (S.)	3
BIOL 3520	Vertebrate Histology (S.)	4
BIOL 4230	Developmental Biology (S.)	3
BMS 3290	Anatomy and Physiology of Domestic Animals	3
BMS 4480	Principles of Human Gross Anatomy	4
GEN 3400	Human Genetics (F.S.SS.)	3

General Science Area

AECL 3210	Ichthyology (S.)	3
AECL 3660	Natural History of Iowa Vertebrates (S.)	3
AECL 4570	Herpetology (F.)	2
AECL 4580	Ornithology (S.)	2
AECL 4590	Mammalogy (S.)	2
ANTHR 3070	Biological Anthropology (S.)	3
ANTHR 3190	Skeletal Biology (F.)	3
ANTHR 4240	Forensic Anthropology (S.)	3
BBMB 3010	Survey of Biochemistry (S.SS.)	3
BIOL 3120	Ecology (F.SS.)	4
BIOL 2550 & 2550L	Fundamentals of Human Anatomy and Fundamentals of Human Anatomy Laboratory	4

BIOL 2560 & 2560L	Fundamentals of Human Physiology and Fundamentals of Human Physiology Laboratory	4
BIOL 3130L	Genetics Laboratory (F.S.)	1
BIOL 3150	Biological Evolution (F.S.)	3
BIOL 3280	Molecular and Cellular Biology of Human Diseases (F.)	3
BIOL 3360	Ecological and Evolutionary Animal Physiology	3
BIOL 3500	Comprehensive Human Anatomy (F.)	4
BIOL 3510	Comparative Vertebrate Anatomy	3
BIOL 3510L	Comparative Vertebrate Anatomy Laboratory	2
BIOL 3530	Introductory Parasitology (S.)	3
BIOL 3540	Animal Behavior (F.)	3
BIOL 3550	Plants and People (S.)	3
BIOL 3560	Dendrology (F.)	3
BIOL 3640	Invertebrate Biology (F)	3-4
BIOL 3650	Vertebrate Biology (F.)	4
BIOL 3660	Plant Systematics (S.)	4
BIOL 3930A	North American Field Trips in Biology: Pre-trip Seminar	1
or BIOL 3930B	North American Field Trips in Biology: North American Field trip	
BIOL 3940A	International Field Trips in Biology: Pre-trip Seminar	1
or BIOL 3940B	International Field Trips in Biology: Field Trip to International Location	
BIOL 4020	Introduction to Pathology	3
BIOL 4300	Principles of Plant Physiology	3
BIOL 4360	Neurobiology (F.)	3
BIOL 4510	Plant Evolution and Phylogeny	4
BIOL 4540	Plant Anatomy (F.)	4
BIOL 4550	Bryophyte and Lichen Biodiversity	3
BIOL 4560	Principles of Mycology (F.)	3
BIOL 4740	Plant Ecology (S.)	3
BIOL 4880	Identification of Aquatic Organisms (F.S.)	1
DS 2010	Introduction to Data Science	3
DS 2020	Data Acquisition and Exploratory Data Analysis	3
ENT 3700	Insect Biology (F.)	3
ENT 3740	Insects and Our Health (S.)	3
GEOL 2020	History of the Earth	3
GEOL 1030	Age of Dinosaurs	1
GEOL 1080	Introduction to Oceanography	3
GEOL 1110	Geological Disasters	1

GEOL 1400	Climate and Society	3
GEOL 1600	Water Resources of the World	3
GEOL 3240	Energy and the Environment	3
GEOL 4120	Micropaleontology	3
GEOL 4150	Paleoclimatology	3
MICRO 3020	Biology of Microorganisms (F.S.SS.)	3
MICRO 3020L	Microbiology Laboratory (F.S.)	1
MICRO 3100	Medical Microbiology (F.)	3
MTEOR 2060	Introduction to Weather and Climate	3
MTEOR 3600	Ocean-Atmosphere Interactions	3
MTEOR 4040	Global Change	3
NREM 3010	Natural Resource Ecology and Soils (F.)	4
NREM 3300	Principles of Interpretation (S.)	3
PSYCH 3100	Brain and Behavior (F.S.)	3
SCIVZ 3950	Field Illustration	1-3
VPTH 4010	Basics of Medical Terminology	1

As majors in the College of Liberal Arts and Sciences, Scientific Illustration and Visualization students must meet College of Liberal Arts and Sciences and University-wide requirements for graduation in addition to those stated above for the major.

LAS majors require a minimum of 120 credits, including a minimum of 45 credits at the 3000/4000 level. You must also complete the LAS world language requirement and career proficiency requirement.

Students in all ISU majors must complete a three-credit course in U.S. Cultures and Communities and a three-credit course in International Perspectives. Check (<http://www.registrar.iastate.edu/courses/div-ip-guide.html>) for a list of approved courses. Discuss with your advisor how the two courses that you select can be applied to your graduation plan.

Scientific Illustration and Visualization, B.A. 120 minimum credits required.

Freshman

Fall	Credits	Spring	Credits	Summer	Credits
LAS 1010	1	LIB 1600	1	Prepare application for major entry / apply during second year	

ENGL 1500	3 Humanities	3 Consider taking a science course over the summer
CHEM 1630	4 BIOL 2120	3
CHEM 1630L	1 BIOL 2120L	1
BIOL 2110	3 ART 2300	3
BIOL 2110L	1 Soc Sci Choice	3
DSNS 1310	4 CHEM 2310 & 2310L or STAT or MATH	3-4
17		17-18
		0

Sophomore

Fall	Credits	Spring	Credits	Summer	Credits
Foreign Lang. or Humanities (ART 2800)		3-4 For Lang or Social Sci		3-4 Consider study abroad, or attending summer AMI / GNSI Conferences and enrolling in Art/ Science/ Techniques Workshops or Iowa Lakeside Lab to take advanced biology courses	
CHEM 2310 & 2310L or STAT or MATH		3-4 SCIVZ 3260		3 Consider conducting SCIVZ 4970 Internship over the summer	
SCIVZ 3230		3 ART 3300		3	

ENGL 2500	3 Humanities	3
Science	3-4 Science	3-4
Core	Core	
Course	Course	
LAS 2030	1	

16-19	15-17	0

Junior

Fall	Credits	Spring	Credits	Summer	Credits

SCIVZ 3270	3	SCIVZ 3370	3	Work with Advisory Committee to fine tune/plan senior portfolio	

Advanced Science or Science Core Course	3-4 Science Core Course or Advanced Science	3-4	If planning to attend graduate school, take GRE over the summer, or at the latest in the fall, and prepare up to 20 portfolio pieces for submission over the summer and fine tune in the fall

ART 3080	3 Soc Sci	3
Humanities or Social Sci	3 ART 2330	3
Advanced Science or Art	3 Humanities and Advanced Art	3

Consider taking SCIVZ 4910, Portfolio Design and Professional Development, to begin preparing for post-graduation steps

15-16	15-16	0

Senior

Fall	Credits	Spring	Credits

Advanced Science	3-5	Advanced Science	3-4
Advanced Art	3-6	Advanced Art	3-6
Humanities/Social Elective	3	Humanities/Social Sci/Elective	3-6
BPMI 4970	1	Advanced English or Elective (ENGL 3020 through ENGL 3160 count as Advanced English)	3
Advanced English or Elective	2-3		

12-18	12-19

Minor

A minor in Scientific Illustration and Visualization is offered. A minimum of 17 credits must be taken, including 8 credits in biological science courses and 9 credits in art and design courses. The minor must include at least 3 credits that are not used to meet any other department, college, or university requirement.

The biological sciences must include:

BIOL 2110	Principles of Biology I	3
BIOL 2110L	Principles of Biology Laboratory I	1
BIOL 2120	Principles of Biology II	3
BIOL 2120L	Principles of Biology Laboratory II	1

The art and design courses must include:

SCIVZ 3230	Scientific Illustration Principles and Techniques	3
SCIVZ 3370	Application of Scientific Illustration Techniques	3
Advanced drawing, illustration, electronic media or painting course		3

For more information, contact the Scientific Illustration and Visualization advisor or view the website listed above.

The Scientific Illustration and Visualization Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

Sociology

Undergraduate Study in Sociology

The Department of Sociology and Criminal Justice offers course work leading to either a Bachelor of Arts, Bachelor of Science, or a minor in sociology.

Student Learning Outcomes

Graduates of all these programs will understand and demonstrate:

1. General knowledge of sociology
2. Research methods in sociology
3. Critical thinking skills
4. Application of sociology to pressing social issues
5. Sociological and professional values
6. Information technology skills
7. Communication skills
8. Personal and career development

Graduates understand how social institutions, communities, and organizations work and change; they can examine the causes and consequences of conformity, deviance, and inequality. They can apply sociological understanding of human behavior to practical work situations and everyday life. Graduates can read critically, think independently, and communicate effectively about social issues and social policy.

Degree Requirements

As majors in the College of Liberal Arts and Sciences, Sociology students must meet College of Liberal Arts and Sciences and University-wide

requirements for graduation in addition to those stated below for the major.

University Requirements:

International Perspectives	3
U.S. Cultures and Communities	3

See <http://www.registrar.iastate.edu/courses/div-ip-guide.html> for a list of approved courses.

Total Credits	6

Communications:

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3

One of the following	3

ENGL 3020	Business Communication
ENGL 3090	Proposal and Report Writing
ENGL 3140	Technical Communication

LIB 1600	Introduction to College Level Research	1

Total Credits	10

World Languages and Culture:

3 years H.S.

2 semesters college	8

Total Credits	8

Departmental Requirements for Sociology Majors

A program of study that meets the needs and interests of the student and department requirements will be developed in consultation with the major advisor. Students must maintain a GPA of 2.0 or higher in their core courses. Programs of study will include:

SOC 1150	Orientation to Sociology	1
SOC 1340	Introduction to Sociology	3
SOC 3020	Research Methods for the Social Sciences	3
SOC 4010	Contemporary Sociological Theories	3

6 credits of 2000+ Sociology courses	6

18 credits of 3000+ Sociology courses	18

Total Credits	34

Bachelor of Arts or Bachelor of Science Degree

In addition to the program of study above, students must select complementary courses that will lead to a bachelor of arts or bachelor of science degree. Programs leading to a bachelor of arts degree will emphasize additional coursework in groups I and III of the general education requirements. Programs leading to a bachelor of science degree will emphasize additional coursework in groups IIA and IIB of the general education requirements. Some of the possible areas

of coursework include criminal justice, community (urban and rural) sociology, family sociology, sociology of work, research methods and statistics, social change and development, social inequality, social psychology and sociological theory.

Bachelor of Arts complementary coursework:

STAT 1010	Principles of Statistics	4
or STAT 1040 Introduction to Statistics		
At least 9 additional arts and humanities and/or social science courses		9
LAS approved arts and humanities and/or social sciences courses. General education courses cannot be cross-listed or dual-listed with Sociology courses that count toward the major.		
Total Credits		13

Bachelor of Science complementary coursework:

STAT 1010	Principles of Statistics	4
or STAT 1040 Introduction to Statistics		
At least 9 additional credits in natural science, math, or statistics		9
LAS approved mathematics and/or natural science courses. In addition, these courses may be used: STAT 3010, STAT 4010D, STAT 4040, STAT 4070, STAT 4150, STAT 4210, STAT 4790; PSYCH 4400; HDFS 4490; ECON 3080, ECON 3760; CRP 4510 and WGS 4020. General education courses cannot be cross-listed or dual-listed with Sociology courses that count toward the major.		
Total Credits		13

LAS majors require a minimum of 120 credits to graduate, **including a minimum of 45 credits at the 3000/4000 level**. You must also complete the LAS world language requirement and career proficiency requirement.

Students in all ISU majors must complete a three-credit course in U.S. Cultures and Communities and a three-credit course in International Perspectives. Check (<http://www.registrar.iastate.edu/courses/div-ip-guide.html>) for a list of approved courses. Discuss with your advisor how the two courses that you select can be applied to your graduation plan.

Majors must complete both ENGL 1500 Critical Thinking and Communication and ENGL 2500 Written, Oral, Visual, and Electronic Composition. According to the university-wide Communication Proficiency Grade Requirement, students must demonstrate their communication proficiency by earning a grade of C or better in ENGL 2500. In addition, majors must also take an advanced course in ENGL 3020 Business Communication or ENGL 3090 Proposal and Report Writing or ENGL 3140 Technical Communication with a grade of C or better.

Sociology, Bachelor of Arts (B.A.) and Bachelor of Science (B.S.)

Freshman

Fall	Credits Spring	Credits
SOC 1150	1 Sociology 2000+	3
SOC 1340	3 ENGL 2500	3
ENGL 1500	3 Social Science Choice	3
LIB 1600	1 Arts and Humanities Choice	3
Arts and Humanities Choice	3 Arts and Humanities Choice	3
STAT 1010 or 1040	3-4	
14-15		15

Sophomore

Fall	Credits Spring	Credits
Sociology 2000+	3 Sociology 3000+	3
Sociology 3000+	3 Sociology 3000+	3
World Language/ International Perspectives	3-4 World Language/ International Perspectives	3-4
Arts and Humanities Choice	3 Natural Science Choice	3
Natural Science Choice	3 Elective	3
	LAS 2030	1
15-16		16-17

Junior

Fall	Credits Spring	Credits
Sociology 3000+	3 SOC 3020	3
U.S. Cultures and Communities	3 Sociology 3000+	3
Natural Science Choice	2 Complementary Course (approved Arts and Humanities or Social Science course if seeking a BA; approved Math or Natural Science course if seeking a BS)	3
Social Science Choice	3 Electives 3000+	6
Electives 3000+	6	
17		15

Senior

Fall	Credits Spring	Credits
SOC 4010	3 Sociology 3000+	3

ENGL 3020, 3090, or 3140	3 Complementary Course (approved Arts and Humanities or Social Science course if seeking a BA; approved Math or Natural Science course if seeking a BS)	3
Complementary Course (approved Arts and Humanities or Social Science course if seeking a BA; approved Math or Natural Science course if seeking a BS)	3 Electives 3000+	6-9
Electives 3000+	6	
		12-15
		15

Sociology Minor

The Department of Sociology and Criminal Justice offers a minor in sociology which may be earned by completing 15 credits in sociology with a minimum 2.0 GPA. At least 9 of the 15 credits must be at the 2000 level or higher, of which at least 6 credits are in courses numbered 3000 level or above. A minimum of 3 credits must be taken at ISU. The minor must include at least 3 credits that are not used to meet any other department, college or university requirement.

Students are required to earn credit for the following courses:

SOC 1340	Introduction to Sociology	3
Additional 12 credits in Sociology courses		12
9 credits must be 2000+, of which at least 6 must be 3000+		
Total Credits		15

The Sociology Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

Graduate Study

The Department offers study toward the **Master of Science** and **Doctor of Philosophy** degrees, with majors available in **Sociology** and **Rural Sociology**, as well as a graduate minor in **Sociology** for students majoring in other departments. The Department offers concentrations in a number of areas, e.g., community studies and development; sociology of families, inequality, food systems, agriculture and environment; criminal justice/ criminology; methodology; social change and development; and social psychology. The Department of Sociology and Criminal Justice does not offer a non-thesis option master's degree program.

The Department accepts applicants for the Ph.D. program from students who hold a master's degree, as well as from students who wish to enter the program directly with a bachelor's degree.

Contact information: Kyle Burgason, 202 East Hall, 515-294-9898 or burgason@iastate.edu.

Graduates have a broad understanding of sociology, address complex societal problems, and communicate effectively with scientific colleagues and the general public in both formal and informal settings. They understand sociological theory, conduct research, and are prepared to educate college students and contribute to public policy. Although the Department stipulates no language requirement for either the degree Master of Science or the degree Doctor of Philosophy, specifying competence in one or more languages may be desirable in some instances.

The Department also participates in the interdepartmental graduate major in **Sustainable Agriculture**, and the interdepartmental graduate minor in **Gerontology**.

Course requirements are listed below. Information about examinations, theses and dissertations, POS committees and other requirements are available on the Department of Sociology website.

Ph.D. Core Degree Requirements

Although responsibility for determining the student's course work resides with the Plan of Study (POS) committee, the Department of Sociology outlines core courses that must be taken by all students. A graduate course taken elsewhere can be substituted for the Ph.D. core requirements with approval by the Director of Graduate Education (DOGE) in consultation with the student's POS committee.

A minimum of 72 semester credits (including master's degree credits) is required for graduation.

Required Courses for the Ph.D. Degree

STAT 5820	Regression for Social and Behavioral Research	3
SOC 5060	Classical Sociological Theory	3
SOC 5110	Research Methodology for the Social Sciences	3
SOC 5120	Applied Multivariate Statistics for Social and Behavioral Research	3
SOC 5130	Qualitative Research Methods	3
SOC 5340	Race, Class and Gender Inequality	3
SOC 5910	Orientation to Sociology	1
SOC 6070	Contemporary Sociological Theory	3
SOC 6990A	Dissertation Research: General Sociology	1-8
	or SOC 6990B Dissertation Research: Rural Sociology	
14 three-credit elective courses as specified on the POS		42

No more than 12 credits of 5900 (special topics) may be applied toward the Ph.D. degree requirements.

Total Credits 65-72

Ph.D. Minor / Co-Major Requirements

Required Courses for the Ph.D. Minor

SOC 5060	Classical Sociological Theory	3
or SOC 6070	Contemporary Sociological Theory	

SOC 5110	Research Methodology for the Social Sciences	3

One of the following two courses:

SOC 5120	Applied Multivariate Statistics for Social and Behavioral Research	3
or SOC 5130	Qualitative Research Methods	

Two 3-credit graduate-level courses in Sociology.	6

Total Credits 15

Required Courses for the Ph.D. Co-Major

STAT 5820	Regression for Social and Behavioral Research	3

SOC 5060	Classical Sociological Theory	3

SOC 5110	Research Methodology for the Social Sciences	3

One Course in Advanced Methodology:

SOC 5120	Applied Multivariate Statistics for Social and Behavioral Research	

SOC 5130	Qualitative Research Methods	

SOC 5340	Race, Class and Gender Inequality	3

SOC 5910	Orientation to Sociology	1

SOC 6070	Contemporary Sociological Theory	3

3 additional three-credit graduate-level courses in Sociology	9

A minimum of 28 total credits is required for the Ph.D. co-major

Co-Major Requirements for the Graduate Program in Sustainable Agriculture

The Graduate Program in Sustainable Agriculture (GPSA) develops student competence and expertise in the design, implementation, and evaluation of sustainable agricultural systems. The program's curriculum satisfies the formal requirements for the MS and Ph.D. degrees, as established by the ISU Graduate College, and fosters transdisciplinary and systems-level thinking.

The Department does not offer double majors in sociology.

For admission to the co-major program contact the graduate program coordinator.

M.S. Core Degree Requirements

Although responsibility for determining the student's course work resides with the POS committee, the Department of Sociology and Criminal Justice outlines core courses that must be taken by all students.

A graduate course taken elsewhere can be substituted for the core requirements with approval by the Director of Graduate Education (DOGE) in consultation with the student's POS Committee.

Required Courses for the M.S. Degree

STAT 5101	Statistical Methods for Data Analysis	4

SOC 5060	Classical Sociological Theory	3
or SOC 6070	Contemporary Sociological Theory	

SOC 5110	Research Methodology for the Social Sciences	3

SOC 5130	Qualitative Research Methods	3
or STAT 5820	Regression for Social and Behavioral Research	

SOC 5910	Orientation to Sociology	1

SOC 6990A	Dissertation Research: General Sociology	1-8
or SOC 6990B	Dissertation Research: Rural Sociology	

4 three-credit elective courses as specified on the POS	12

No more than 6 credits of 5900 (special topics) may be applied toward the M.S. degree requirements.

Total Credits 27-34

M.S. Minor / Co-Major Requirements

Required Courses for the M.S. Minor

SOC 5060	Classical Sociological Theory	3

or SOC 6070	Contemporary Sociological Theory	

SOC 5110	Research Methodology for the Social Sciences	3

Two 3-credit graduate-level courses in Sociology.	6

Total Credits 12

Required Courses for the M.S. Co-Major

STAT 5101	Statistical Methods for Data Analysis	4

SOC 5060	Classical Sociological Theory	3
or SOC 6070	Contemporary Sociological Theory	

SOC 5110	Research Methodology for the Social Sciences	3

One Course in Advanced Methodology:

STAT 5820	Regression for Social and Behavioral Research	3
or SOC 5130	Qualitative Research Methods	

SOC 5910	Orientation to Sociology	1

2 additional three-credit graduate-level courses in sociology	6

A minimum of 20 total credits is required for the M.S. co-major

The department does not offer double majors in sociology at the graduate level. Admission requirements to the co-major program are the same as for the major.

Co-Major Requirements for the Graduate Program in Sustainable Agriculture

The Graduate Program in Sustainable Agriculture (GPSA) develops student competence and expertise in the design, implementation, and evaluation of sustainable agricultural systems. The program's curriculum satisfies the formal requirements for the M.S. and Ph.D. degrees, as established by the ISU Graduate College, and fosters transdisciplinary and systems-level thinking.

Software Engineering

Administered by the College of Engineering and the College of Liberal Arts and Sciences.

For the undergraduate curriculum in Software Engineering (<http://www.se.iastate.edu>) leading to the degree Bachelor of Science. The Software Engineering Program is accredited by the Engineering Accreditation Commission of ABET, <https://www.abet.org> (<https://www.abet.org/>), under the commission's General Criteria and Program Criteria for Software and Similarly Named Engineering Programs.

A software engineer uses their expertise to design, develop, and evaluate software, configure and install computer systems, and build and maintain software systems throughout their lifecycle. Specific tasks software engineers perform evolve quickly, reflecting changes in technology, as well as the needs of employers. Software engineers work as members of teams that may include experts in engineering, marketing, manufacturing, accounting, training, and design.

The Software Engineering Program provides undergraduate students with the opportunity to learn Software Engineering fundamentals, to study applications of state-of-the-art software technologies, and to prepare for the practice of Software Engineering. The student-faculty interaction necessary to realize this opportunity occurs within an environment motivated by the principle that excellence in undergraduate education is enhanced by an integrated commitment to successful, long-term research, and outreach programs.

Student learning outcomes

Graduates of the Software Engineering curriculum should have, at the time of graduation:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.

3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

PROGRAM EDUCATIONAL Objectives

Within five years of graduation, the graduates should:

1. Attain a **productive career** in Software Engineering or related fields.
2. Attain **leadership** roles and become **effective collaborators and innovators** to advance professional and organizational goals.
3. Engage in **lifelong learning** and professional development.
4. Encourage and support **diversity** and **inclusiveness** in their workplace.

We expect that these objectives will be manifested in our graduates through the following five key attributes: (a) *peer-recognized expertise*, (b) *engagement in professional practice*, (c) *sustained learning*, (d) *leadership* and (e) *teamwork*.

Demonstration of expertise involves applying state-of-the-art practices for solving problems in the design, development, validation, evolution and sustainment of (software) products. Demonstration of professional engagement involves contributing locally and globally to the use of ethical, competent, and creative practices in industry, academia or the public sector. Demonstration of sustained learning involves the ability to adapt to rapid technological, environmental, and organizational changes through self-study and group study and through opportunities of professional development or graduate study. Demonstration of leadership involves the ability to take initiative, and to facilitate the advancements of individuals and the community by influencing others and by having a widespread, positive impact on critical issues and projects. Finally, demonstration of teamwork involves the ability to work with collaborators who have varied expertise, and with diverse cultural and interdisciplinary backgrounds.

As a complement to the instructional activity, the College of Engineering and the College of Liberal Arts and Sciences provide opportunities for

each student to have experience with broadening activities. Students have the opportunity to gain practical industry experience in the cooperative education and internship program. Students have the opportunity to participate in advanced research activities. Through international exchange programs, students learn about engineering practices in other parts of the world.

Curriculum in Software Engineering

Degree requirements leading to the degree Bachelor of Science in Software Engineering.

Total credits required: 125 cr.

Any transfer credit courses applied to the degree program require a grade of C or better (but will not be calculated into the ISU cumulative GPA, Engineering Basic Program GPA, or Software Engineering Core GPA). See also Engineering Basic Program and Special Programs. Note: Pass/Not Pass credits cannot be used to meet graduation requirements.

International Perspectives: 3 cr.¹

U.S. Cultures and Communities: 3 cr.¹

Communication Proficiency/Library requirement:

ENGL 1500	Critical Thinking and Communication (C or better in this course)	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition (C or better in this course)	3
LIB 1600	Introduction to College Level Research	1
Choose one of the following:		3
ENGL 3090	Proposal and Report Writing (C or better in this course)	
ENGL 3140	Technical Communication (C or better in this course)	
Total Credits		10

General Education Requirements: 21 cr.

²

Choose 1 course from the following:		3
ECON 1010	Principles of Microeconomics	
ECON 1020	Principles of Macroeconomics	
ECON 1030X	Introduction to Economics: Real World Applications	
IE 3050	Engineering Economic Analysis	
Approved Arts and Humanities or Social Sciences courses		9
ENGL 2500	Written, Oral, Visual, and Electronic Composition (C or better in this course)	3
Choose one of the following ENGL courses (C or better in this course)		3
ENGL 3090	Proposal and Report Writing	
ENGL 3140	Technical Communication	

SPCM 2120	Fundamentals of Public Speaking	3
Total Credits		21

Engineering Basic Program: 24 cr.

A minimum GPA of 2.00 is required for this set of courses (please note that transfer course grades will not be calculated into the Engineering Basic Program GPA). See Requirement for Entry into Professional Program in College of Engineering Overview section.

CHEM 1670	General Chemistry for Engineering Students	4
or CHEM 1770 General Chemistry I		
ENGL 1500	Critical Thinking and Communication (C or better in this course)	3
SE 1010	Software Engineering Orientation	R
SE 1850	Problem Solving in Software Engineering ³	3
LIB 1600	Introduction to College Level Research	1
MATH 1650	Calculus I	4
MATH 1660	Calculus II	4
PHYS 2310	Introduction to Classical Physics I	4
PHYS 2310L	Introduction to Classical Physics I Laboratory	1
Total Credits		24

Math and Physical Science: 17 cr.

COMS 2270	Object-oriented Programming (C- or better in this course)	4
COMS 2280	Introduction to Data Structures (C- or better in this course)	3
MATH 2670	Elementary Differential Equations and Laplace Transforms	4
Math Elective: Choose one of the following:		3
MATH 2070	Matrices and Linear Algebra	
MATH 2650	Calculus III	
MATH 3040	Combinatorics	
MATH 3140	Graph Theory	
MATH 3170	Theory of Linear Algebra	
STAT 3300	Probability and Statistics for Computer Science	3
Total Credits		17

Software Engineering Core: 37 cr.

A minimum GPA of 2.00 is required for this set of courses, including any transfer courses (please note that transfer course grades will not be calculated into the Software Engineering Core GPA):

CPRE 2810	Digital Logic	4
Choose one of the following:		3
COMS 3270	Advanced Programming Techniques	

CPRE 2880	Embedded Systems I: Introduction	
Choose one of the following:		3
COMS 3210	Introduction to Computer Architecture and Machine-Level Programming	
CPRE 3810	Computer Organization and Assembly Level Programming	
Choose one of the following:		3
COMS 3520	Introduction to Operating Systems	
CPRE 3080	Operating Systems: Principles and Practice	
Choose one of the following:		3
COMS 2300	Discrete Computational Structures	
CPRE 3100	Theoretical Foundations of Computer Engineering	
COMS 3110	Introduction to the Design and Analysis of Algorithms	3
COMS 3630	Introduction to Database Management Systems	3
SE 3090	Software Development Practices	3
SE 3170	Introduction to Software Testing	3
SE 3190	Construction of User Interfaces	3
SE 3390	Software Architecture and Design	3
SE 4210	Software Analysis and Verification for Safety and Security	3

Note: CPRE 2880, CPRE 3810, and CPRE 3080 are 4-credit courses. The Software Engineering Core credit requirement (37 credits) is given in terms of 3-credit courses. If the 4-credit courses are taken instead, then the extra credits will be used as credits for Supplemental Electives.

Total Credits **37**

Other Remaining Courses: 26 cr.

SE 1660	Careers in Software Engineering	R
SE 4910	Senior Design Project I and Professionalism	3
SE 4920	Senior Design Project II	2
Software Engineering Electives ²		9
Supplemental Electives ²		9
Open Elective ²		3
Total Credits		26

Optional Co-op/Internships

Co-op (ENGR 3980) or internship (ENGR 3960 or ENGR 3970) is optional

Transfer Credit Requirements

The degree program must include a minimum of 30 credits at the 3000-level or above in professional and technical courses earned at ISU in order to receive a Bachelor of Science in Software Engineering. These 30

credits must include SE 4910 Senior Design Project I and Professionalism and SE 4920 Senior Design Project II. The Software Engineering degree program requires a grade of C or better for any transfer credit course that is applied to the degree program.

1. These university requirements will add to the minimum credits of the program unless the university-approved courses are also approved by the department to meet other course requirements within the degree program. U.S. Cultures and Communities and International Perspectives courses may not be taken Pass/Not Pass.
2. Choose from approved lists (<http://www.se.iastate.edu/academics/>).
3. See Basic Program for Professional Engineering Curricula for accepted substitutions for curriculum designated courses in the Engineering Basic Program.

See also: A 4-year plan of study grid showing course template by semester.

Note: International Perspectives and U.S. Cultures and Communities courses are used to meet the General Education Electives (<http://www.se.iastate.edu/academics/>).

Software Engineering, B.S.

Freshman

Fall	Credits Spring	Credits
SE 1010	R SE 1660	R
SE 1850	3 COMS 2270	4
MATH 1650	4 MATH 1660	4
CHEM 1670 or 1770	4 PHYS 2310	4
LIB 1600	1 PHYS 2310L	1
Economics Elective	3 ENGL 1500	3
15		16

Sophomore

Fall	Credits Spring	Credits
COMS 2280	3 SE 3190 ¹	3
CPRE 2810 ¹	4 COMS 3270 or CPRE 2880 ^{1,2}	3
MATH 2670	4 CPRE 3100 or COMS 2300	3
SPCM 2120	3 Math Elective	3
ENGL 2500	3 General Education Elective	3
17		15

Junior

Fall	Credits Spring	Credits
SE 3090 ¹	3 SE 3170 ¹	3
COMS 3210 or CPRE 3810 ^{1,2}	3 SE 3390 ¹	3

COMS 3110	3 COMS 3520 or CPRE 3080 ¹ , 2	3
COMS 3630 ¹	3 ENGL 3140 or 3090	3
General Education Elective	3 General Education Elective	3
15		15

Senior

Fall	Credits Spring	Credits
SE 4910	3 SE 4920	2
SE 4210 ¹	3 Software Engineering Elective	3
Software Engineering Elective	3 Software Engineering Elective	3
Supplemental Elective	3 Supplemental Elective	3
STAT 3300	3 Supplemental Elective	3
	Open Elective	3
15		17

Total Credits: 125

* Total credits required - 125 credits. Any transfer credit courses applied to the degree program require a grade of C or better (but will not be calculated into the ISU Cumulative GPA, Engineering Basic Program GPA, or Software Engineering Core GPA). See also Basic Program and Special Programs.

Engineering Basic Program - A minimum GPA of 2.00 is required for this set of courses, including any transfer courses (please note that transfer course grades will not be calculated into the Engineering Basic Program GPA)

Must receive a C or better grade in required English classes.

Must receive a C- or better grade in MATH 1650, MATH 1660, COMS 2270, and COMS 2280.

General Educational Elective courses to be selected in consultation with Software Engineering Academic Advisors from a list of approved courses. They must include courses that satisfy university and college general education requirements. These courses include courses or categories of courses such as International Perspectives and U.S. Cultures and Communities, World Language, Arts and Humanities, and Social Sciences. Pass/Not Pass credit is not accepted.

Software Engineering Electives and Supplemental Electives must be selected from the program-approved list (<http://www.se.iastate.edu/academics/>).

¹ Software Engineering Core (A minimum GPA of 2.00 is required for this set of courses, including any transfer courses but transfer course grades will not be calculated into the Software Engineering Core GPA)

² Students who take the 4-credit lab courses CPRE 2880, CPRE 3080, and CPRE 3810 instead of the corresponding 3-credit alternatives can apply the additional credits toward Supplemental Electives. The total number

of credits required in the Software Engineering Program remains the same for all students.

The Software Engineering Program has established concurrent undergraduate and graduate programs with the Department of Computer Science, the Department of Electrical and Computer Engineering, and the Ivy College of Business. Please visit <https://se.iastate.edu/academics/> for details.

Speech Communication Overview

The cross-disciplinary program in speech communication offers courses designed for all students as part of their general education and as a complement to their professional training. It also offers a minor in speech communication.

Students who minor in speech communication will prepare themselves for a wide variety of employment opportunities in business, industry and government, as well as in non-profit and educational organizations. With their effective oral communication, listening, teamwork, problem-solving and leadership skills, speech communication students find positions in general business management: human resources, benefits, financial services, retail, sales and marketing and serve various organizations as recruiters, trainers, promotions managers, communication specialists, community outreach personnel and event planners.

Speech Communication Minor

Students from any major can complement their studies with a Speech Communication Minor (<https://engl.iastate.edu/undergraduate-students/minors/#spcm>). The minor must include at least 3 credits that are not used to meet any other department, college or university requirement. Three credits must be earned at Iowa State University.

The Speech Communication Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

The Speech Communication Undergraduate Minor requires 18 Credits.

SPCM 2120	Fundamentals of Public Speaking	3
Up to 6 credits from the following:		6
SPCM 1100	Listening	
SPCM 2160	America Speaks: Great Speakers and Speeches in US History	
SPCM 2750	Analysis of Popular Culture Texts	
At least 9 credits from the following:		9
SPCM 3100	Rhetorical Analysis	

SPCM 3120	Business and Professional Speaking	
SPCM 3230	Gender and Communication	
COMST 3270	Persuasion and Social Influence	
SPCM 3240	Legal Communication	
SPCM 3500	Rhetorical Traditions	
SPCM 4170	Campaign Rhetoric	
SPCM 4180	Seminar in Rhetoric and Writing	
Total Credits		18

Sports Media and Communication

SPORTS MEDIA AND COMMUNICATION

<http://www.greenlee.iastate.edu> (<http://www.greenlee.iastate.edu/>)

The Sports Media and Communication major prepares students for careers on the sidelines, in the broadcast booth, behind the cameras or in a newsroom. Each student will receive hands-on experiences from the outset through practicums, building toward a full-scale internship. Coursework in this major focuses on creating compelling content using industry-standard and emerging digital tools. Each student is required to complete a capstone internship experience to practice and refine relevant skills.

The Greenlee School of Journalism and Communication prepares students for communication fields. The school offers four majors:

- Advertising (<https://catalog.iastate.edu/collegeofliberalartsandsciences/advertising/>) Bachelor of Arts (ADVRT)
- Journalism and Mass Communication (https://catalog.iastate.edu/collegeofliberalartsandsciences/journalism_and_mass_communication/) Bachelor of Science (JLMC)
- Public Relations (<https://catalog.iastate.edu/collegeofliberalartsandsciences/publicrelations/>) Bachelor of Science (PR)
- Sports Media and Communication Bachelor of Arts (SMC)

Professional skills are taught and practiced alongside academic requirements, using the latest technology and leading-edge communication trends and methods.

Student Learning Outcomes

Students who major in programs of the Greenlee School of Journalism and Communication are expected to develop competencies in 10 key areas:

- Apply the principles and laws of freedom of speech and press in a global context, and for the country in which the institution that invites ACEJMC is located.

- Demonstrate an understanding of the multicultural history and role of professionals and institutions in shaping communications.
- Demonstrate culturally proficient communication that empowers those traditionally disenfranchised in society, especially as grounded in race, ethnicity, gender, sexual orientation and ability, domestically and globally, across communication and media contexts.
- Present images and information effectively and creatively, using appropriate tools and technologies.
- Write correctly and clearly in forms and styles appropriate for the communications professions, audiences and purposes they serve.
- Demonstrate an understanding of professional ethical principles and work ethically in pursuit of truth, accuracy, fairness and diversity.
- Apply critical thinking skills in conducting research and evaluating information by methods appropriate to the communications professions in which they work.
- Effectively and correctly apply basic numerical and statistical concepts.
- Critically evaluate their own work and that of others for accuracy and fairness, clarity, appropriate style and grammatical correctness.
- Apply tools and technologies appropriate for the communications professions in which they work.

Additionally, SMC majors will develop competencies to:

- Effectively communicate sports stories across multiple platforms, using appropriate content forms, including writing, audio, video, photography and graphics.
- Critically think about how communication in sports functions within contemporary culture.
- Understand the impact of media rights across the high school, collegiate and professional sports landscapes.

the sports media and communication major

To receive a Bachelor of Arts degree in sports media and communication, a student must earn at least 120 credits. A minimum of 72 credits must come from courses other than ADVRT, JLMC, PR or SMC. At least 50 of these credits must come from the liberal arts and sciences. Overall, at least 45 credits must be from 3000-level courses or above.

The degree requirements allow for a minimum of 34 credits and a maximum of 48 credits to be taken in ADVRT, JLMC, PR or SMC. These include:

JLMC 1100	Orientation to Journalism and Communication	1
SMC 2500	Principles of Sports Media and Communication	3
JLMC 2010	Reporting and Writing for the Mass Media (C+ or better)	3
SMC 3040	Sportswriting and Announcing	3

3000-level ADVRT, JLMC, PR or SMC Electives	9
JLMC 4600 Law of Mass Communication	3
JLMC 4620 Media Ethics, Freedom, Responsibility	3
SMC 4910 Sports Fieldwork	3
SMC 4950 Senior Integrative Capstone	3
SMC 4990A Professional Media Internship: Required	3
Total Credits	34

Sports Media and Communication majors are also required to take:

STAT 1010 Principles of Statistics (or another approved statistics course)	4

As majors in the College of Liberal Arts and Sciences, Sports Media and Communication students must meet College of Liberal Arts and Sciences (<https://catalog.iastate.edu/collegeofliberalartsandsciences/#lascollegerequirementstext>) and University-wide requirements (<https://catalog.iastate.edu/collegescurricula/>) for graduation in addition to those stated above for the major.

University Requirement: Students in all ISU majors must complete a three-credit course in U.S. Cultures and Communities (formerly U.S. Diversity), as well as a three-credit course in International Perspectives. The approved course lists are found at the following web addresses: U.S. Cultures and Communities <http://www.registrar.iastate.edu/students/div-ip-guide/usdiversity-courses> (<http://www.registrar.iastate.edu/students/div-ip-guide/usdiversity-courses/>) and International Perspectives <http://www.registrar.iastate.edu/students/div-ip-guide/IntlPerspectives-current> (<http://www.registrar.iastate.edu/students/div-ip-guide/IntlPerspectives-current/>). Students must also demonstrate their communication proficiency by earning a grade of C or better in ENGL 2500.

College of LAS Requirement: Minimum of 120 credits, including a minimum of 45 credits at the 3000-level and above. You must also complete the LAS world language requirement, LAS career proficiency requirement, and any unmet ISU admission requirements.

Greenlee majors and minors cannot take ADVRT, JLMC, PR or SMC courses pass/not pass.

Minor or Additional Major: Students are required to fulfill a secondary area of expertise. This requirement can be met by declaring a minor or an additional major outside of the Greenlee School of Journalism and Communication. Students taking one major at the school may not seek an additional major or a minor in the school.

Sports Media and Communication, B.A.

Freshman

Fall	Credits	Spring	Credits
JLMC 1100	1	JLMC 2010	3
SMC 2500	3	STAT 1010	4
ENGL 1500	3	Social Science	3
Arts and Humanities	3	Natural Science	3
Natural Science	3	Arts and Humanities	3
LIB 1600	1	SMC 4910	1
SMC 4910	1		
15		17	

Sophomore

Fall	Credits	Spring	Credits
ADVRT, JLMC, PR or SMC 3000-level choice	3	SMC 3040	3
ENGL 2500	3	U.S. Cultures and Communities (formerly U.S. Diversity)	3
Social Science	3	World Language or Elective	4
World Language or Elective	4	Arts and Humanities	3
Natural Science	2	Social Science	3
LAS 2030	1		
16		16	

Junior

Fall	Credits	Spring	Credits	Summer	Credits
ADVRT, JLMC, PR or SMC 3000-level choice	3	ADVRT, JLMC, PR or SMC 4000-level choice	3	JLMC 4990A	3

Minor/ Additional Major Choice	3 Minor/ Additional Major Choice 3000+ Level	3
International Perspective	3 Minor/ Additional Major Choice 3000+ Level	3
Minor/ Additional Major Choice	3 Arts and Humanities	3
Minor/ Additional Major Choice	3	
		3
Senior		
Fall	Credits	Spring Credits
JLMC 4600	3 JLMC 4620	3
Minor/ Additional Major 3000+ Level	3 SMC 4950	3
SMC 4910	1 Elective or Minor/ Additional Major Choice 3000+ Level	3
Elective or Minor/ Additional Major Choice	4 Elective or Minor/ Additional Major Choice	3

Minor/ 3
Additional
Major
Choice
3000+
Level

14

12

Total Credits: 120

Statistics

Overview of Statistics

The curriculum in liberal arts and sciences with a major in statistics is designed to prepare students for (1) statistics positions in business, industry or commerce, nonprofit institutions, and in state or federal government; and (2) graduate study in statistics. Positions include the following types of work: statistical design, data visualization, analysis and interpretation of experiments and surveys; data processing and analysis using modern computation facilities and statistical computing systems; application of statistical principles and methods in commercial areas such as finance, insurance, industrial research, technology, marketing, manufacturing, sports analytics, quality control, and nonprofit organizations, such as institutions involved in health care or medical research.

Given the application of statistical work to a broad range of fields, students majoring in statistics often obtain at least a minor in a field of application. Some common minors earned by statistics majors are Economics, General Business, and Mathematics. Students preparing for positions in data analysis should consider a minor or certificate in Data Science. Students preparing for a career in the field of actuarial science should consider a certificate in Actuarial Science. Students intending to pursue graduate study in Statistics are strongly advised to complete at least a minor in Mathematics (<https://catalog.iastate.edu/collegeofliberalartsandsciences/mathematics/#undergraduateminortext>) including credit in MATH 4140 Analysis I.

Many Statistics majors earn an additional major or degree in a field of application or in Mathematics. Your academic advisor can assist you in developing your course of study including other majors.

Student Learning Outcomes

Students completing the undergraduate degree in statistics should have a broad understanding of the discipline of statistics. Upon graduation, students should be able to:

- Design observational studies and experiments in order to efficiently collect data to help answer questions about science, technology, and society.

- Analyze data arising from observational studies and experiments in order to help answer questions about the world around them.
- Use modern statistical computing to aid in the collection and analysis of data.
- Explain and apply the mathematical and theoretical basis for probability and statistical inference to help answer questions about the world around them.
- Effectively communicate statistical findings using oral, visual and written formats.
- Effectively respond to ethical issues associated with data collection, data analysis, and communication of statistical findings.

Undergraduate Major

The requirements for the undergraduate major in statistics are:

STAT 1100	Orientation in Statistics	1
STAT 2010	Introduction to Statistical Concepts and Methods	4
STAT 3010	Intermediate Statistical Concepts and Methods	4
STAT 3410	Introduction to the Theory of Probability and Statistics I	4
STAT 3420	Introduction to the Theory of Probability and Statistics II	4
STAT 4212	Experimental Design and Data Analysis	3
STAT 4750	Introduction to Multivariate Data Analysis	3
STAT 4840	Computer Processing of Scientific Data	3
STAT 4279	Statistical Computing for Data Analysis	3

A minimum of 6 credits from the following:

STAT 3610	Statistical Quality Assurance
STAT 4215	Time Series Data Analysis
STAT 4219	Bayesian Data Analysis
STAT 4610X	Sports Analytics
STAT 4730	Introduction to Survey Sampling
STAT 4760	Introduction to Spatial Data Analysis
STAT 4770	Introduction to Categorical Data Analysis
STAT 4780	Introduction to Stochastic Process Models
STAT 4820	Regression for Social and Behavioral Research
STAT 4830	Empirical Methods for the Computational Sciences

Completion of one of the following options:

Option I

MATH 1650	Calculus I
MATH 1660	Calculus II
MATH 2650	Calculus III

Option II

MATH 1650	Calculus I

MATH 1660H	Calculus II: Honors
MATH 2650H	Calculus III: Honors

Credit in one of the following:

MATH 2070	Matrices and Linear Algebra
MATH 3170	Theory of Linear Algebra

Credit in one of the following:

COMS 1270	Introduction to Computer Programming
COMS 2070	Fundamentals of Computer Programming
COMS 2270	Object-oriented Programming

Credit in one of the following:

COMST 2110	Interpersonal Communication
SPCM 2120	Fundamentals of Public Speaking

Credit in one of the following (with a grade of C- or higher):

ENGL 3020	Business Communication
ENGL 3020H	Business Communication: Honors
ENGL 3140	Technical Communication
ENGL 3140H	Technical Communication: Honors

As majors in the College of Liberal Arts and Sciences, Statistics students must meet College of Liberal Arts and Sciences and University-wide requirements for graduation in addition to those stated above for the major.

LAS majors require a minimum of 120 credits, including a minimum of 45 credits at the 3000/4000 level or above taken at a four-year college. All such credits, including courses taken on a pass/not pass basis, may be used to meet this requirement. You must also complete the LAS world language requirement and career proficiency requirement.

Students in all ISU majors must complete a three-credit course in U.S. Cultures and Communities and a three-credit course in International Perspectives. Check (<http://www.registrar.iastate.edu/courses/div-ip-guide.html>) for a list of approved courses. Discuss with your advisor how the two courses you select can be applied to your academic plan.

Statistics, B.S.

Freshman

Fall	Credits Spring	Credits
ENGL 1500	3 MATH 1660 or 1660H	4
LIB 1600	1 Social Science Choice	3
STAT 1100	1 Humanities Choice	3
MATH 1650	4 Natural Science Choice	4
STAT 2010	4	
Humanities Choice	3	
16		14

Sophomore

Fall	Credits Spring	Credits
STAT 3010	4 STAT 4212	3
MATH 2650 or 2650H	4 MATH 2070 or 3170	3-4
ENGL 2500	3 Computer Science Choice	3
Natural Science Choice	4 Humanities Choice	3
LAS 2030	1 Social Science Choice	3
	16	15-16

Junior

Fall	Credits Spring	Credits
STAT 3410	4 STAT 3420	4
STAT 4840	3 STAT 4279	3
SPCM 2120 or COMST 2110	3 Social Science Choice	3
World Language/Elective	4 World Language/Elective	4
	Elective	1
	14	15

Senior

Fall	Credits Spring	Credits
STAT 4750	3 Statistics Choices	6
ENGL 3020 or 3140	3 Electives	9
Humanities Choice	3	
Electives	6	
	15	15

Total Credits: 120-121

Undergraduate Minor

The department offers a minor in statistics which may be earned by satisfying the following requirements:

- Credit in one introductory level course in statistics, chosen from the following list: STAT 1010, STAT 1040, STAT 2010, STAT 2260, STAT 2310, STAT 3050, STAT 3220, STAT 3300.
- Credit in one intermediate level course in statistics, chosen from the following list: STAT 3010, STAT 3260.
- At least 9 additional credits in statistics courses, chosen from the following list: STAT 3410, STAT 3420, STAT 3470, STAT 3610, STAT 4212, STAT 4215, STAT 4219 STAT 4279, STAT 4610X, STAT 4730, STAT 4750, STAT 4760, STAT 4770, STAT 4780, STAT 4820, STAT 4830, STAT 4840.

At least 3 credits used to complete the minor may not be used to meet any other department, college, or university requirement.

All credits used to meet the minor requirements may also be used to satisfy the credit requirement for graduation and to meet credit requirements in courses numbered 3000 or above.

Courses used to complete the minor may not be taken on a pass-not pass basis.

The Statistics Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

Graduate Study

The department offers graduate programs leading to the Master of Applied Statistics degree, and the Master of Science (M.S.) and the Doctor of Philosophy (Ph.D.) degrees with a major in Statistics.

Graduates of the Master of Applied Statistics program develop a strong foundation in statistical applications, learning to correctly use and interpret the most frequently employed classical and modern methods in statistics. The students will gain skills in selecting appropriate techniques for data-driven problems, explaining theoretical foundations of classical and modern statistical methods, and effectively communicating statistical results to all stakeholders. Students will also learn to use modern statistical computing technologies, and to apply machine learning and artificial intelligence to enhance insights from data. Students complete a minimum of 30 semester credits, including statistical consulting coursework and credit for statistical work experience through an internship or current employer.

Graduates of the M.S. program have studied basic statistical theory and methods. Elective courses in the M.S. program provide an opportunity for students to emphasize particular areas of application in their program. Students complete a minimum of 34 semester credits, including work on a capstone project resulting in a written creative component under the direction of an individual major professor and defended in a final oral examination.

Graduates of the Ph.D. program have demonstrated mastery of basic statistical theory and methods, studied advanced statistical theory and methods, and have demonstrated the ability to conduct independent research resulting in an original contribution to the discipline. Candidates for the Ph.D. degree in Statistics complete a minimum of 72 semester credits, including at least 18 credits given for research activity, pass an oral preliminary examination, and submit a written dissertation containing original research that is defended in a final oral examination. Dissertation research is typically conducted in close collaboration with a major professor and usually results in publishable material. The department does not offer specific program tracks or areas of emphasis, but the diversity of elective courses and research areas of faculty allow

students to tailor their individual programs to reflect areas of particular interest.

The Ph.D. degree is also offered as a co-major with other graduate programs. Graduates of co-major Ph.D. programs in Statistics and an applied scientific discipline have demonstrated mastery of basic statistical theory and methods and have studied advanced statistical methodology. Students complete a minimum of 72 semester credits for courses in statistics and the chosen scientific discipline. Students conduct research that is a combination of statistical methodology and the scientific discipline. Co-major professors work with the student to prepare for an oral preliminary examination and to conduct research leading to a single dissertation project, defended in a final oral examination, that produces an original contribution to at least one of the two disciplines.

Graduates of co-major Ph.D. programs in statistics and an area of theoretical mathematics have demonstrated mastery of basic statistical theory and methods and have studied advanced statistical theory. Students complete a minimum of 72 semester credits for courses in statistics and the other discipline. Co-major professors work with the student to prepare for an oral preliminary examination and to conduct research leading to a single dissertation project, defended in a final oral examination, that makes an original contribution at the interface of statistical theory and a sub-discipline of mathematics.

Graduate work leading to a minor in statistics is available for students majoring in other programs, at both the M.S. and Ph.D. levels.

The department participates in inter-disciplinary graduate programs in Bioinformatics and Computational Biology, Ecology and Evolutionary Biology, Genetics, Human Computer Interaction, Nutritional Sciences, and Wind Energy Science, Engineering, and Policy.

Teaching English as a Second Language (TESL) Minor

The Minor in TESL prepares students to teach English to nonnative speakers of English, either in community programs in the United States or in overseas locations. The Minor provides understanding of how languages work and practical and theoretical applications in how English is taught to those who do not speak English natively. The TESL Minor prepares students to cross cultural boundaries to learn about, interact with, and assist speakers of other languages in learning English, the leading global language today. A TESL Minor will help students become global citizens through interacting with and teaching those from around the world who come to the United States and by giving students skills that will allow them to live and work in other countries.

Requirements

All classes listed are requirements for the Minor in TESL (15 credits).

A C or better is required in each course used to satisfy the minor. The minor must include at least 3 credits that are not used to meet any other department, college, or university requirement.

ENGL 2190	Introduction to Linguistics	3
LING 3220	Language and Society	3
LING 3240	Introduction to Teaching ESL Literacy	3
LING 3250	Teaching Methods for ESL Learners: Oral Communication Skills	3
ENGL 4250	Second Language Learning and Teaching	3

The Teaching English as a Second Language Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

Technical Communication

A double major or minor in Technical Communication can open new career paths in business, science, and industry. Some students in technical or scientific fields enhance their degree by double majoring or minoring in Technical Communication. Technical Communication is also an additional major or minor for students who major in English (<http://catalog.iastate.edu/collegeofliberalartsandsciences/english/>), linguistics, or other humanities and social science disciplines.

BS in Technical Communication Learning Outcomes

Students who major in Technical Communication will be able to

- Compose a wide range of print and online documents for use in business, science, industry, schools, and communities.
- Identify specific audience needs in rapidly changing digital and print environments.
- Identify and create user-friendly interfaces; understand and put into practice strategies to enable the optimal usability of documents.
- Demonstrate mastery of concepts from organizational culture and visual communication, including collaborative writing and clear, responsive professional and technical documents.
- Understand technical and scientific information and strategies for writing and designing texts to communicate that information to others.
- Describe and use the theories that assess print and online documents, collaboration, organizational activities, and various technologies.

Technical Communication Major Requirements

Majors develop advanced skills in multiple aspects of technical communication and apply their knowledge of technical communication to a specific discipline. Technical communication majors must take 33 credits within the major and 6 hours in a designated area of concentration related to science, technology, or design (an acceptable minor will also fulfill this requirement).

ENGL 2140	Introduction to Technical Communication	3
ENGL 3100	Rhetorical Analysis	3
ENGL 3130	Rhetorical Website Design	3
ENGL 3140	Technical Communication	3
ENGL 4150	Business and Technical Editing	3
ENGL 4160	Visual Aspects of Business and Technical Communication	3
Electives: 9 credits (with at least 6 credits from 4000 or above courses)		9
ENGL 2200	Descriptive English Grammar	
ENGL 2220	Artificial Intelligence and Writing	
ENGL 3020	Business Communication	
ENGL 3090	Proposal and Report Writing	
ENGL 3120	Communicating Science and Public Engagement	
ENGL 3500	Rhetorical Traditions	
ENGL 4110	Technology, Rhetoric, and Professional Communication	
ENGL 4180	Seminar in Rhetoric and Writing	
ENGL 4770	Seminar in Technical Communication	
ENGL 4870	Internship in Business, Technical, and Professional Communication	
SPCM 3120	Business and Professional Speaking	
Graduate course options below require instructor approval		
ENGL 5050	User Experience Architecture and Testing	
ENGL 5420	Technical Editing and Publication Management	
ENGL 5490	Multimedia and Interaction Design	
ENGL 5860	Visual Rhetoric in Professional Communication	
Designated Area of Concentration (DAC) in technical, scientific, or design field		6
Total Credits		33

Technical Communication Major Requirements

Technical Communication majors are required to have, in addition to ISUComm foundation courses (ENGL 1500 (<http://catalog.iastate.edu/search/?P=ENGL%201500>) Critical Thinking and Communication and ENGL 2500 (<http://catalog.iastate.edu/search/?P=ENGL%202500>) Written, Oral, Visual, and Electronic Composition), at least 33 credits in TComm (including 6 credits in a designated area of concentration). Majors transferring from other institutions must take at least 18 of their credits in TComm while in residence at Iowa State.

To graduate with a major in Technical Communication and meet the university-wide Communication Proficiency Grade Requirement, a student must have credit for ENGL 1500 Critical Thinking and Communication and earn at least a C (not C-) in ENGL 2500 Written, Oral, Visual, and Electronic Composition as well as in each of the courses taken to fulfill the program of study, including one advanced communication course.

The Designated Area of Concentration (DAC) is a student-designed grouping of related courses in a technical, scientific, or design field that will meet the student's professional or academic interests. Courses for the 6-credit DAC must be taken outside the English Department and approved by the Technical Communication Program Advisor. An additional major or a minor in areas such as computer science, social science, natural science, entrepreneurial studies, design studies, engineering studies, or another technical, scientific, or design field may substitute for the DAC.

Designated Area of Concentration Courses

Students in all ISU majors must complete a three-credit course in U.S. Cultures and Communities and a three-credit course in International Perspectives. Check <http://www.registrar.iastate.edu/courses/div-ip-guide.html> for a list of approved courses. Discuss with your advisor how the two courses that you select can be applied to your graduation plan.

LAS majors require a minimum of 120 credits, **including a minimum of 45 credits at the 3000/4000 level**. You must also complete the LAS world language requirement and career proficiency requirement.

As majors in the College of Liberal Arts and Sciences, Technical Communication students must meet College of Liberal Arts and Sciences and University-wide requirements for graduation in addition to those stated above for the major.

Technical Communication, B.S.

Freshman

Technical Communication, B.S.

Freshman

Fall	Credits Spring	Credits
ENGL 1500 (or ENGL 2500 by placement or transfer credit)	3 Social Science Choice	3
Humanities Choice	3 Natural Science Choice	3
World Language/Elective	4 Humanities Choice	3
MATH or STAT	3 World Language/Elective	4
LIB 1600	1 ENGL 2500 (if not in Fall); or ENGL 3100	3

ENGL 2140	3	
	17	16

Sophomore

Fall	Credits Spring	Credits
ENGL 3100, 3130, or 2500	3 Technical/Scientific/Design Course	3
Social Science Choice	3 ENGL 3140	3
U.S. Cultures and Communities Choice	3 ENGL 3130, 3100, or TComm Elective	3
Natural Science Choice	3 Humanities Choice or elective	3
Elective/Minor	3 TComm Elective/Minor	3
LAS 2030	1 Natural Science Choice	2
	16	17

Junior

Fall	Credits Spring	Credits
TComm Choice: ENG 4160, 4770, or other 4000-level TComm course	3 ENGL 4150	3
Elective/Minor	3 Minor	3
International Perspectives Choice	3 TComm Elective from List (ENGL 3000+)	3
Humanities Choice	3 Technical/Scientific/Design Course	3
Social Science Choice	3 Electives	3
	15	15

Senior

Fall	Credits Spring	Credits
Technical/Scientific/Design Course	3 ENGL 4870 (recommended)	3
TComm Elective from List – ENGL 4000+	9 TComm Elective from List – ENGL 4000+	3
Electives/Minor	3 Electives or Minor	6
	15	12

Students may double-count some courses to complete the degree requirements in 120 credits.

Technical Communication Minor Requirements

The department offers a minor in Technical Communication, which students may earn by completing the following:

ENGL 3140	Technical Communication	3
Choose 4:		12
ENGL 2140	Introduction to Technical Communication	

ENGL 3020	Business Communication
ENGL 3090	Proposal and Report Writing
ENGL 3100	Rhetorical Analysis
ENGL 3120	Communicating Science and Public Engagement
ENGL 3130	Rhetorical Website Design
ENGL 3320	Visual Communication of Quantitative Information
ENGL 3550	Literature and the Environment
or with the appropriate prerequisites	
ENGL 4110	Technology, Rhetoric, and Professional Communication
ENGL 4150	Business and Technical Editing
ENGL 4160	Visual Aspects of Business and Technical Communication
ENGL 4770	Seminar in Technical Communication
ENGL 5290	Content Management
ENGL 5420	Technical Editing and Publication Management
ENGL 5490	Multimedia and Interaction Design

Total Credits **15**

The minor requires 15 credits as listed above; at least 9 credits must be numbered 2000 level or above, of which at least 6 credits are in courses numbered 3000 or above. The minor must include at least 3 credits that are not used to meet any other department, college, or university requirement.

Students must earn a grade of C (not C-) or higher in each course taken in the minor. The minor must include at least 3 credits that are not used to meet any other department, college, or university requirement. Students may design their minor programs around their own interests but are encouraged to work with the Technical Communication Program Advisor.

The Technical Communication Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

Note: Students should check the ISU catalog to be sure that they meet prerequisites if they intend to register for 4000+ courses.

Theatre and Performing Arts Overview

www.music.iastate.edu/theatre (<http://www.music.iastate.edu/theatre/>)

The Theatre and Performing Arts program:

- Utilizes a flexible, interdisciplinary curriculum.
- Focuses on undergraduate experiences, high impact learning, interdisciplinary and cross-community collaboration, and exceptional professional preparation and training.
- Engages in collaborative, innovative practices in both classroom and production settings.
- Empowers students to take an active role in an interconnected system of artistic community engagement and creative momentum.
- Is dedicated to individualized student-centered programming that is ambitious, relevant, and rigorous.

ISU Theatre impacts hundreds of students from majors throughout the university in our classes, productions and studios. Our students are compassionate, enthusiastic, aware, ambitious, dependable, dedicated, disciplined and generous. The Theatre and Performing Arts program offers a wide variety of courses that support the student’s individual interests and specialization.

The major in performing arts offers the undergraduate student a cross-disciplinary core including 24.5 credits in three categories: Theatre, Music and Dance. Students also select a 21-22 credit emphasis in one or more of the following areas of focus:

- Acting/Directing
- Dance
- Musical Theatre
- Theatrical Design and Technology

Additional professional development occurs within two required professional internships in which students can practice the skills and passions developed throughout their individualized plans of study. Preparation for these internships include various impactful experiences in theatre and the performing arts here at Iowa State. This work is vital for students to gain a practical understanding of the rigors of the field.

ISU Theatre and Performing Arts focuses solely on the undergraduate student artist, offering students many opportunities to participate in production experiences throughout the academic year. Students implement the theories and principles explored in the classroom with experiential learning through public performances. These productions vary in scope, taking place in the 435-seat proscenium space at Fisher Theatre as well as in other intimate and “found” venues both on and off campus. Performing arts majors must maintain a 2.0 GPA to participate in production activities. Scholarships and employment opportunities are available to both incoming and current students on a yearly basis. All areas of ISU Theatre and Performing Arts, including classes and productions, are open to all students regardless of major. Visit here (<https://www.music.iastate.edu/how-get-involved-theatre-and-performing-arts/>) to learn about scholarships and all of the ways to get involved with Theatre and the Performing Arts at ISU.

In addition to building a solid foundation in theatre, Performing Arts graduates enter the world as empathetic members of their community prepared to engage in civic life and meet the challenges of the work force or graduate school with strong skills in leadership, collaboration, and critical thinking.

Student Learning Outcomes

Upon graduation, students should be able to:

- Recognize the ways in which theatre and performing arts can reflect and change communities and culture.
- Apply collaboration principles to the creation of performing arts.
- Analyze and critique performing arts theory, practice, literature, design, performance, and one’s own process and work within cultural, community, and historical contexts.
- Organize and integrate resources - including human (self and others), technology, and systems - to solve abstract and practical problems.
- Apply the fundamental skills of performing artists in both theory and practice.

Bachelor of Arts - Performing Arts Major (Perf)

As majors in the College of Liberal Arts and Sciences, students must meet College of Liberal Arts and Sciences and University-wide requirements for graduation in addition to those stated below for the major.

LAS majors require a minimum of 120 credits, including a minimum of 45 credits at the 3000/4000 level. You must also complete the LAS world language requirement and career proficiency requirement.

Students in all ISU majors must complete a three-credit course in U.S. Cultures and Communities and a three-credit course in International Perspectives. Check (<http://www.registrar.iastate.edu/courses/div-ip-guide.html>) for a list of approved courses. Discuss with your advisor how the two courses that you select can be applied to your graduation plan.

All performing arts majors must complete both the performing arts core and at least one of the emphases listed below. A Minimum GPA of 2.00 in both the major core and the chosen emphasis is required to graduate.

The Core for the Performing Arts Major (24.5 credits)

MUSIC 1010	Fundamentals of Music	2
THTRE 1060	Introduction to the Performing Arts	3
	or THTRE 1100 Theatre and Society	

or MUSIC 1020 Introduction to Music Listening		
THTRE 2500	Technical Theatre Practicum	2
THTRE 2510	Acting Foundations	3
THTRE 2550	Introduction to Theatrical Production	4
THTRE 2630	Script Analysis	3
PERF 1050	Performing Arts Seminar (Three semesters required at .5 credits per semester)	1.5
PERF 3100	Performing Arts Internship (2 professional internships required)	R
or THTRE 4990 Theatre Internship		
PERF 4010	Performing Arts Capstone Seminar	2
Choose four credits of DANCE from the following:		4
DANCE 1200	Modern Dance I	
DANCE 1300	Ballet I	
DANCE 1400	Jazz I	
DANCE 1500	Tap Dance I	
DANCE 1600	Ballroom Dance I	
DANCE 2110	Fundamentals and Methods of Social and World Dance	
DANCE 2200	Modern Dance Composition	
DANCE 2220	Modern Dance II	
DANCE 2230	Modern Dance III	
DANCE 2320	Ballet II	
DANCE 2330	Ballet III	
DANCE 2420	Jazz II	
DANCE 2500	Yoga Movement	
DANCE 2700	Dance Appreciation	
DANCE 3200	Sound and Movement	
DANCE 3600	History and Philosophy of Dance	
DANCE 3700	Advanced Studies in Dance	
DANCE 3840	Teaching Children's Dance	
DANCE 3850	Methods of Teaching Dance	
DANCE 3860	Teaching Dance Technique and Composition	
Total Credits		24.5

Emphasis in Acting/Directing (21 Credits)

THTRE 1510	Actor's Voice and Movement	3
THTRE 3930	Studies in Theatre Design and Production Workshop	3
THTRE 4550	Directing	3
THTRE 4650	Theatre History: Ancient to 19th Century	3
THTRE 4660	Theatre History: 19th Century to Present	3
Choose 6 credits from the following:		6

THTRE 3510	Acting: Contemporary Scene Study	
THTRE 3520	Puppetry Design and Performance	
THTRE 3530	Acting for the Camera	
THTRE 4510	Acting: Period Styles	
THTRE 3160	Creative Writing: Playwriting	
THTRE 4560	Advanced Directing	
THTRE 5040B	Seminar: Acting Techniques	
THTRE 5040C	Seminar: Acting Styles	
THTRE 5040E	Seminar: Arts Management	

Total Credits **21**

Emphasis in Theatrical Design and Technology (21 credits)

THTRE 4550	Directing	3
THTRE 4650	Theatre History: Ancient to 19th Century	3
THTRE 4660	Theatre History: 19th Century to Present	3
Choose 12 Credits from the following:		12

THTRE 3930A	Studies in Theatre Design and Production Workshop: Costume Design	
THTRE 3930B	Studies in Theatre Design and Production Workshop: Scenic Design	
THTRE 3930C	Studies in Theatre Design and Production Workshop: Lighting Design	
THTRE 3930D	Studies in Theatre Design and Production Workshop: Sound Design	
THTRE 3930E	Studies in Theatre Design and Production Workshop: Stagecraft	
THTRE 3930F	Studies in Theatre Design and Production Workshop: Costume Draping and Patterning	
THTRE 3930G	Stage Makeup	
THTRE 3930I	Studies in Theatre Design and Production Workshop: Stage Management	
THTRE 3930J	Studies in Theatre Design and Production Workshop: Technical Direction	
THTRE 3930K	Studies in Theatre Design and Production Workshop: Arts Management	
THTRE 3930L	Studies in Theatre Design and Production Workshop: Scenic Painting	
THTRE 3930M	Studies in Theatre Design and Production Workshop: Costume Construction	
THTRE 5040D	Seminar: Design and Technical Theatre	
THTRE 5040E	Seminar: Arts Management	

Total Credits **21**

Emphasis in Musical Theatre (22 credits)

MUSIC 1180A	Applied Music: Non-majors: Voice (2 semesters of MUSIC 1180A required)	2
MUSIC 1250	Class Voice (2 semesters of 1250 required)	2
THTRE 3540	Musical Theatre History and Performance	3
THTRE 3550	Musical Theatre Auditions and Performance	3
THTRE 4650	Theatre History: Ancient to 19th Century	3
	or THTRE 4660 Theatre History: 19th Century to Present	
Choose 9 credits from the following:		9
THTRE 1510	Actor's Voice and Movement	
THTRE 3510	Acting: Contemporary Scene Study	
THTRE 3520	Puppetry Design and Performance	
THTRE 3530	Acting for the Camera	
THTRE 3930	Studies in Theatre Design and Production Workshop	
THTRE 4510	Acting: Period Styles	
THTRE 4550	Directing	
THTRE 4560	Advanced Directing	
THTRE 5040A	Seminar: Musical Theatre	
THTRE 5040B	Seminar: Acting Techniques	
THTRE 5040C	Seminar: Acting Styles	
THTRE 5040E	Seminar: Arts Management	
Total Credits		22

Emphasis in Dance (21 credits)

DANCE 3600	History and Philosophy of Dance	3
12 Credits of DANCE in addition to DANCE 3600 and the six taken in the PERF core. At least 6 credits must be 3000+.		12
6 credits of 3000+ credits in THEATRE.		6
Total Credits		21

Suggested Four year plans for Performing Arts majors

Listed below are example pathways for completing the Performing Arts major. Students will work with their academic adviser to navigate their pathway through the curriculum requirements.

Performing Arts B.A. - Emphasis in Acting/Directing**Freshman**

Fall	Credits	Spring	Credits
THTRE 2510	3	THTRE 1510	3
THTRE 2550	4	THTRE 2630	3
PERF 1050	.5	THTRE 2500	1
THTRE 1060	3	MUSIC 1010	2

ENGL 1500	3	ENGL 2500	3
LIB 1600	1	General Education Requirement	3
Dance Elective	1	Dance Elective	1
15.5		16	

Sophomore

Fall	Credits	Spring	Credits	Summer	Credits
PERF 1050	.5	THTRE 3510 (or other 3000+ Performance class)		3 PERF 3100	R
THTRE 2500	1	Dance Class		1	
Dance Class	1	General Education Requirement		3	
THTRE 3930		General Education Requirement		3	
3000+ Elective	3	3000+ Elective		3	
3000+ Elective	3	3000+ Elective		3	
General Education Requirement	2				
General Education Requirement	3				
LAS 2030	1				
14.5		16		0	

Junior

Fall	Credits	Spring	Credits	Summer	Credits
PERF 1050	.5	THTRE 4660		3 PERF 3100	R
THTRE 4550	3	Dance Class Elective		1	
THTRE 4650	3	General Education Requirement		3	

General Education Requirement	3 General Education Requirement	3	
General Education Requirement	3 3000+ Elective	3	
3000+ Elective	3 3000+ Elective	3	
Dance Elective	1		
16.5		16	0

Senior

Fall	Credits	Spring	Credits
PERF 4010		2 General Education Requirement	3
THTRE 4510 (or other 3000+ acting/directing course)		3 3000+ Elective	3
General Education Requirement		3 3000+ Elective	3
3000+ Elective		3 3000+ Elective	3
3000+ Elective		3 3000+ Elective	3
14		15	

Total Credits: 123.5**Performing Arts - B.A. - Emphasis in Theatrical Design/Technology****Freshman**

Fall	Credits	Spring	Credits
PERF 1050	.5	THTRE 2630	3
THTRE 2510		3 ENGL 2500	3
THTRE 2550		4 MUSIC 1010	2
LIB 1600		1 THTRE 2500	1
THTRE 1060		3 General Education Requirement	3

General Education Requirement	3 General Education Requirement	3	
ENGL 1500	3		
17.5		15	

Sophomore

Fall	Credits	Spring	Credits	Summer	Credits
PERF 1050	.5	DANCE 3600		3 PERF 3100	R
DANCE 2700 (Or other Dance course)		3 THTRE 3930A (or other 3000+ THTRE Design/Tech course)		3	
THTRE 3930 (any 3930)		3 General Education Requirement		3	
THTRE 2500		1 General Education Requirement		3	
General Education Requirement		3 3000+ Elective		3	
General Education Requirement		2			
3000+ Elective		3			
LAS 2030		1			
16.5		15		0	

Junior

Fall	Credits	Spring	Credits	Summer	Credits
PERF 1050	.5	THTRE 3930B (Or other 3000+ THTRE Design/Tech Class)		3 PERF 3100	R
THTRE 4550		3 THTRE 3930			
THTRE 4650		3 General Education Requirement		3	

General Education Requirement	3 General Education Requirement	3	
General Education Requirement	3 3000+ Elective	3	
3000+ Elective	3		
15.5		12	0

Senior

Fall	Credits	Spring	Credits
PERF 4010	2	3000+ Elective	3
3000+ Elective	3	3000+ Elective	3
3000+ Elective	3	3000+ Elective	3
3000+ Elective	3	3000+ Elective	3
3000+ Elective	3	3000+ Elective	3
14		15	

Total Credits: 120.5

Performing Arts - B.A. - Emphasis in Musical Theatre**Freshman**

Fall	Credits	Spring	Credits
THTRE 2510	3	THTRE 2630	3
THTRE 2550	4	THTRE 2500	1
PERF 1050	.5	MUSIC 1010	2
THTRE 1060	3	ENGL 2500	3
ENGL 1500	3	General Education Requirement	3
LIB 1600	1	Dance Elective	1
Dance Elective	1	THTRE 1510 (or other Acting/Directing course)	3
15.5		16	

Sophomore

Fall	Credits	Spring	Credits	Summer	Credits
PERF 1050	.5	Dance Class		1 PERF 3100	R
3000+ Elective	3	THTRE 3550		3	
THTRE 2500	1	MUSIC 1250		1	
Dance Class	1	General Education Requirement		3	
THTRE 3540	3	General Education Requirement		3	
3000+ Elective	3	3000+ Elective		3	
General Education Requirement	2				
MUSIC 1250	1				
LAS 2030	1				
15.5		14		0	

Junior

Fall	Credits	Spring	Credits	Summer	Credits
PERF 1050	.5	Dance Class		1 PERF 3100	R
THTRE 4550 (or other 3000+ Acting/Directing Course)	3	THTRE 3510 (Or other 3000+ THTRE Acting/Directing Course)		3	
THTRE 4650	3	General Education Requirement		3	
General Education Requirement	3	General Education Requirement		3	
3000+ Elective	3	3000+ Elective		3	
Dance Elective	1	3000+ Elective		3	
MUSIC 1180A	1-2	MUSIC 1180A		1-2	
14.5-15.5		17-18		0	

Senior

Fall	Credits	Spring	Credits
PERF 4010	2	General Education Requirement	3
THTRE 3520 (or other THTRE 3000+ course from degree requirements)	3	3000+ Elective	3
THTRE 4510 (or other 3000+ acting/directing course)	3	3000+ Elective	3
General Education Requirement	3	3000+ Elective	3
3000+ Elective	3		
3000+ Elective	3		
17		12	

Total Credits: 121.5-123.5

Please see the Department advisors for more information about suggested Four Year Plans for the Emphases in Dance. Students in all ISU majors must complete a three-credit course in U.S. Cultures and Communities and a three-credit course in International Perspectives. Consult the catalogue for a list of approved courses. Discuss with your advisor how these two courses can be applied to your graduation plan.

Performing Arts Minor

To complete the minor in Performing Arts, students must take at least 15 credits of either Theatre or Performing Arts courses. Six credits must be 3000 level or higher. *THTRE 2240, 2900, 4900, and 4990 do not count toward the Performing Arts minor.* Only 3 credits total of THTRE 2500, THTRE 3010, and THTRE 4690 count toward the minor. The minor must include at least 3 credits that are not used to meet any other department, college or university requirement. The following classes are required:

PERF 1050	Performing Arts Seminar (2 semesters)	1
THTRE 2550	Introduction to Theatrical Production	4

THTRE 2630	Script Analysis	3
7 additional PERF or THTRE elective credits, 6 of which must be 3000 or above.		7

The Performing Arts Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

U.S. Latino/a Studies Program Overview

Latinos/as/x are the largest and fastest growing culturally diverse population in the United States, representing dynamic and thriving American realities.

U.S. Latino/a Studies at Iowa State University is a cross-disciplinary, coalition-building program that offers well-structured and creative coursework to students interested in the arts, cultures, economies, histories, politics, religions, and literatures of Latino/a/x communities throughout the United States. It facilitates the study of a vast array of communities and individuals with roots in the Caribbean and Latin America, and long-established U.S. citizen communities such as Chicanos/as, Mexican Americans, Tejanos, Californios, Cuban-Americans, Dominican-Americans, and Puerto Ricans on the island and on the mainland.

The program aims to serve as a hub that connects classes, service and outreach opportunities across colleges, schools, and departments. Consequently, students can discover a stimulating field of critical and academic research, engage in an exciting platform on which to link different fields of study, and become part of outreach/community networks in which they will grow to become outstanding, conscientious leaders in their respective careers.

The Program in U.S. Latino/a Studies is well suited to careers in Education, Psychology, History, Sociology, Business, Journalism, Spanish Language and Cultures, Women's and Gender Studies, and Agriculture. A U.S. Latino/a Studies minor, or a double major with a Latino/a Studies track in Interdisciplinary Studies, strengthens student profiles as they compete for jobs on the global market because they have attained an in-depth experience of local and global experiences of Latin America and the Caribbean, as well as a sophisticated understanding of how to work respectfully within these many social and cultural settings.

The US LS Program offers course work that meets the ISU U.S. Cultures and Communities requirement and also offers a 15-credit U.S. Latino/a Studies Minor (<https://usls.las.iastate.edu/minor/>).

U.S. Latina/o/x Studies Program Student Learning Outcomes

Upon the completion of their program of study, students with an interdisciplinary studies major in U.S. Latino/a/x Studies will demonstrate proficiency in four goal areas: Communication, Cross-Cultural Literacy, Critical Thinking, and Lifelong Learning Skills.

1. **Communication:** Key communication skills, including written, oral, and digital. Understanding textual and media sources and ability to apply media literacy to cross-cultural analysis. Working knowledge of social scientific and/or humanistic approaches in the field.
2. **Cross-Cultural Literacy:** Ability to communicate across communities and acknowledge different communicative styles and languages including Spanish, Portuguese, and Indigenous.
3. **Critical Thinking:** Ability to analyze from a transnational/transborder/translocal perspective and to objectively examine the interconnections between Latinx, Caribbean, and Latin American communities. Developing key skills, such as finding and understanding sources, comparing arguments, proposing solutions to discussed problems within an expansive historical perspective that includes class, ethnicity, gender, and race.
4. **Lifelong Learning Skills:** Acquisition of practical hands-on skills in community engagement, extension and outreach service, in different settings such as urban, rural, and international.

Interdisciplinary Studies Major, Track in U.S. Latino/a Studies

In addition to meeting the general requirements for the Interdisciplinary Studies major, students wishing to complete a track in U.S. Latino/a Studies must complete a minimum of 36 credits in the area of U.S. Latino/a Studies including USLS 2110 (Introduction to U.S. Latino/a Studies) and an experiential learning course (USLS 3250 or USLS 4990). At least 15 of the 36 credits must be in courses numbered 3000 and above and 6 credit hours must be earned at the 4000-level. Students must also meet the upper-level communication proficiency requirement by taking English 3020 or 3140. Students can work with the USLS program director and an Interdisciplinary Studies advisor to explore options within this individualized major program.

Required Courses (36 credits)

USLS 2110	Introduction to U.S. Latino/a Studies	3
One Experiential Learning course in USLS		3
USLS 3250	Culture and Community: Iowa and Midwest Latino/as	
USLS 3770	Latina/o/x Life Stories: Memoirs and Oral History	
USLS 4990	Internship in US Latino/a Studies	
Two of the following Historical Foundations of USLS		6
USLS 3720	Latina/o History	

HIST 3400	Colonial Latin America	
HIST 3410	Modern Latin America	
Two of the following Social Science Foundations of USLS		6
USLS 3430	Latin American Government and Politics	
USLS 3470	U.S. Latino/a Psychology	
USLS 3600	Latinas and Victimization	
USLS 4730	Civil Rights and Ethnic Power	
ANTHR 3230A	Latin American Anthropology: Violence and Memory	3
or ANTHR 3230B Latin American Anthropology: Social movements and Democracy		
or ANTHR 3230C Latin American Anthropology: Race, Class and Gender		
or ANTHR 3230D Latin American Anthropology: Regional Focus		
or ANTHR 3230E Latin American Anthropology: Culture and Sport		
SOC 3320	The Latino/Latina Experience in U.S. Society	
SPAN 3220	Latin American Civilization	
SPAN 3240	Latin America Today	
Two of the following Literature and Language in USLS		6
SPAN 3040	Spanish for Global Professionals	
SPAN 3050	Spanish for Heritage Speakers	
SPAN 4450	Seminar on the Literatures and Cultures of Latin America	
And twelve additional credits from any USLS, USLS cross-listed, or other course listed above		12

Total Credits **39**

Notes

1. The list of acceptable courses may include courses not currently listed. Contact the Director of US Latino/a Studies for information on eligible courses.
2. The student must have an average grade of C in courses applied to the major.
3. Fulfillment of the world language requirement with Spanish is strongly recommended, but not required. Students pursuing multiple majors can apply up to nine (9) credits of approved Spanish courses (3040, 3220, 3240, 4450) to both the USLS and their other major.

As majors in the College of Liberal Arts and Sciences, Interdisciplinary Studies students must meet College of Liberal Arts and Sciences and University-wide requirements for graduation in addition to those stated above for the major.

LAS majors require a minimum of 120 credits, including a minimum of 45 credits at the 3000/4000-level. You must also complete the LAS world language requirement and career proficiency requirement.

Students in all ISU majors must complete a three-credit course in U.S. diversity and a three-credit course in international perspectives. Check (<http://www.registrar.iastate.edu/courses/div-ip-guide.html>) for a list of approved courses. Discuss with your advisor how the two courses that you select can be applied to your graduation plan.

U.S. Latino/a Studies Minor

The minor in US Latino/a Studies requires a minimum of 15 credit hours including USLS 2110 (Introduction to U.S. Latino/a Studies), an experiential learning course (USLS 3250, USLS 3770, or USLS 4990), with at least 12 credit hours numbered 3000 or above. University policy indicates that minors must include at least 3 credits that are not applied to any other degree requirement.

Required course work

USLS 2110	Introduction to U.S. Latino/a Studies	3
One of the following:		3
USLS 3250	Culture and Community: Iowa and Midwest Latino/as	
USLS 3770	Latina/o/x Life Stories: Memoirs and Oral History	
USLS 4990	Internship in US Latino/a Studies	
And nine credits from any USLS or USLS cross-listed course		9
Total Credits		15

Notes:

1. A limit of six (6) credits of approved Spanish courses (SPAN 3040, SPAN 3220, SPAN 3240, SPAN 4450) may be substituted for USLS courses.
2. A maximum of 3 credit hours of USLS 4900 (Independent Study) may be applied toward the minor.

The U.S. Latino/a Studies Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

Women's and Gender Studies Overview

The Women's and Gender Studies Program is a cross-disciplinary program in the College of Liberal Arts and Sciences. The program offers students opportunities to analyze issues concerning women, gender, and sexuality in diverse cultural contexts and to investigate a variety of disciplines from feminist perspectives. The field of women's and gender studies creates an understanding that interrelated factors—e.g., race, ethnicity, class, age, disability, gender identity, religion, national origin, and sexual orientation—inform knowledge of women's history, culture, and social roles.

Women's and Gender Studies seeks to improve critical thinking and to provide students with the intellectual means to question prevailing assumptions. It encourages students to explore the contexts and ideological origins of knowledge and to examine the relationship between knowledge and power in society. By promoting social justice and inclusion, this area of study focuses on the connections between personal experience and political activity and validates student contributions and voices.

Graduates from this program are skilled in critical thinking, research methods, and effective communication. Because they have developed a thorough understanding of gender, race, and class, graduates work effectively with employers, colleagues, and clients to analyze and solve complex social problems. Women's and Gender Studies students also acquire strong backgrounds for careers in areas such as counseling, education, human resources, international development, public policy, politics, business, and law. The program includes core and cross-listed courses in anthropology, history, economics, English, history, health and human performance, political science, psychology, religion, sociology, speech communication, and world languages and cultures.

Student Learning Outcomes

Through student-driven discussions, based on engagement with critical and cultural texts by feminist scholars and activists, the Women's and Gender Studies Program curriculum will help students develop the necessary skills to:

- Increase awareness of women's history and experiences that affect representations of gender in contemporary society.
- Explore forms of social inequality through feminist theories and concepts.
- Understand how intersecting identities shape individuals and their life experiences.
- Analyze gender dynamics in different types of relationships.

Degree Requirements

Women's and Gender Studies (B.A., B.S.)

An undergraduate major requires a minimum 2.00 GPA in the 34 credits of core and cross-listed courses. Women's and Gender Studies' majors must satisfy the following requirements:

1. 16 credits selected from Women's and Gender Studies core courses (WGS).

A. Required core courses:

WGS 1600	Gender Justice	1
WGS 2010	Introduction to Women's and Gender Studies	3
WGS 3010	International Perspectives on Women and Gender	3
WGS 4010	Feminist Theories	3

WGS 4020	Feminist Research in Action	3
WGS 4910	Internship	3
or WGS 4990	Senior Thesis	
Total Credits		16

B. The remaining 18 credits of required coursework can be chosen from any of the following Areas of Emphasis: 1) Communication and Cultural Representation; 2) Identities and Sexualities; 3) Leadership and Social Justice; or students can work with their advisor to identify the set of courses that support their personal and professional goals.

1) Communication and Cultural Representation

Courses in this field offer diverse perspectives on how media and communication represent and shape culture in the US and around the world. Students engage with feminist literature, philosophy, art, and other expressions of culture in society. These themes are used to examine how the lives and roles of women have changed throughout history.

WGS 2100	Gender and Sexuality in American Pop Culture	3
WGS 3080	Write Like a Woman	3
WGS 3230	Gender and Communication	3
WGS 3250	Portrayals of Gender and Sexualities in the Media	3
WGS 3270	Gender and Sexualities in Society	3
WGS 3380	Feminist Philosophy	3
WGS 3450	Women's Literature	3
ENGL 3490	Multicultural Literatures of the United States	3
WGS 3520	Queer Literature	3
WGS 3700	Studies in English Translation	3
WGS 3740	Sex, Gender, and Culture in the Ancient Mediterranean World	3
WGS 4220	Women, Men, and the English Language	3
WGS 4300	Gender and Consumer Culture	3
WGS 4500	Topics in Women's and Gender Studies	3
WGS 4600	Seminar in Gender and Ethnicity	3
WGS 4900	Independent Study	1-3
WGS 4940	Women/Gender in Art	3
WGS 5450	Women's Literature	3
WGS 5940	Women/Gender in Art	3

2) Identities and Sexualities

This area highlights the growing emphasis in Women's and Gender Studies on how experiences and societal narratives shape and are impacted by gender identities and sexualities. Courses explore power relations, oppression, privilege, and resistance as ways of understanding these social identities. Students will learn about how issues of race,

class, gender, sexuality, and other axes of difference intersect and enable political resistance.

WGS 2030	Introduction to Lesbian Communities	3
WGS 2050	Introduction to Queer Studies	3
WGS 2100	Gender and Sexuality in American Pop Culture	3
WGS 3080	Write Like a Woman	3
WGS 3250	Portrayals of Gender and Sexualities in the Media	3
WGS 3270	Gender and Sexualities in Society	3
WGS 3280	Sociology of Masculinities and Manhood	3
WGS 3360	Religion, Sex and Gender	3
WGS 3390	Goddess Religions	3
WGS 3440	Human Reproduction	3
WGS 3460	Psychology of Women	3
ENGL 3490	Multicultural Literatures of the United States	3
AFAM 3500	Women of Color in the U.S	3
WGS 3520	Queer Literature	3
WGS 3740	Sex, Gender, and Culture in the Ancient Mediterranean World	3
WGS 3800	History of Women in Science, Technology, and Medicine	3
WGS 3860	History of Women in America	3
WGS 4100	Human Trafficking	3
WGS 4250	Intersections of Race, Class and Gender	3
WGS 4300	Gender and Consumer Culture	3
WGS 4400	Gender Issues in Sports	3
WGS 4500	Topics in Women's and Gender Studies	3
WGS 4570	History of American Sexualities	3
WGS 4900	Independent Study	1-3
WGS 4940	Women/Gender in Art	3
WGS 5250	Intersections of Race, Class and Gender	3
WGS 5860	Readings Seminar in Women's and Gender History	3

3) Leadership and Social Justice

Courses in this area of specialization provide students with the tools and theories needed to become successful change agents, activists, and community organizers. These courses explore how social movements can transform communities, cultural norms, and global systems. Students will engage with critiques and the context of movements such as transnational feminism, Black Lives Matter, LGBTQIA+ Pride, and #MeToo.

WGS 2100	Gender and Sexuality in American Pop Culture	3
WGS 3070	Women in Science and Engineering	3
ENVS 3200	Ecofeminism	3

WGS 3210	Economics of Discrimination	3
WGS 3330	Women, Gender, and Leadership	3
WGS 3440	Human Reproduction	3
AFAM 3500	Women of Color in the U.S.	3
WGS 3800	History of Women in Science, Technology, and Medicine	3
WGS 3850	Women in Politics	3
WGS 3860	History of Women in America	3
WGS 3870	First Ladies in U.S. History	3
WGS 4100	Human Trafficking	3
WGS 4250	Intersections of Race, Class and Gender	3
WGS 4350	Gender, Globalization and Development	3
WGS 4400	Gender Issues in Sports	3
WGS 4500	Topics in Women's and Gender Studies	3
WGS 4900	Independent Study	1-3
WGS 5860	Readings Seminar in Women's and Gender History	3

A minor or additional major is recommended. The typical degree awarded is a Bachelor of Arts; students interested in a Bachelor of Science degree in Women's and Gender Studies need to complete 12 credits in addition to the general education requirements across the areas of natural science, mathematics, and social science.

Communication Proficiency requirement:

The Women's and Gender Studies major requires credit for ENGL 1500; ENGL 2500 (or ENGL 2500H) (with a grade of C or better, per the university-wide Communication Proficiency Grade Requirement); and WGS 3010 or WGS 4010 or WGS 4020 (with a grade of C or better).

Students in all ISU majors must complete a three-credit course in U.S. Cultures and Communities and a three-credit course in International Perspectives. Check (<http://www.registrar.iastate.edu/courses/div-ip-guide.html>) for a list of approved courses. Discuss with your advisor how the two courses that you select can be applied to your graduation plan.

LAS majors require a minimum of 120 credits, **including a minimum of 45 credits at the 3000/4000 level**. You must also complete the LAS General Education requirements as well as the world language and career proficiency requirements.

As majors in the College of Liberal Arts and Sciences, Women's and Gender Studies students must meet College of Liberal Arts and Sciences and University-wide requirements for graduation in addition to those stated above for the major.

Four Year Plan

Women's and Gender Studies, B.A., B.S. (1)

Freshman

Fall	Credits Spring	Credits
ENGL 1500	3 WGS 2010	3
LIB 1600	1 Math Choice	3
World Language/Elective ¹	3-4 World Language/Elective	3-4
Humanities Choice	3 Humanities Choice	3
Natural Science Choice	3 Social Science Choice	3
Social Science Choice	3	
16-17		15-16

Sophomore

Fall	Credits Spring	Credits
U.S. Cultures and Communities Choice	3 Women's and Gender Studies Choices - 2000/3000 Level	6
WGS 3010	3 Int'l Perspectives Choice	3
WGS 1600	1 Humanities Choice	3
Humanities Choice	3 Social Science Choice	3
ENGL 2500	3 LAS 2030	1
Natural Science Choice	3	
16		16

Junior

Fall	Credits Spring	Credits
Women's and Gender Studies Choice - 3000/4000 Level	3 Electives - 3000/4000 Level	9
Electives	7 WGS 4020	3
Natural Science Choice	2 Women's and Gender Studies Choice - 3000/4000 Level	3
WGS 4010	3	
15		15

Senior

Fall	Credits Spring	Credits
Women's and Gender Studies Choice - 3000/4000 Level	6 Electives	5
Elective - 3000/4000 Level	6 Electives - 3000/4000 Level	6

WGS 4910 or 4990	1-3 Women's and Gender Studies Choice - 3000/4000 Level	3
13-15		14

Total Credits: 120-124

Minor

Undergraduate students may minor in Women's and Gender Studies by taking 15 semester hours of Women's and Gender Studies classes, including the following:

WGS 2010	Introduction to Women's and Gender Studies	3
WGS 3010	International Perspectives on Women and Gender	3
One 4000-level WGS course and 6 additional credits in WGS; at least 3 of the additional credits must be at the 3000-4000 level.		9

University policy requires that at least 3 credits used for the minor stand alone and are not used to meet any other requirement. All WGS courses for the minor require a grade of C (not C-) or higher.

Any student can declare a major or minor in Women's and Gender Studies or choose to co-major in another program. Students interested in a minor or major in Women's and Gender Studies should contact the director or the undergraduate advisor in the program.

The Women's and Gender Studies Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

Graduate Study

The graduate minor in Women's and Gender Studies is designed to provide students with knowledge of theories and methods within a variety of approaches in feminist scholarship. The program seeks to integrate and synthesize knowledge from many disciplines and to offer students opportunities for systematic study of gender and women's experiences and perspectives in all knowledge fields. Students will be prepared to take a leadership role in supporting gender equity and diversity in their careers in education, social service work, business, law, public policy, governmental and non-governmental organizations, and research.

The graduate minor requires 9 credits for students enrolled in a master's or a doctoral degree program. Students are required to take either WGS 5010 Contemporary Feminist Theories or WGS 5020 Advanced Seminar in Feminist Research Methods; taking both is strongly recommended. Students will also take two or three electives selected from the list of core and cross-listed Women's and Gender Studies courses approved for graduate study. At least one member of the faculty affiliated with Women's and Gender Studies will serve on the program

of study for doctoral students. A list of eligible faculty members may be obtained from the Director of the Women's and Gender Studies Program.

World Film Studies Minor
World Film Studies

The World Film Studies undergraduate minor is an interdisciplinary, cross-cultural program in the department of World Languages and Cultures that provides coursework in the history, theory, and aesthetics of world cinemas. Upon completion of the World Film Studies minor students will

- 1) Demonstrate solid skills of formal film analysis and knowledge of the essential theoretical concepts of cinema studies;
- 2) Become familiar with prominent film directors, influential cinematic works, and cinematic traditions across the world;
- 3) Gain an understanding of the evolution of cinema as an art form; understand the relations between cinema and other arts;
- 4) Acquire knowledge and understanding of cinema as a mode of cultural expression and communication; develop new perspectives on U.S. culture and cinema through comparison with other world cultures and cinemas.

A student seeking an undergraduate minor in World Film Studies must successfully complete a minimum of 15 credits, which must include WFS 2780 or ENGL 2370 Survey of Film History and 12 credits selected from the following list of electives. Of these, at least 6 credits must be from courses taught in the department of World Languages and Cultures. The minor must include at least 3 credits that are not used to meet any other department, college or university requirement.

Courses taught in WLC (at least 6 credits)

CHIN 3780	Chinese Film and Society	3
FRNCH 3260	French and Francophone Film	3
FRNCH 3780	French Cinema	3
GER 3780	German Film and Media Studies	3-4
RUS 3780	Russian Film Studies in English	3
SPAN 3260	Studies in Hispanic Art or Film	3
SPAN 3780	Hispanic Film Studies in English	3

Courses outside of WLC (up to 6 credits)

ENGL 3150	Creative Writing: Screenplays	3
ENGL 3350	Studies in Film	3
ENGL 4500	Seminar in Literary Genres	3
JLMC 3070	Fundamentals of Digital Video Production	3
AMIN 2050	American Indians in the Movies	3

ENGL 4450 Seminar: Literature/Film Crossing Boundaries counts toward the minor when taught as a film course.

Curricular note: no more than 6 credits of each repeatable course (FRNCH 3260 and FRNCH 3780) may be applied to the minor. Both WLC 2780 and ENG 2370 (6 credits max) may count toward the minor.

The World Film Studies Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

World Languages and Cultures

OVERVIEW OF DEPARTMENT OFFERINGS

World language study should be an integral part of an academic program for most students. The theoretical understanding of and practical experience in language underlie many intellectual disciplines that try to meet the complex problems of contemporary society. Courses offered by the Department of World Languages and Cultures are designed to develop students' understanding of a second culture through the language spoken by that culture.

The Department of World Languages and Cultures offers the following majors:

- Anthropology (B.A. or B.S.)
- World Languages and Cultures (B.A.) with the following options:
 - French
 - German
 - Spanish
 - Language Teacher Preparation, for French, German, Spanish
- World Languages and Cultures Additional Major with the following options for students with a primary major in another field:
 - French - OR - French (Languages and Cultures for Professions)
 - German - OR - German (Languages and Cultures for Professions)
 - Spanish - OR - Spanish (Languages and Cultures for Professions)

The Department of World Languages and Cultures offers the following minors:

- Anthropology
- Chinese Studies
 - Chinese Studies (Option: Languages and Cultures for Professions)
- French
- German
 - German (Option: Languages and Cultures for Professions)
- Middle Eastern Studies
- Russian Studies
 - Russian Studies (Option: Languages and Cultures for Professions)
- Spanish
 - Spanish (Option: Languages and Cultures for Professions)

- Spanish Translation and Interpretation Studies
- World Film Studies

Additional Language Instruction

- American Sign Language
- Arabic
- Classical Latin
- Italian
- Portuguese

The Department houses several College of Liberal Arts and Sciences Cross Disciplinary Studies Programs:

- American Indian Studies
- Classical Studies
- International Studies
- U.S. Latino/a Studies

Students at all levels of world language study will have access to the Language Studies Resource Center, located in 3142 Pearson. The Resource Center contains an extensive collection of world language materials, including audio-visual materials, electronic resources, music, books, language specific software and hardware, and other course-related materials.

WORLD LANGUAGES AND CULTURES, B.A.

World Languages and Cultures (B.A.) with the following options:

- French
- German
- Spanish
- Language Teacher Preparation, for French, German, Spanish

As majors in the College of Liberal Arts and Sciences, World Languages and Cultures students must meet College of Liberal Arts and Sciences and University-wide requirements for graduation in addition to those stated for the major and option.

WORLD LANGUAGES AND CULTURES ADDITIONAL MAJOR

The World Languages and Cultures Additional Major has six options, plus teacher preparation.

- French
- French (Languages and Cultures for Professions)
- German
- German (Languages and Cultures for Professions)
- Spanish

- Spanish (Languages and Cultures for Professions)
- Language Teacher Preparation, for French, German, Spanish

Student Learning Outcomes for the World Languages and Cultures Major

Upon the completion of their program of studies in the Department of World Languages and Cultures, majors with a concentration in French, German, or Spanish will demonstrate proficiency in five goal areas: Communication, Cultures, Connections, Comparisons, and Communities. Using their concentration language, students will be able to:

1. **COMMUNICATION:** understand, interpret, and present information, negotiate meaning, and communicate in spoken or written conversations to share information, reactions, feeling, and opinions to various audiences of listeners, readers, or viewers.
2. **CULTURES:** investigate, explain, and reflect on the relationship between the practices and the perspectives of the cultures studied.
3. **CONNECTIONS:** demonstrate their ability to build, reinforce, and expand their knowledge of other disciplines and to access and evaluate information from diverse perspectives, while also developing critical thinking to solve problems creatively.
4. **COMPARISONS:** investigate, explain, and reflect on the nature of language as well as the concept of culture through comparisons of their own culture with other cultures and the language studied.
5. **COMMUNITIES:** demonstrate an ability to use the language both within and beyond the classroom and to interact and collaborate in their community and the globalized world while also setting goals and reflecting on their progress in using languages for enjoyment, enrichment, and advancement.

Graduates will achieve both linguistic proficiency and cultural literacy through the study of the language and culture of their program. Linguistic proficiency entails the ability to function effectively in the target language and the ability to communicate competently with native speakers of the target language. Cultural literacy includes a general knowledge of the culture's history, familiarity with its literature, and basic knowledge of its social and political institutions.

GENERAL B.A. REQUIREMENTS

LAS majors require a minimum of 120 credits, including a minimum of 45 credits at the 3000/4000-level. You must also complete the LAS world language requirement and career proficiency requirement (LAS 2030 Professional Career Preparation).

Students in all ISU majors must complete a three-credit course in U.S. Cultures and Communities and a three-credit course in International Perspectives. Check (<http://www.registrar.iastate.edu/courses/div-ip->

[guide.html](#)) for a list of approved courses. Discuss with your advisor how the two courses that you select can be applied to your graduation plan.

Communication Proficiency Requirements: According to the university-wide Communication Proficiency Grade Requirement, students must demonstrate their communication proficiency by earning a grade of C or better in ENGL 2500 Written, Oral, Visual, and Electronic Composition (or ENGL 2500H Written, Oral, Visual, and Electronic Composition: Honors). As the upper-level communication requirement, the Department requires a grade of C or better in any course numbered between 3700 and 3790 taught by the Department of World Languages and Cultures (with the exception of Anthropology courses) or the interdepartmental program in Classical Studies. Such a course will also fill an LAS Area I (Arts and Humanities) requirement.

LANGUAGES AND CULTURES FOR PROFESSIONS (LCP)

What are Languages and Cultures for Professions? The primary objective of the LCP options is to provide learning environments within which students can achieve global literacy, linguistic proficiency, and intercultural competence. In the LCP curriculum, students will learn how professions are shaped by social and cultural forces and, alternatively, how professions shape society. In courses on contemporary culture and society, students will identify and analyze issues dealing with the complex interrelationships of languages and cultures and consider how they may affect their chosen profession. Students will experience living and working in diverse cultural settings through study abroad and internship opportunities offered through the LCP program and/or in collaboration with their respective primary-major colleges or the ISU Study Abroad Center.

Students can complete a World Languages and Cultures Additional Major with an option in French LCP, German LCP, or Spanish LCP. The following LCP minors are available: Chinese Studies (LCP), German (LCP), Russian Studies (LCP), Spanish (LCP). Students enrolled in an LCP option of the World Languages and Cultures Additional Major may receive non-graded academic credit for the successful completion of internships (WLC courses numbered 4990 in each language area).

For the LCP options of the World Languages and Cultures Additional Major, students will complete 30 credits within their language concentration (see specific language requirements to the right) beyond the fourth-semester level, selected from the list of approved LCP core courses and electives designated for their respective college curricula. Students may only enroll in the LCP options as an WLC Additional Major and may not graduate with the LCP option in the WLC primary major.

Students in the College of Business may combine course work in the International Business (IB) Secondary Major with course work in LCP by selecting from a list of approved options. Students should consult their

academic advisor in the College of Business and the WLC advisor for coursework and international experience that fulfill requirements in both the IB and LCP options.

American Sign Language (ASL)

The Department of World Languages and Cultures offers coursework in American Sign Language. There are no minors or major options.

A listing of American Sign Language Coursework is available in the A-Z course list and below.

Courses primarily for undergraduate students

ASL 1010: American Sign Language I

Credits: 4. Contact Hours: Lecture 4.

Introduction to American Sign Language (ASL). Development of expressive and receptive skills including vocabulary, grammar, usage, and cultural information. Note: Distinct from 'Signed English'. ASL is a natural language with its own rules of grammar and usage. (Typically Offered: Fall, Spring)

ASL 1020: American Sign Language II

Credits: 4. Contact Hours: Lecture 4.

Prereq: ASL 1010

Introduction to American Sign Language (ASL) II continues development of expressive and receptive skills introduced in American Sign Language I, including vocabulary, grammar, usage, and cultural information. Distinct from 'Signed English'. ASL is a natural language with its own rules of grammar and usage. (Typically Offered: Spring)

ASL 1070: Introduction to the Deaf-World

Credits: 1. Contact Hours: Lecture 1.

Nature and significance of the Deaf-World as a cultural and linguistic minority.

ASL 2010: Intermediate American Sign Language I

Credits: 4. Contact Hours: Lecture 4.

Prereq: ASL 1020

Development of fluency for intermediate conversational skills. Review of grammar and varying grammatical forms for both structured and unstructured social situations such as sharing opinions, discussing weekend activities, and exchanging views on current topics. (Typically Offered: Fall)

ASL 2020: Intermediate American Sign Language II

Credits: 4. Contact Hours: Lecture 4.

Prereq: ASL 2010

A continuation and further application of language principles learned in ASL 2010, to deepen ability to actively engage in dialogue both in structured and unstructured social situations. Further fluency in intermediate conversational skills will be developed, particularly in the areas of semantic equivalence and dialogic/monologic register. (Typically Offered: Spring)

ASL 2750: Topics in Deaf Culture

Credits: 3. Contact Hours: Lecture 3.

Focus on contemporary topics in Deaf Culture, Communities, and History. Readings and discussion from a wide range of sources. Topics vary according to faculty interest.

ASL 3050: ASL Classifiers and Depiction

Credits: 3. Contact Hours: Lecture 3.

Prereq: ASL 2010

Focused analysis, documentation, discussion, and increased development of classifiers and depiction in ASL. Investigation in how these grammatical features are deliberately incorporated into conversational, presentational, scientific, and artistic language production.

ASL 3250: Deaf Peoples: Pre-World War II

Credits: 3. Contact Hours: Lecture 3.

Prereq: ASL 2020 or Permission of Instructor

Perspectives on and treatment of deaf people as individuals and groups prior to World War II. Taught in American Sign Language. (Typically Offered: Fall)

ASL 4900: Independent Study

Credits: 1-6. Repeatable, maximum of 6 credits.

Designed to meet the needs of students in areas other than those in which courses are offered, or who desire to integrate a study of literature or language with special problems in major fields. Graduation Restriction: No more than 6 credits of ASL 4900 may be counted towards graduation. (Typically Offered: Fall, Spring, Summer)

Arabic (ARABC)

The Department of World Languages and Cultures offers coursework in Arabic. There are no minors or major options.

A listing of Arabic Coursework is available in the A-Z course list and below.

ARABC 1010: Elementary Arabic I

Credits: 4. Contact Hours: Lecture 5.

Beginning level development of reading, writing, listening comprehension, and speaking in Arabic, within the context of Arabic culture. Attention to the use of the Arabic alphabet. (Typically Offered: Fall)

ARABC 1020: Elementary Arabic II

Credits: 4. Contact Hours: Lecture 5.

Prereq: ARABC 1010 or placement by department exam

Continuation of ARABC 1010. Beginning level development of reading, writing, listening comprehension, and speaking in Arabic, within the context of Arabic culture. Meets International Perspectives Requirement. (Typically Offered: Spring)

ARABC 1950: Study Abroad

Credits: 1-30.

Supervised instruction in Arabic language and culture, formal class instruction at level appropriate to student's training, augmented by practical living experience. Taught in Arabic. (Typically Offered: Summer)

ARABC 2010: Intermediate Arabic I

Credits: 4. Contact Hours: Lecture 4.

Prereq: ARABC 1020 or placement by department exam

Intermediate level development of reading, writing, listening comprehension, and speaking in Arabic, within the context of Arabic culture. Meets International Perspectives Requirement. (Typically Offered: Fall)

ARABC 2020: Intermediate Arabic II

Credits: 4. Contact Hours: Lecture 4.

Prereq: ARABC 2010 or placement by department exam

Continuation of ARABC 2010. Intermediate level development of reading, writing, listening comprehension, and speaking in Arabic, within the context of Arabic culture. Meets International Perspectives Requirement.

ARABC 2950: Study Abroad

Credits: 1-30.

Prereq: ARABC 1020

Supervised instruction in Arabic language and culture, formal class instruction at level appropriate to student's training, augmented by practical living experience. Taught in Arabic. (Typically Offered: Summer)

ARABC 3750: Arab Culture

Credits: 3. Contact Hours: Lecture 3.

Survey of contemporary Arab culture in the Middle East and North Africa as reflected in history, language, the arts, and social institutions with attention to the Arab Diaspora. Taught in English. Meets International Perspectives Requirement. (Typically Offered: Spring)

ARABC 4900: Independent Study

Credits: 1-6. Repeatable.

Prereq: Instructor Permission for Course

CHINESE

Minor in Chinese Studies

The Minor in Chinese Studies requires the following 17 credits:

CHIN 2010	Intermediate Mandarin Chinese I	4
CHIN 2020	Intermediate Mandarin Chinese II	4
Electives at the 3000-level and above		
6-9 credits from the following		6-9
CHIN 3010	Advanced Mandarin Chinese I	
CHIN 3020	Advanced Mandarin Chinese II	
CHIN 3040	Chinese for Global Professionals	
CHIN 3700	Chinese Literature in English Translation	
CHIN 3710X	Chinese Calligraphy: History, Appreciation and Practice	
CHIN 3720	Introduction to Chinese Culture	
CHIN 3750	China Today	
CHIN 3780	Chinese Film and Society	
CHIN 4030A	Seminar in Chinese Language and Culture: Translating Contemporary Chinese Texts	
CHIN 4030B	Seminar in Chinese Language and Culture: Topics on Business and Professions	
CHIN 4030C	Seminar in Chinese Language and Culture: Reading Chinese Texts	
0-3 credits from the following:		
ARCH 4270	History, Theory, and Criticism of Chinese Architecture	
HIST 3360	Ancient China	
HIST 3370	Modern China	
POLS 3420	Chinese Politics	

The Chinese Studies Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

Minor in Chinese Studies (Option: Languages and Cultures for Professions)

Students who complete a Minor in Chinese Studies (Languages and Cultures for Professions) seek to become culturally-competent global professionals and engage in language and cultural training. The minor requires the following 17 credits:

CHIN 2010	Intermediate Mandarin Chinese I	4
CHIN 2020	Intermediate Mandarin Chinese II	4

Electives at the 3000-level and above

6-9 credits from the following: 6-9

CHIN 3010	Advanced Mandarin Chinese I
CHIN 3020	Advanced Mandarin Chinese II
CHIN 3040	Chinese for Global Professionals
CHIN 3700	Chinese Literature in English Translation
CHIN 3710X	Chinese Calligraphy: History, Appreciation and Practice
CHIN 3720	Introduction to Chinese Culture
CHIN 3750	China Today
CHIN 3780	Chinese Film and Society
CHIN 4030A	Seminar in Chinese Language and Culture: Translating Contemporary Chinese Texts
CHIN 4030B	Seminar in Chinese Language and Culture: Topics on Business and Professions
CHIN 4030C	Seminar in Chinese Language and Culture: Reading Chinese Texts
CHIN 4990	Internship in Chinese

0-3 credits from the following:

ARCH 4270	History, Theory, and Criticism of Chinese Architecture
HIST 3360	Ancient China
HIST 3370	Modern China
POLS 3420	Chinese Politics

Students in the Chinese LCP Minor are encouraged to study abroad in a Chinese-speaking country or complete a relevant internship.

The Chinese Studies Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

A listing of all Chinese Coursework is available in the A-Z course list.

FRENCH

World Languages and Cultures, B.A., French Option

See World Languages and Cultures, B.A. for general requirements.

W.L.C. (World Languages and Cultures) Students with a concentration in French must complete at least 30 credits beyond the intermediate level (FRNCH 2010 & FRNCH 2020).

Required Courses for the French Studies Option (12 credits)

FRNCH 3010	Language, Culture, Contexts	3
FRNCH 3020	Text and Media Analysis	3
FRNCH 3400	Cultural Expressions in the French-Speaking World	3
FRNCH 4400	Seminar in French and/or Francophone Studies	3

Additional Courses (at least 18 credits)

FRNCH 3040	French for Global Professionals	3
FRNCH 3050	French Conversation	3
FRNCH 3100	French Pronunciation	1
FRNCH 3200	France Today	3
FRNCH 3260	French and Francophone Film	3
FRNCH 3400	Cultural Expressions in the French-Speaking World	3
FRNCH 3700	French Studies in English	3
FRNCH 3750	Francophone Studies in English	3
FRNCH 3780	French Cinema	3
FRNCH 3950	Study Abroad	1-10

No more than 6 credits from FRNCH 3700, FRNCH 3750, and/or FRNCH 3780 may be counted for the major.

Study Abroad: The department strongly recommends that all students of French participate in an approved study abroad program based in a French-speaking country. Credit from an approved study abroad program may be applied to the major or minor.

Complementary Coursework for French Teacher Preparation

EDUC 4260	Principles of Secondary Education	3
WLC 4870	Methods in Secondary School World Language Instruction (same as EDUC 4870 & LING 4870)	3
or ENGL 3180	Introduction to ESL methods and materials	
PSYCH 2300	Developmental Psychology	3
POLS 1110	Introduction to American Government (or a course in U.S. History)	3

Additional requirements of the Secondary Major in Education. See footnote for catalog link to requirements. ^{TP}

^{TP}Students preparing to teach a language declare the Secondary Major in Education and complete the additional course requirements.

World Languages and Cultures Additional Major, French Option

The requirements for the World Languages and Cultures Additional Major with the French Option are the same as the major requirements for the primary major listed above.

World Languages and Cultures Additional Major, French Language and Cultures for Professions (LCP) Option

Students who complete an additional major in World Languages and Cultures with LCP Option seek to become culturally competent global professionals and engage in language and cultural training. Note: Students may only enroll in the French Languages and Cultures for

Professions (LCP) Option as an additional major; they may not graduate with this as a primary major.

Students are required to take at least 30 credits beyond the intermediate level (FRNCH 2010 & FRNCH 2020).

Required LCP Core Courses (16 credits)

FRNCH 3010	Language, Culture, Contexts	3
FRNCH 3020	Text and Media Analysis	3
FRNCH 3040	French for Global Professionals	3
FRNCH 3200	France Today	3
FRNCH 3400	Cultural Expressions in the French-Speaking World	3
FRNCH 4990	Internship in French	1-3

Additional Courses (at least 14 credits)

FRNCH 3050	French Conversation	3
FRNCH 3100	French Pronunciation	1
FRNCH 3260	French and Francophone Film	3
FRNCH 3400	Cultural Expressions in the French-Speaking World	3
FRNCH 3700	French Studies in English	3
FRNCH 3750	Francophone Studies in English	3
FRNCH 3780	French Cinema	3
FRNCH 3950	Study Abroad	1-10
FRNCH 4400	Seminar in French and/or Francophone Studies	3

No more than 6 credits from FRNCH 3700, FRNCH 3750, and/or FRNCH 3780 may be counted for the major.

MINOR IN FRENCH

The Minor in French requires at least 17 credits of courses taught in French beyond the elementary level (FRNCH 1010 Elementary French I & FRNCH 1020 Elementary French II).

Required Core Courses (11 credits)

FRNCH 2010	Intermediate French I	4
FRNCH 2020	Intermediate French II	4
FRNCH 3010	Language, Culture, Contexts	3

Additional Courses (at least 6 credits)

FRNCH 3020	Text and Media Analysis	3
FRNCH 3040	French for Global Professionals	3
FRNCH 3050	French Conversation	3
FRNCH 3200	France Today	3
FRNCH 3260	French and Francophone Film	3
FRNCH 3400	Cultural Expressions in the French-Speaking World	3
FRNCH 3700	French Studies in English	3
	or FRNCH 3750 Francophone Studies in English	
	or FRNCH 3780 French Cinema	

FRNCH 3950	Study Abroad	1-10
FRNCH 4400	Seminar in French and/or Francophone Studies	3

Study Abroad: The department strongly recommends that all students of French participate in an approved study abroad program based in a French-speaking country. Credit from an approved study abroad program may be applied to the major or minor.

The French Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

A listing of all French Coursework is available in the A-Z course list.

GERMAN

World Languages and Cultures, B.A., German Option

See World Languages and Cultures, B.A. for general requirements.

Students with a concentration in German must complete at least 30 credits beyond the intermediate level (GER 2010 & GER 2020).

German Option Required Core Courses (22 credits)

GER 3010	Reading	3
GER 3020	Composition	3
GER 3040	German for Global Professionals	3
GER 3050	Conversation	3
GER 3200	Germany Today	3
GER 3300	German Literature and Culture	3
GER 4760	Topics in German Cultural Studies	4

Additional Courses (8 credits)

GER 3300	German Literature and Culture (Repeatable once when offered with a different topic.)	
GER 4990	Internship in German (Study Abroad and Internship Option)	

Courses taught in English (maximum of eight credits applicable towards the major; must enroll for 4 credits)

GER 3700	German Studies in English	
GER 3710	The Holocaust in Text, Image, and Memory	
GER 3750	Grimms' Tales	
GER 3780	German Film and Media Studies	

Study Abroad: The department strongly recommends that all students of German participate in an approved study abroad program based in a German-speaking country. Credit from an approved study abroad program may be applied to the major.

Complementary Coursework for German Teacher Preparation

EDUC 4260	Principles of Secondary Education	3
WLC 4870	Methods in Secondary School World Language Instruction (same as EDUC 4870 & LING 4870)	3
or ENGL 3180	Introduction to ESL methods and materials	
PSYCH 2300	Developmental Psychology	3
POLS 1110	Introduction to American Government (or a course in U.S. History)	3

Additional requirements of the Secondary Major in Education. See footnote for catalog link to requirements. ^{TP}

^{TP}Students preparing to teach a language declare the Secondary Major in Education and complete the additional course requirements.

World Languages and Cultures Additional Major, German Option

The requirements for the World Languages and Cultures Additional Major with the German Option are the same as the major requirements for the primary major listed above.

World Languages and Cultures Additional Major, German Language and Cultures for Professions (LCP) Option

Students who complete an additional major in World Languages and Cultures with LCP Option seek to become culturally competent global professionals and engage in language and cultural training. Note: Students may only enroll in the German Languages and Cultures for Professions (LCP) Option as an additional major; they may not graduate with this as a primary major.

Students must complete a minimum of 30 credits beyond the intermediate level (GER 2010 Intermediate German I & GER 2020 Intermediate German II).

Required German LCP Core Courses (19 credits)

GER 3010	Reading	3
GER 3040	German for Global Professionals	3
GER 3050	Conversation	3
GER 3200	Germany Today	3
GER 4760	Topics in German Cultural Studies	4
GER 4990	Internship in German (or approved credit-bearing study abroad experience)	3
Additional Courses (11 credits)		
GER 3020	Composition	3
GER 3300	German Literature and Culture	3

Courses taught in English (maximum of eight credits applicable towards the major; must enroll for 4 credits)

GER 3700	German Studies in English
GER 3710	The Holocaust in Text, Image, and Memory
GER 3750	Grimms' Tales
GER 3780	German Film and Media Studies

Minor in German

The Minor in German requires at least 17 credits of courses taught in German. At least 9 credits must be 3000-level German courses, 3 credits of which must be chosen from GER 3200 and 3300.

GER 2010	Intermediate German I	4
GER 2020	Intermediate German II	4
3 credits must be in literature or culture taught in German		3
GER 3200	Germany Today	
	or GER 3300 German Literature and Culture	
6 additional credits from the following		6
GER 3010	Reading	
GER 3020	Composition	
GER 3040	German for Global Professionals	
GER 3050	Conversation	
GER 3200	Germany Today	
GER 3300	German Literature and Culture	

Note: Courses taught primarily in English (German 3700, 3710, 3750, 3780, and 4760) cannot count toward the German minor.

The German Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

Minor in German (Option: Language and Cultures for Professions)

Students who complete a Minor in German (Option: Languages and Cultures for Professions) seek to become culturally competent global professionals and engage in language and cultural training. The German Minor (LCP Option) requires at least 17 credits of courses taught in German. At least 9 credits must be 3000-level German courses, including the required course GER 3040.

GER 2010	Intermediate German I	4
GER 2020	Intermediate German II	4
GER 3040	German for Global Professionals	3
6 additional credits from the following		6
GER 3010	Reading	
GER 3020	Composition	
GER 3050	Conversation	
GER 3200	Germany Today	

GER 3300 German Literature and Culture

Note: Courses taught primarily in English (German 3700, 3710, 3750, 3780, and 4760) cannot count toward the German LCP Minor.

The German Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

A listing of all German Coursework is available in the A-Z course list.

Italian (ITAL)

The Department of World Languages and Cultures offers coursework in Italian. There are no minors or major options.

A listing of Italian Coursework is available in the A-Z course list and below.

ITAL 1070: Intensive Beginning Italian

Credits: 4. Contact Hours: Lecture 4.

A communicative approach to grammar and vocabulary within the context of Italian culture for students whose native language is not Italian. Taught in Italian. (Typically Offered: Fall, Spring)

Latin (LATIN)

The Department of World Languages and Cultures offers coursework in Latin. There are no minors or major options.

For courses in Latin literature taught in English, see Classical Studies.

A listing of Latin Coursework is available in the A-Z course list and below.

Courses primarily for undergraduate students

LATIN 1010: Elementary Latin I

Credits: 3. Contact Hours: Lecture 3.

Grammar and vocabulary of classical Latin, within the context of Roman culture; reading knowledge through texts adapted from classical authors. (Typically Offered: Fall)

LATIN 1020: Elementary Latin II

Credits: 3. Contact Hours: Lecture 3.

Grammar and vocabulary of classical Latin, within the context of Roman culture; reading knowledge through texts adapted from classical authors. Meets International Perspectives Requirement. (Typically Offered: Spring)

LATIN 4900: Independent Study

Credits: 1-6. Repeatable, maximum of 9 credits.

Prereq: 9 credits in LATIN; Permission of Department Chair

Designed to meet the needs of students who seek work in areas other than those in which courses are offered, or who desire to integrate a study of literature or language with special problems in major fields. Graduation Restriction: No more than 9 credits in LATIN 4900 may be counted toward graduation.

Portuguese (PORT)

The Department of World Languages and Cultures offers coursework in Portuguese. There are no minors or major options.

A listing of Portuguese Coursework is available in the A-Z course list and below.

Courses primarily for undergraduate students

PORT 1010: Elementary Portuguese I

Credits: 4. Contact Hours: Lecture 4.

An introduction to the Portuguese language through the communicative approach within the context of Luso-Brazilian culture.

PORT 1020: Elementary Portuguese II

Credits: 4. Contact Hours: Lecture 4.

Prereq: PORT 1010

An introduction to the Portuguese language through the communicative approach within the context of Luso-Brazilian culture. Meets International Perspectives Requirement.

PORT 1110: Intensive Beginning Portuguese

Credits: 3. Contact Hours: Lecture 3.

A communicative approach to grammar and vocabulary within the context of Luso-Brazilian culture for students whose native language is not Portuguese. Taught in Portuguese.

PORT 1120: Elementary Portuguese, Accelerated II

Credits: 3. Contact Hours: Lecture 3.

Prereq: PORT 1110

An introduction to the Portuguese language through the communicative approach within the context of Luso-Brazilian culture. Meets International Perspectives Requirement.

PORT 3750: Brazil Today

Credits: 3. Contact Hours: Lecture 3.

A survey of social, political, economic, and cultural topics relevant to contemporary Brazil. Includes an introduction to Portuguese language. Meets International Perspectives Requirement. (Typically Offered: Fall)

RUSSIAN

Minor in Russian Studies

The Minor in Russian Studies requires 17 credits, 9 of which must be at the 3000-level or higher.

RUS 2010	Intermediate Russian I	4
RUS 2020	Intermediate Russian II	4
9 credits must be at the 3000-level and above, including at least 3 credits in the Russian curriculum (courses taught in English or Russian).		9
RUS 3010	Composition and Conversation	
RUS 3040	Russian for Global Professionals	
RUS 3140	Reading Russian Literary and Cultural Texts	
RUS 3700	Russian Studies in English Translation	
RUS 3700A	Russian Studies in English Translation: Topics in Russian Literature	
RUS 3700B	Russian Studies in English Translation: Russian Fairy Tales	
RUS 3700R	Studies in English Translation: Russian Topics on Women or Feminism	
RUS 3750	Russia Today	
RUS 3780	Russian Film Studies in English	
RUS 3950	Study Abroad	
RUS 4990	Internship in Russian	
RUS 5900A	Special Topics in Russian: Literature or Literary Criticism	
RUS 5900B	Special Topics in Russian: Linguistics	
RUS 5900C	Special Topics in Russian: Language Pedagogy	
HIST 4210	History of Russia I	
HIST 4220	History of Russia II	
HIST 5300	Readings Seminar in Modern Russian/Soviet History	
POLS 3490	Politics of Russia and Eastern Europe	

The Russian Studies Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

Minor in Russian Studies (Option: Languages and Cultures for Professions)

The Minor in Russian Studies (LCP) requires 17 credits.

Required Core Courses		11
RUS 2010	Intermediate Russian I	
RUS 2020	Intermediate Russian II	
RUS 3040	Russian for Global Professionals	

Electives 6

RUS 3010	Composition and Conversation	
RUS 3140	Reading Russian Literary and Cultural Texts	
RUS 3700	Russian Studies in English Translation	
RUS 3700A	Russian Studies in English Translation: Topics in Russian Literature	
RUS 3700B	Russian Studies in English Translation: Russian Fairy Tales	
RUS 3700R	Studies in English Translation: Russian Topics on Women or Feminism	
RUS 3750	Russia Today	
RUS 3780	Russian Film Studies in English	
RUS 3950	Study Abroad	
RUS 4900	Independent Study	
RUS 4990	Internship in Russian	
RUS 5900A	Special Topics in Russian: Literature or Literary Criticism	
RUS 5900B	Special Topics in Russian: Linguistics	
RUS 5900C	Special Topics in Russian: Language Pedagogy	
HIST 4210	History of Russia I	
HIST 4220	History of Russia II	
HIST 5300	Readings Seminar in Modern Russian/Soviet History	
POLS 3490	Politics of Russia and Eastern Europe	

The Russian Studies Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

A listing of all Russian Coursework is available in the A-Z course list.

SPANISH

World Languages and Cultures, B.A., Spanish Option

See World Languages and Cultures, B.A. for general requirements.

Students with a concentration in Spanish must complete a minimum of 30 credits beyond the intermediate level (SPAN 2010 Intermediate Spanish I & SPAN 2020 Intermediate Spanish II).

Spanish Required Core Courses (9 credits)

SPAN 3030A	Spanish Conversation and Composition: through Culture	3
	or SPAN 3030B Spanish Conversation and Composition: for Professionals	
SPAN 3140	Textual and Media Analyses	3
SPAN 3520	Spanish Pronunciation	3

Additional Courses: Students must take at least 15 credits chosen from A, B, and C below (minimum 3 credits from each).

A) At least 3 credits of literary studies chosen from the following:

SPAN 3300	Studies in Spanish Literature
SPAN 3320	Studies in Latin American Literature

B) At least 3 credits of cultural studies chosen from the following:

SPAN 3040	Spanish for Global Professionals
SPAN 3210	Spanish Civilization
SPAN 3220	Latin American Civilization
SPAN 3230	Spain Today
SPAN 3240	Latin America Today
SPAN 3250	Culture and Community: Iowa and Midwest Latino/as
SPAN 3260	Studies in Hispanic Art or Film

C) At least 3 credits of applied language and linguistics chosen from the following:

SPAN 3020A	Mini-Modules for Global Professionals: Tourism and Hospitality
SPAN 3020B	Mini-Modules for Global Professionals: Health and Medicine
SPAN 3020C	Mini-Modules for Global Professionals: Criminal Justice and the Law
SPAN 3050	Spanish for Heritage Speakers
SPAN 3510	Introduction to Spanish-English Translation
SPAN 3540	Introduction to Spanish-English Interpretation
SPAN 4010	Advanced Composition and Grammar
SPAN 4620	Contrastive Analysis of Spanish/ English for Translators
SPAN 4630	Contemporary Spanish Linguistics
SPAN 4990	Internship in Spanish

Students may apply up to 6 credits of SPAN 3950 Study Abroad to section A, B, or C above (appropriate section based upon course content and assigned by the WLC advisor).

Students must take at least 6 credits of language, literature and/or culture at the 4000 level, chosen from the following (each repeatable to 6 credits):

SPAN 4400	Seminar on the Literatures and Cultures of Spain
SPAN 4410	Seminar on Cervantes and the Golden Age
SPAN 4450	Seminar on the Literatures and Cultures of Latin America
SPAN 4630	Contemporary Spanish Linguistics

Approved study abroad in a Spanish-speaking country or completion of an additional course from the approved options.

Study Abroad: The department strongly recommends that all students of Spanish participate in an approved study abroad program based in a Spanish-speaking country. Any student pursuing the World Languages and Cultures Major, B.A., Spanish Option who chooses not to participate in a department-approved study abroad program will be required to take 3 additional elective credits of Spanish at or above the SPAN 3210 level (for a total of 33 credits beyond the intermediate 2010-2020 level).

Complementary Coursework for Spanish Teacher Preparation

EDUC 4260	Principles of Secondary Education	3
WLC 4870	Methods in Secondary School World Language Instruction (same as EDUC 4870 & LING 4870)	3
or ENGL 3180	Introduction to ESL methods and materials	
PSYCH 2300	Developmental Psychology	3
POLS 1110	Introduction to American Government (or a course in U.S. History)	3

Additional requirements of the Secondary Major in Education. See footnote for catalog link to requirements. ^{TP}

^{TP}Students preparing to teach a language declare the Secondary Major in Education and complete these additional course requirements in addition to the requirements for the major in World Languages and Cultures, B.A., Spanish Option.

World Languages and Cultures Additional Major, Spanish Option

The requirements for the World Languages and Cultures Additional Major with the Spanish Option are the same as the major requirements for the primary major listed above.

World Languages and Cultures Additional Major, Spanish Language and Cultures for Professions (LCP) Option

Students who complete an additional major in World Languages and Cultures with LCP Option seek to become culturally-competent global professionals and engage in language and cultural training. Note: Students may only enroll in the Spanish Languages and Cultures for Professions (LCP) Option as an additional major; they may not graduate with this as a primary major.

Students must complete a minimum of 30 credits beyond the intermediate level (SPAN 2010 Intermediate Spanish I & SPAN 2020 Intermediate Spanish II).

A. Required LCP Core Courses: (12 Credits)

SPAN 3030B	Spanish Conversation and Composition: for Professionals	3
SPAN 3040	Spanish for Global Professionals	3
SPAN 3510	Introduction to Spanish-English Translation	3

SPAN 4990	Internship in Spanish *	3
or SPAN 3950	Study Abroad	

B. Literature and Culture Courses: (9 Credits)

SPAN 3140	Textual and Media Analyses	3
SPAN 3230	Spain Today	3
or SPAN 3210	Spanish Civilization	
SPAN 3240	Latin America Today	3
or SPAN 3220	Latin American Civilization	

C. Additional Courses: Select one course from each of the following two categories (6 credits)

Category 1:

SPAN 3300	Studies in Spanish Literature	3
or SPAN 3320	Studies in Latin American Literature	

Category 2:

SPAN 4400	Seminar on the Literatures and Cultures of Spain	3
or SPAN 4410	Seminar on Cervantes and the Golden Age	
or SPAN 4450	Seminar on the Literatures and Cultures of Latin America	
or SPAN 4630	Contemporary Spanish Linguistics	

D. Additional 3 credits taken at the SPAN 3000-level or higher. 3

*Additional credit from an approved study abroad program may be applied to the major.

Minor in Spanish

The Minor in Spanish requires at least 15 credits, 12 of which must be at the 3000-level or higher. The department strongly recommends that all students of Spanish participate in an approved study abroad program based in a Spanish-speaking country. Any student who chooses not to participate in a department-approved study abroad program will be required to take 3 additional elective credits of Spanish at the 3000-level or higher.

Minor in Spanish (Option: Language and Cultures for Professions)

Students who complete a Minor in Spanish (Option: Languages and Cultures for Professions) seek to become culturally-competent global professionals and engage in language and cultural training. The minor option requires the following 15 credits:

SPAN 3030B	Spanish Conversation and Composition: for Professionals	3
SPAN 3040	Spanish for Global Professionals	3
SPAN 3510	Introduction to Spanish-English Translation	3
One of the following		3
SPAN 3210	Spanish Civilization	

or SPAN 3220	Latin American Civilization	
or SPAN 3230	Spain Today	
or SPAN 3240	Latin America Today	

Approved study abroad in a Spanish-speaking country or completion of an additional course from the approved options. 3

The Spanish Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

Minor in Spanish Translation and Interpretation Studies

The Minor in Spanish Translation and Interpretation Studies requires the following 15 credits.

SPAN 3030B	Spanish Conversation and Composition: for Professionals	3
or SPAN 3040	Spanish for Global Professionals	
or SPAN 3050	Spanish for Heritage Speakers	

SPAN 3510	Introduction to Spanish-English Translation	6
& SPAN 3540	and Introduction to Spanish-English Interpretation	

Choose two of the following courses (6 credits) 6

SPAN 3520	Spanish Pronunciation	
SPAN 4620	Contrastive Analysis of Spanish/ English for Translators	
SPAN 4630	Contemporary Spanish Linguistics	

Transfer credit accepted at ISU or credit earned on an ISU-approved study abroad program can apply toward the minor. The minor is intended for students pursuing or holding a baccalaureate degree at ISU and open to any student with proficiency in Spanish that would place them into the 3000-level.

The Spanish Translation and Interpretation Studies Undergraduate Minor is an LAS Minor. In addition to University policies governing minors, LAS minors require at least 6 credits in courses numbered 3000 and above, with a grade of C or higher.

STUDY ABROAD ALTERNATIVES

The department strongly recommends that all students of Spanish participate in an approved study abroad program based in a Spanish-speaking country. For programs that allow an additional course instead of study abroad, any student who chooses not to participate in a department-approved study abroad program will be required to take 3 additional credits in culture chosen from the following:

SPAN 3210	Spanish Civilization	3
SPAN 3220	Latin American Civilization	3
SPAN 3230	Spain Today	3
or SPAN 3240	Latin America Today	

Students taking either SPAN 3210 or SPAN 3230 must take either SPAN 3220 or SPAN 3240; students taking either SPAN 3220 or SPAN 3240 must take either SPAN 3210 or SPAN 3230.

A listing of all Spanish Coursework is available in the A-Z course list.

PLACEMENT POLICIES AND COURSE GUIDANCE

Students who have had formal training in world languages offered at Iowa State may obtain credit by passing appropriate examinations. Students with native fluency in languages taught at Iowa State may not enroll in or take the Exam for Credit in elementary or intermediate courses (1000 and 2000-level) in their native language. Students are considered to have native fluency if their ethnic first language as indicated on the matriculation form is the language in which they wish to enroll. Students are also considered to have native fluency if they have had substantial attendance at a secondary school or university where the language of instruction is the language in which they wish to enroll at ISU. Students with native fluency may be eligible to enroll in literature and civilization courses in their native language at the 3000-level or above; such students must also consult the department office to determine eligibility for advanced composition and conversation courses (3000-level and above). Students who have completed three or more years of high-school world language study may not enroll in or receive credit for 1010-1020 in those languages; credit may be obtained by passing the appropriate Exam for Credit or by completing an advanced sequence (2000-level or higher) in that language. Students who complete an approved sequence of courses in a single language at the 2000- or 3000-level (e.g., 2010 and 2020 or 3010 and 3020) with a grade of C- or higher are eligible to receive credit for 1010 and 1020 in that same language if they have not received credit for a 1010 or 1020 course in the language. Students who complete a 1020 course with a grade of C- or higher are eligible to receive credit for 1010 in that same language if they have not received credit for 1010 in the same language. Students should contact the department after completion of the course sequence to receive credit. Courses in the 1010-1020 level may not be taken on a remedial basis.

Students who have completed two years, but fewer than three years of a single high-school world language may not enroll in a 1010 course in that language. These students may enroll in either a 1020 course in that language, or in the case of Spanish, SPAN 1970 Accelerated Elementary Spanish. Before enrolling in either SPAN 1970 Accelerated Elementary Spanish or a 1020 language course, students are recommended to take the online placement test available at www.language.iastate.edu (<http://www.language.iastate.edu/>). After completing the online placement test, students who believe that they have extenuating circumstances may appeal to the Department of World Languages and Cultures in order to request enrollment in a 1010 language course.

SPAN 1970 Accelerated Elementary Spanish is designed for students who a) wish to fulfill the LAS world language requirement in one semester with a single course, b) want more experience with Spanish before moving to the 2000-level, or c) want to fast track their Spanish coursework to complete a minor or primary or additional major in Spanish more quickly. Students who complete with a passing grade will have fulfilled the LAS world language requirement. Students who have completed SPAN 1970 Accelerated Elementary Spanish and wish to pursue further study in Spanish may enroll in SPAN 2010.

Students with disabilities who need to satisfy the world language requirement may direct questions to their academic advisor, the Department of World Languages and Cultures, or the Disability Resources Office.

Credit by examination in the Department of World Languages and Cultures for courses numbered 1010, 1020, 2010, and 2020 is available only to students who are not currently enrolled in the course. Credit by examination for other courses in the Department is not normally available.

Language and literature courses numbered 3000 and above are principally taught in the target language; courses numbered in the 2700s, 3700s, and 4700s are taught in English. For courses taught in English about Ancient Greek and Rome, see Classical Studies. Students may not take intermediate (2000 level) courses for credit after successfully completing any advanced (3000/4000-level) course, except those in the 3700 series or courses taught in English translation. Students who have successfully completed any course in the intermediate (2000-level) sequence may not take a lower-numbered course in that sequence for a grade.

STUDY ABROAD

The Department also offers faculty-led summer study abroad programs in Costa Rica, France, Germany, Italy, and Spain; and semester study abroad programs in Spain. Programs and exchanges in other areas of the world are offered through study abroad providers. Information concerning these programs can be obtained directly from the Department.

World Languages and Cultures B.A - French/German/ Spanish Options

Freshman		
Fall	Credits Spring	Credits
ENGL 1500	3 Humanities Choice	3
Language 1010	4 Language 1020	4
Elective	3 Humanities Choice	3
Humanities Choice	3 Natural Science Choice	2
Natural Science Choice	3 Social Science Choice	3

Sophomore

Fall	Credits Spring	Credits
Language 2010	4 Language 2020	4
ENGL 2500	3 Humanities Choice	3
LIB 1600	1 Social Science Choice	3
Natural Science Choice	3 Elective	3
Social Science Choice	3 Elective	1-2
	LAS 2030	1
	14	15-16

Junior

Fall	Credits Spring	Credits
Language Choice - 3000-level	3 Language Choice - 3000-level	3
Language Choice - 3000-level	3 Language Choice - 3000-level	3
English Proficiency Requirement	3 Language Choice - 3000-level	3
Math Choice	3 Elective	3
Elective	3 Elective	3
	15	15

Senior

Fall	Credits Spring	Credits
Language Choice - 3000 or 4000-level	3 Language Choice - 3000 or 4000-level	3
Language Choice - 4000-level	3 Language Choice - 4000-level	3
Language Choice - 4000-level	3 Language Choice - 4000-level	3
Electives	6 Electives	6
	15	15

Total Credits: 120-121

Graduate Programs

Graduate Minor in Spanish

The Department of World Languages and Cultures offers course work leading to a graduate minor in Spanish. The graduate minor is designed to provide an opportunity for graduate students to further their knowledge of Spanish to complement work in their major disciplines and provides formal recognition of student achievement and expertise.

Prerequisites

Graduate students who wish to minor in Spanish must have 4000-level proficiency in Spanish. When this is not the case, the student may be required to take a language course below the 4000-level, which would not count towards the graduate minor requirements.

Course Requirements

For the M.A. or M.S.: Three courses in Spanish at the 4000-level or above.

For the Ph.D.: Four courses in Spanish at the 4000-level or above; must include at least one three credit course at the 5000-level.

At least two courses for the M.A. and the Ph.D. minors must be taken in residence at Iowa State University. Papers written for these courses are expected to have a content and depth commensurate with the graduate status of the student.

Courses primarily for undergraduates:**WLC 1070: Introduction to Swahili**

Credits: 1. Contact Hours: Lecture 1.

Basics of grammar and vocabulary within the context of the cultures where Swahili is spoken. For students whose native language is not Swahili. Taught in Swahili. Offered on-line. Offered irregularly. (Typically Offered: Spring)

WLC 1190: Introduction to World Languages

(Cross-listed with LING 1190).

Credits: 3. Contact Hours: Lecture 3.

Study of language diversity and the personal, social and political effects of diversity. Language families, attitudes toward language and language use, language and culture, multilingualism, foreign language learning, written codes, official languages, and language policy. Meets International Perspectives Requirement.

WLC 2030X: The Global Professional: Building an International Career

Credits: 1. Contact Hours: Lecture 1.

This course equips students in all fields of study with the knowledge, skills, and mindset to pursue international careers. Asynchronous online modules cover topics including global career research, intercultural competency for the job market, international networking strategies, language study for global careers, cross-cultural negotiation, resume and cover letter adaptation, and personal branding for the global market. Students who successfully complete this course will be equipped with the knowledge, skills, and job market materials to execute international internship and job searches. (Typically Offered: Fall, Fall, Spring, Spring)

WLC 2050: World Religions

(Cross-listed with RELIG 2050).

Credits: 3. Contact Hours: Lecture 3.

An introduction to religious studies - the academic study of religion.

Religions from around the world will be discussed, including their myths, rituals, beliefs, values, and social forms. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

WLC 2100: Introduction to Asian American Studies

(Cross-listed with ANTHR 2100).

Credits: 3. Contact Hours: Lecture 3.

An interdisciplinary and chronological examination of Asian American immigration experiences from the early 19th century to the 21st century. Focus on how these immigration histories are accompanied by changing racial constructions. Discussion of racial stereotyping, the model minority myth, identity development, and efforts for social justice. Meets U.S. Cultures and Communities Requirement.

WLC 2700: Cultures in Transition

Credits: 3. Contact Hours: Lecture 3.

An interdisciplinary introduction to a world region in a state of rapid social and cultural transition. Discussion of the history, social and political institutions, arts, economy, agriculture, and environment of the new nations. Meets International Perspectives Requirement.

WLC 3520: Religions of India

(Cross-listed with RELIG 3520).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500 or Permission of Instructor

Study of texts, practices, beliefs, historical development, and mutual influence of a variety of the religious traditions of India. Emphasis on Vedic religion and the diversity of traditions of Classical Hinduism; survey of Buddhist, Jain, Sikh, and South Asian Islamic traditions. Meets International Perspectives Requirement.

WLC 3580: Islam

(Cross-listed with RELIG 3580).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500 or Permission of Instructor

An introduction to Islamic religion, culture, and society from its origins to the present. Topics include the Quran, the Prophet Muhammad, Islamic theology and philosophy, Islamic history, and Islam in America. Meets International Perspectives Requirement.

WLC 3590: The Quran

(Cross-listed with RELIG 3590).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500 or Permission of Instructor

A study of the Quran, the sacred text of Islam, with attention to its history, its major themes, and the diverse ways it is interpreted and applied. Meets International Perspectives Requirement.

WLC 3700A: Topics in World Languages and Cultures in English**Translation: Global Sustainability**

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Topics vary according to faculty interest. Author, genre or period study, women's writing, cinema, or cultural studies of a non-English speaking world culture or cultures. Readings, discussion, and written work in English. Meets International Perspectives Requirement.

WLC 3700B: Topics in World Languages and Cultures in English**Translation: Middle East**

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Topics vary according to faculty interest. Author, genre or period study, women's writing, cinema, or cultural studies of a non-English speaking world culture or cultures. Readings, discussion, and written work in English. Meets International Perspectives Requirement.

WLC 3700C: Topics in World Languages and Cultures in English**Translation: Global Urban Cultures**

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Topics vary according to faculty interest. Author, genre or period study, women's writing, cinema, or cultural studies of a non-English speaking world culture or cultures. Readings, discussion, and written work in English. Meets International Perspectives Requirement.

WLC 3710: The Arabian Nights

(Cross-listed with ARABC 3710).

Credits: 3. Contact Hours: Lecture 3.

Focus on the tales of the famous '1001 Arabian Nights' book.

Discussions of the narrative tools, supernatural elements, and the culture of the Medieval Middle East. Readings, discussions, and papers in English. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

WLC 4170G: Student Teaching: World Language

(Dual-listed with EDUC 5170G/ WLC 5170G). (Cross-listed with EDUC 4170G).

Credits: 1-30. Repeatable.

Prereq: Admitted to the Educator Preparation Program

Evaluation of instruction, lesson planning, and teaching in world languages, secondary grades. (Typically Offered: Fall, Spring)

WLC 4840: Technology, Globalization and Culture

(Dual-listed with WLC 5840/ ME 5840/ MKT 5840). (Cross-listed with ME 4840/ MKT 4840).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior or Senior Classification

Cross-disciplinary examination of the present and future impact of globalization with a focus on preparing students for leadership roles in diverse professional, social, and cultural contexts. Facilitate an understanding of the threats and opportunities inherent in the globalization process as they are perceived by practicing professionals and articulated in debates on globalization. Use of a digital forum for presenting and analyzing globalization issues by on-campus and off-campus specialists. Meets International Perspectives Requirement. (Typically Offered: Fall)

WLC 4860: Methods in Elementary School World Language Instruction

(Cross-listed with EDUC 4860/ LING 4860).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 25 credits in a World Language

Planning, implementation, and assessment of standards-based, student-centered, and thematic instruction in the elementary (K-8) classroom. Special emphasis on K-8 students' communicative skills, cultural knowledge, and content learning. (Typically Offered: Fall)

WLC 4870: Methods in Secondary School World Language Instruction

(Cross-listed with EDUC 4870/ LING 4870).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 25 credits in a world language; Department Permission

Theories and principles of contemporary world language learning and teaching. Special emphasis on designing instruction and assessments for active learning. Admission to teacher education required. (Typically Offered: Fall)

WLC 4910: Experiences Abroad: Learning to Think Globally

(Cross-listed with INTST 4910).

Credits: 1. Contact Hours: Lecture 1.

Repeatable, maximum of 2 credits.

Prereq: Minimum of 3 credits of study abroad and/or internship abroad

Students returning from study abroad gain perspective on the personal, academic, and professional impact of their time spent abroad through readings and discussions. Students will be expected to make one presentation about the culture they experienced to an audience outside ISU. Offered on a satisfactory-fail basis only.

Courses primarily for graduate students, open to qualified undergraduates:

WLC 5170G: Student Teaching: World Language

(Dual-listed with EDUC 4170G/ WLC 4170G). (Cross-listed with EDUC 5170G).

Credits: 1-30. Repeatable.

Prereq: Admitted to the Educator Preparation Program

Evaluation of instruction, lesson planning, and teaching in world languages, secondary grades. (Typically Offered: Fall, Spring)

WLC 5840: Technology, Globalization and Culture

(Dual-listed with WLC 4840/ ME 4840/ MKT 4840). (Cross-listed with ME 5840/ MKT 5840).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate classification

Cross-disciplinary examination of the present and future impact of globalization with a focus on preparing students for leadership roles in diverse professional, social, and cultural contexts. Facilitate an understanding of the threats and opportunities inherent in the globalization process as they are perceived by practicing professionals and articulated in debates on globalization. Use of a digital forum for presenting and analyzing globalization issues by on-campus and off-campus specialists. Meets International Perspectives Requirement. (Typically Offered: Fall)

INTERDISCIPLINARY PROGRAMS

Interdepartmental programs are available at both graduate and undergraduate levels. An interdepartmental program is an administrative structure usually not functioning as a department, ordinarily headed by a supervisory committee, and offering a degree with major(s) in that subject area. Interdepartmental programs have been officially approved and may offer courses.

See individual programs for information regarding admission and academic requirements.

Cyber Security Graduate Programs

INTERDEPARTMENTAL GRADUATE MAJOR

Iowa State University has been offering courses in cyber security since 1995 and has one of the largest programs in the country. Graduate degrees can be obtained in a traditional on campus setting or as an on-line program. For information about the online Cyber Security program visit Iowa State Online (<https://iowastateonline.iastate.edu/>).

Students graduating from the major will help to fill the need for well-educated system security specialists in the government, private sector, and academia. The program objectives identified as being critical to the accomplishment of this mission are:

- 1. Impart and enhance knowledge about information infrastructure security
- 2. Expand and develop the ability to engineer complex systems
- 3. Instill and nurture social awareness, and the ability to function in a team
- 4. Instill and nurture a sense of ethics
- 5. Develop an understanding of strategic and policy issues

We offer 4 different graduate degree options:

- 1. Masters of Science with thesis
- 2. Masters of Science without thesis
- 3. Masters of Engineering (coursework only)
- 4. Graduate certificate

Graduate Certificate

A graduate certificate in Cyber Security is offered, which consists of four courses (12 credits): The graduate certificate is targeted for off-campus students as a way to either supplement their education or as way to try out online education courses. All of the certificate courses will transfer into the MS or MENG degree in Cyber Security.

for Certificate in Cyber Security

CYBSC 5300	Network Protocols and Security	3
CYBSC 5310	Information System Security	3
CYBSC 5320	Information Warfare	3
MATH 5330	Cryptography	3
	or CYBSC 5350 Steganography and Digital Image Forensics	
	or CYBSC 5340 Legal and Ethical Issues in Cyber Security	
	or CYBSC 5360 Computer and Network Forensics	
	or CPRE 5370 Wireless Network Security	

Total Credits 12

For additional information students should visit <https://www.cyio.iastate.edu/>. (<http://www.iac.iastate.edu>)

Master of Science with & without thesis

The degree Master of Science with a major in Cyber Security is under a cooperative arrangement with various home departments including Electrical and Computer Engineering, Political Science, Information Systems and Business Analytics, and Mathematics.

The degree Master of Science with thesis is recommended for students who intend to continue toward the Doctor of Philosophy degree or to undertake a career in research and development. The non-thesis Master of Science degree requires a creative component and is intended for students interested in a career in cybersecurity.

Students interested in the interdepartmental major apply and are admitted to both a home department (the department that is most closely aligned with the student's research interest and background) and to the program. The home department sets the admission standards, course requirements, and thesis standards. (**Note:** Electrical and Computer Engineering is the only home department for off-campus students pursuing the Master of Science in Cyber Security).

The program is broadly based and uses courses in the various departments. The program will consist of 24 course credits with 6 credits of research work for a Master of Science with thesis. A non-thesis Master of Science will consist of 27 credits of courses and 3 credits of creative component. The courses are divided into three categories: core, electives, and thesis research. A student's Program of Study Committee, in consultation with the student, determines the elective courses to be taken and the acceptability of transfer credits. The major professor will be selected from the discipline where the student is admitted (home department).

The basic prerequisite for admission to this program is a baccalaureate degree in engineering, mathematics, computer science, management information systems, political science, or closely related field. The GRE or GMAT examination may be required based on the standards of the home

department. If the GRE or GMAT is not required it will be considered in admissions decisions if offered. Potential students with baccalaureate degrees in the physical sciences, statistics, or other related fields will be considered on an individual basis, possibly with provisional admission.

Master of Engineering

The Master of Engineering (MENGR) in Cyber Security degree is only offered to off-campus students. This program is designed to assist all individuals who already have a bachelor's degree in computing or related areas to pursue an in-depth study in information assurance. The Master of Engineering program is based on coursework credits only (a thesis or creative component is not required). Courses are offered via digital streaming video. (**Note:** Electrical and Computer Engineering is the only home department for the Master of Engineering in Cyber Security).

A coursework only Master of Engineering degree in Cyber Security consists of 30 credits. The courses are divided into two categories: core and electives. (**Note:** Students pursuing the MENGR do not have a program of study committee and the major professor is the Cyber Security, Director of Graduate Education (DoGE)

Students interested in the MENGR in Cyber Security degree apply and are admitted to Cyber Security (CYBSC) with ECpE as the home department.

The admission requirements for students entering the program without work experience are the same as the admission requirements for the ECpE department. For students with 3 or more years of work experience in a computer related position the GRE and GPA minimum may be waived.

Students with an undergraduate degree in a non computing field that have at least 3 years of work experience in an information technology field may be admitted to the program.

Courses primarily for undergraduates:

CYBSC 1310: Introduction to Computer Security Literacy

(Cross-listed with CPRE 1310).

Credits: 1. Contact Hours: Lecture 1.

Basic concepts of practical computer and Internet security: passwords, firewalls, antivirus software, malware, social networking, surfing the Internet, phishing, and wireless networks. This class is intended for students with little or no background in information technology or security. Basic knowledge of word processing required. Offered on a satisfactory-fail basis only.

CYBSC 3320: Cyber Defense Competition

(Cross-listed with CPRE 3320).

Credits: 1. Contact Hours: Laboratory 2.

Repeatable.

Participation in cyber defense competition driven by scenario-based network design. Includes computer system setup, risk assessment and implementation of security systems, as well as defense of computer and network systems against trained attackers. Team based. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

CYBSC 3700: Fundamentals of Network Security

Credits: 2. Contact Hours: Lecture 3.

Fundamentals of network security, including common network protocols, potential security risks, and countermeasures. Network routing and its impact on security.

CYBSC 3710: Adversarial Thinking

Credits: 2. Contact Hours: Lecture 2.

Mindset and tactics of cyber adversaries. Anticipating and countering cybersecurity threats. Analyzing and predicting the strategies of cyber adversaries, including understanding their motives, methods, and techniques to evade detection. Multi-week team project where students will assume the role of attackers and plan an attack against a fictitious target.

CYBSC 3720: Fundamentals of Data Security and Privacy

Credits: 2. Contact Hours: Lecture 2.

Introduction and application of basic mechanisms for protecting data. Security issues related to safeguarding sensitive personal and corporate information against inadvertent disclosure. Real-world effects of data breaches on individuals and businesses and the balancing of interests among individuals, government, and enterprises. Emerging technologies that may affect security and privacy concerns. Issues related to developing enterprise data security programs, policies, and procedures that consider the requirements of all relevant constituencies, e.g., technical, business, and legal.

CYBSC 4300: Network Protocols and Security

(Dual-listed with CPRE 5300/ CYBSC 5300). (Cross-listed with CPRE 4300).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (CPRE 3080 or COMS 2520 or COMS 3520) OR CPRE 2880

Detailed examination of networking standards, protocols, and their implementation. TCP/IP protocol suite, network application protocols. Network security issues, attack and mitigation techniques. Emphasis on laboratory experiments.

CYBSC 4600: Application of Security Literacy

Credits: 1. Contact Hours: Lecture 1.

Prereq: ENGL 3140 or ENGL 3140H

Training of teaching of basic cybersecurity concepts and running effective security awareness campaigns. Communication strategies, collaboration with departments such as HR, and promoting a security culture within organizations. Preparation to become advocates for security awareness in professional settings.

CYBSC 4610: Cyber Exercise Design

Credits: 1. Contact Hours: Lecture 1.

Prereq: ENGL 3140 or ENGL 3140H

Introduction to designing and facilitating cybersecurity exercises, including tabletop exercises and live simulations. Creation of tabletop exercises and live simulations that enhance cybersecurity awareness, preparedness, and response capabilities. Scenario planning, facilitation skills, post-exercise evaluation, adaptation for various roles, and evaluation using federal guidelines.

CYBSC 4700: Threat Hunting and Intelligence

Credits: 2. Contact Hours: Lecture 2.

Prereq: CYBSC 3710 and CYBSC 3720 and CYBSC 4300

Tools and methods for threat hunting and intelligence gathering to strengthen organizational defense. Techniques for identifying and mitigating cyber threats, utilizing various security tools and intelligence sources.

CYBSC 4710: Digital Forensics and Incident Response

Credits: 2. Contact Hours: Lecture 2.

Prereq: CYBSC 3710 and CYBSC 3720 and CYBSC 4300

Fundamentals of digital forensics and incident response, including evidence collection, analysis, and response planning techniques. Preparation to handle security incidents effectively, covering forensic analysis techniques, evidence collection and handling, response planning, and incident response policy development.

CYBSC 4720: Applications of Cryptography

Credits: 2. Contact Hours: Lecture 2.

Prereq: CYBSC 3710 and CYBSC 3720 and CYBSC 4300

Cryptographic methods for information security, privacy assurance, and authenticity verification. Encryption techniques, cryptographic protocols, secure key management, and digital signatures, emphasizing practical applications in cybersecurity.

CYBSC 4730: Fundamentals of Operating Systems Security

Credits: 2. Contact Hours: Lecture 2.

Prereq: CYBSC 3710 and CYBSC 3720

Introduction of security principles for operating systems, focusing on securing Windows and Linux environments. Access control, privilege management, file system security, memory management, and system hardening techniques to protect against vulnerabilities. Exploring vulnerabilities in operating systems, analysis of security features, and defensive strategies for enhancing OS security.

CYBSC 4740: Fundamentals of Cloud Security

Credits: 2. Contact Hours: Lecture 2.

Prereq: CYBSC 3710 and CYBSC 3720

Introduction to cloud security concepts, architectural principles, secure cloud design, and best practices for cloud service providers and users. Cloud security principles, including secure design, data protection, identity management, and regulatory compliance. Protecting cloud environments from unique cybersecurity threats.

CYBSC 4750: Fundamentals of Software Security

Credits: 2. Contact Hours: Lecture 2.

Prereq: CYBSC 3710 and CYBSC 3720

Overview of secure software development, common vulnerabilities, secure coding practices, and testing methods. Basic secure coding practices, threat modeling, vulnerability assessment, and techniques for mitigating risks such as buffer overflows, injection attacks, and improper input validation.

CYBSC 4760: Fundamentals of Cybersecurity Scripting

Credits: 2. Contact Hours: Lecture 2.

Prereq: CYBSC 3710 and CYBSC 3720

Scripting for cybersecurity tasks, focusing on automation and custom tool development. Basics of scripting languages commonly used in cybersecurity, such as Python and PowerShell. Writing scripts for data parsing, log analysis, and network monitoring, as well as developing custom scripts for security tasks like vulnerability scanning and incident response.

CYBSC 4770: Fundamentals of Cyber Resilience

Credits: 2. Contact Hours: Lecture 2.

Prereq: CYBSC 3710 and CYBSC 3720

Strategies for designing systems that can withstand and recover from cyber-attacks, detection, response, and recovery from cyber-attacks while minimizing impact. Resilience planning, incident response, maintaining operational continuity, and strategies to ensure operational continuity under adverse conditions.

CYBSC 4780: Fundamentals of Cyber-Physical and Critical Infrastructure Security

Credits: 2. Contact Hours: Lecture 2.

Prereq: CYBSC 3710 and CYBSC 3720

Cybersecurity challenges unique to cyber-physical systems and critical infrastructure sectors. Securing cyber-physical systems, critical infrastructure, threat modeling, risk management, and incident response. Emphasizes security challenges in energy, manufacturing, agriculture, and transportation sectors.

CYBSC 4790: Fundamentals of Web Security

Credits: 2. Contact Hours: Lecture 2.

Prereq: CYBSC 3710 and CYBSC 3720

Securing web applications by addressing vulnerabilities such as SQL injection and cross-site scripting. Fundamental principles of web security and secure applications. SQL injection, cross-site scripting (XSS), authentication and session management, and the Open Web Application Security Project (OWASP) Top Ten.

CYBSC 4890: Cybersecurity Capstone

Credits: 3. Contact Hours: Lecture 3.

Prereq: CYBSC 3710, CYBSC 3720, CYBSC 4300, and 8 additional credits CYBSC courses

Culminating capstone experience. Development a cybersecurity solution, including threat assessment, architecture design, incident response plan, and final plan presentation.

Courses primarily for graduate students, open to qualified undergraduates:

CYBSC 5300: Network Protocols and Security

(Dual-listed with CPRE 4300/ CYBSC 4300). (Cross-listed with CPRE 5300).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Detailed examination of networking standards, protocols, and their implementation. TCP/IP protocol suite, network application protocols. Network security issues, attack and mitigation techniques. Emphasis on laboratory experiments.

CYBSC 5310: Information System Security

(Cross-listed with CPRE 5310).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Computer, software, and data security: basic cryptography, security policies, multilevel security models, attack and protection mechanisms, legal and ethical issues.

CYBSC 5320: Information Warfare

(Cross-listed with CPRE 5320).

Credits: 3. Contact Hours: Lecture 3.

Prereq: CPRE 4300 or 5300

Computer system and network security: implementation, configuration, testing of security software and hardware, network monitoring. Authentication, firewalls, vulnerabilities, exploits, countermeasures. Study and use of attack tools. Ethics in cyber security. Emphasis on laboratory experiments. (Typically Offered: Spring)

CYBSC 5330: Cryptography

(Cross-listed with CPRE 5330/ MATH 5330).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 3010 OR CPRE 310 OR COMS 230

Basic concepts of secure communication, DES and AES, public-key cryptosystems, elliptic curves, hash algorithms, digital signatures, applications. Relevant material on number theory and finite fields. (Typically Offered: Spring)

CYBSC 5340: Legal and Ethical Issues in Cyber Security

(Cross-listed with CPRE 5340/ POLS 5340).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Legal and ethical issues in computer security. State and local codes and regulations. Privacy issues. (Typically Offered: Spring)

CYBSC 5350: Steganography and Digital Image Forensics

(Cross-listed with CPRE 5350/ MATH 5350).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Basic principles of covert communication, steganalysis, and forensic analysis for digital images. Steganographic security and capacity, matrix embedding, blind attacks, image forensic detection and device identification techniques. Related material on coding theory, statistics, image processing, pattern recognition. (Typically Offered: Spring)

CYBSC 5360: Computer and Network Forensics

(Cross-listed with CPRE 5360).

Credits: 3. Contact Hours: Lecture 3.

Prereq: CPRE 4890 OR CPRE 4300 OR CPRE 5300

Fundamentals of computer and network forensics, forensic duplication and analysis, network surveillance, intrusion detection and response, incident response, anonymity and pseudonymity, privacy-protection techniques, cyber law, computer security policies and guidelines, court testimony and report writing, and case studies. Emphasis on hands-on experiments.

CYBSC 5380: Reverse Engineering and Security Testing

(Cross-listed with CPRE 5380).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Techniques and tools for understanding the behavior of software/hardware systems based on reverse engineering. Flaw hypothesis, black, grey, and white box testing as well as other methods for testing the security of software systems. Discussion of counter-reverse engineering techniques. (Typically Offered: Spring)

CYBSC 5600: Data-Driven Security and Privacy

(Cross-listed with COMS 5600/ CPRE 5600).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Examination of applications of machine learning and big data techniques to various security and privacy problems, as well as secure and privacy-preserving machine learning algorithms. Offered irregularly. (Typically Offered: Spring)

CYBSC 5920: Seminar in Cyber Security

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Projects or seminar in Cyber Security. (Typically Offered: Fall, Spring, Summer)

Courses for graduate students:**CYBSC 6310: Cyber Security Operations Practicum**

(Cross-listed with CPRE 6310).

Credits: 3. Contact Hours: Lecture 1.

Repeatable.

Practical experience in cyber operations. Cyber security threat analysis, malware analysis, and intrusion detection management. Cyber security data analysis methods. Pen testing tools and techniques. Weekly threat analysis briefings. Offered on a satisfactory-fail basis only.

CYBSC 6320: Cyber Security Capstone Design

(Cross-listed with CPRE 6320).

Credits: 3. Contact Hours: Lecture 3.

Capstone design course which integrates the security design process. Design of a security policy. Creation of a security plan. Implementation of the security plan. The students will attack each other's secure environments in an effort to defeat the security systems. Students evaluate the security plans and the performance of the plans. Social, political and ethics issues. Student self-evaluation, journaling, final written report.

CYBSC 6340: Current Research Problems in Cyber Security

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Discussion of complex cyber security problems. Students will learn how to apply research techniques, think clearly about these issues, formulate and analyze potential solutions, and communicate their results. Working in small groups under the mentorship of technical clients from government and industry, each student will formulate, carry out, and present original research on complex current cybersecurity problems of interest to the nation. This course will be run in a synchronized distance fashion, coordinating some activities with our partner schools and our technical clients. (Typically Offered: Fall, Spring)

CYBSC 6970: Cyber Security Summer Internship

Credits: Required.

One semester and one summer maximum per academic year professional work period. Offered on a satisfactory-fail basis only.

Ecology and Evolutionary Biology

The Ecology and Evolutionary Biology (EEB) major is offered through the Department of Ecology, Evolution, and Organismal Biology. Faculty based in EEOB and other associated departments offer courses and direct research leading to M.S. and Ph.D. degrees with a major in Ecology and Evolutionary Biology.

The EEB major is designed for students interested in the study of mechanisms controlling the composition, structure, and functional processes of ecological systems and the mechanisms that regulate the pattern and rate of evolutionary change within and among species. Applicants should have completed an undergraduate or master of science or arts degree in one of the biological, physical, or mathematical sciences. Applicants also should have taken undergraduate courses in both basic ecology and evolution.

The EEB curriculum includes a core course and seminar courses. Cooperating departments provide courses and research opportunities in the following areas:

Conservation and Restoration Ecology

Quantitative Ecology and Evolution

Evolutionary Ecology

Landscape Ecology, Modeling, and Spatial Dynamics

Natural Resources Ecology and Management

Physiological and Behavioral Ecology

Population, Community, and Ecosystems Ecology

Population, Quantitative, and Evolutionary Genetics

Systematics, biodiversity, and biogeography

In addition, offerings are available in the ethics and practice of research in the biological sciences as well as in science communication (both written and oral).

Students majoring in EEB are trained for careers focused on basic or applied ecology and evolutionary biology in a variety of settings, including academia, government, industry, and private organizations. Graduates have a broad understanding of ecology and evolutionary biology, experience designing and conducting research, writing grant proposals, and communicating effectively with scientific colleagues at meetings and through publications.

Information on admission procedures (<https://eeb.iastate.edu/admissions/>), academic requirements (<https://eeb.iastate.edu/academics/>), and faculty research areas (<https://www.eeb.iastate.edu/people/faculty/>) is available on the EEB website (<http://www.eeb.iastate.edu/>).

Courses primarily for graduate students, open to qualified undergraduates:

EEB 5110: Conceptual Foundations in Ecology and Evolutionary Biology Credits: 4.

Prereq: Graduate Standing or Permission of Instructor

Introduction to key figures and ideas that have shaped the development of ecology and evolutionary biology. Covers major developments in ecology and evolutionary biology at five levels of biological organization: Genome, Organism, Population, Community, and Ecosystem. Impacts of these developments on current approaches to investigation and argument formulation. Effects of technological advances on the direction of scientific investigations. Introduction to analytical skills important for critical thinking in ecology and evolutionary biology and the impact of accepted lines of scientific reasoning on the objectives and conduct of research, such as explanation and prediction, design of studies as experimentation, and structured or unstructured observation. (Typically Offered: Fall)

EEB 5850B: Extended Field Trip: Travel

Credits: 1. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Extended field trip to study major terrestrial and aquatic ecosystems. Location and duration vary. Report required. (Typically Offered: Fall, Spring, Summer)

EEB 5900: Special Topics

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

For students wishing to conduct in-depth study of a particular topic in ecology and evolutionary biology. (Typically Offered: Fall, Spring, Summer)

Courses for graduate students:

EEB 6980: Seminar

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Reports and discussion of recent research and literature. (Typically Offered: Fall, Spring)

EEB 6990: Research

Credits: 1-30. Repeatable.

Prereq: Department Permission for Course

Thesis and dissertation research. (Typically Offered: Fall, Spring, Summer)

Engineering Management Engineering Management Master's Degree

Administered by the Department of Industrial and Manufacturing Systems Engineering

The Engineering Management Program focuses on developing an individual's engineering, science, and management skills so they can succeed in a technology driven environment. There is a growing need for engineers that can build multi-disciplinary design teams, then lead those teams to solve technical and business challenges. The Iowa State University Master of Engineering in Engineering Management program is designed to train leaders who can meet both the technical and managerial challenges in developing modern complex engineered systems. The program can be completed online or in residence, part-time or full-time.

Admission Requirements

To be considered for admission, the applicant should have a bachelor's degree in engineering or related field from a college, university, or technical school of recognized standing. Non-engineering backgrounds will be considered on a case-by-case basis. High academic achievement or other persuasive evidence of professional accomplishments is expected for admission to the program. The GRE is not required.

Applicants for admission to this program apply through the ISU Graduate College. Each applicant must submit:

- Application and application fee
- Official academic transcripts

- Three letters of recommendation
- Resume

Applications should be submitted as early as possible before the beginning of the semester for which admission is sought. Individuals may also take up to nine credits at Iowa State as a non-degree seeking student and then transfer them to the program when they are admitted. (<https://iowastateonline.iastate.edu/apply-and-enroll/>)

Degree Requirements

Engineering Management Core:

Intro/Core (required first year)

IE 5630	Engineering and Systems Management	3
IE 5650	Systems Engineering and Analysis	3

Core (required)

SCM 5240	Strategic Process Analysis and Improvement	3
IE 5700	Systems Engineering and Project Management	3
MGMT 5830	Formulating and Implementing Innovation Strategies	3
ACCT 5810	Accounting for Decision Making	3

Electives

IE 5200	Engineering Problem Solving with R	3
IE 5600	Engineering Risk Analysis	3
IE 5610	Total Quality Management	3
IE 5640	Decision Analysis	3
IE 5720	Design and Evaluation of Human-Computer Interaction	3
IE 5770	Human Factors	3
IE 5810	e-Commerce Systems Engineering	3
CONE 3800	Engineering Law	3
FIN 5010	Financial Valuation and Corporate Financial Decisions	3
MKT 5010	Marketing	3
MGMT 5030	Professional Responsibility in Business and Society (One course from any graduate program)	3

One course from any graduate program 3

Entrepreneurship Minor

Are you a problem-solver, innovator, or change maker? Do you want to make an impact in your community or change the world? By minoring in entrepreneurship, you will sharpen your creative thinking and problem-solving skills, develop your entrepreneurial mindset, start your own business, develop a new product, or become an innovator in an established company. The interdisciplinary Entrepreneurship Minor was designed to complement any major area of study by introducing

knowledge and skills needed to create value through recognizing and developing opportunities.

UNIVERSITY-WIDE UNDERGRADUATE MINOR

A minor in entrepreneurship is available to all undergraduate students at ISU. The minor requires at least 15 credits from an approved list of courses, including at least 6 credits in courses numbered 3000 or above taken at Iowa State University with a grade of C or higher. The minor must include at least 3 credits that are not used to meet any other department, college, or university requirement. Students must follow college-specific rules in selecting courses. The college representatives to the supervisory committee will be responsible for advising students in their college and will inform students about the details of the college rules. Students with declared majors have priority over students with declared minors in courses with space constraints.

Non-business students with an Entrepreneurship minor are not permitted to major in Entrepreneurship. Business students interested in entrepreneurship may choose to major in Entrepreneurship (<https://catalog.iastate.edu/collegeofbusiness/entrepreneurship/#undergraduatemajortext>) or pursue the Entrepreneurship minor.

A student seeking a minor in entrepreneurship must successfully complete a minimum of 15 credits in courses approved for use in the entrepreneurship program, including the following:

Required Courses (6 credits):

ENTSP 3100	Entrepreneurship and Innovation	3
ENTSP 3130	Feasibility Analysis for New Ventures	3
or ENTSP 3200 Corporate Entrepreneurship		
or ENTSP 4100 Social Entrepreneurship		

ENTSP 3100 Entrepreneurship and Innovation is the introductory course and provides an overview of the entire field.

ENTSP 3130 Feasibility Analysis for New Ventures emphasizes developing an idea for a new venture, conducting a feasibility study, researching the potential market, analyzing the competition, and preparing a formal business plan.

ENTSP 3200 Corporate Entrepreneurship introduces and examines state-of-the-art approaches to product innovation and technology development in today's large and established organizations.

ENTSP 4100 Social Entrepreneurship discusses issues related to the role of social entrepreneurship in helping to solve social problems, including innovation, opportunity recognition, planning and the launch of new non-profit organizations.

Elective Courses (6 credits):

Select TWO entrepreneurship-oriented electives from an approved course list (see below). Students are encouraged to take electives within their major college.

Experiential Learning (3 credits):

Students will engage in the process(es) of entrepreneurship to earn experiential learning credits. Students will either take a course that has been designated as an experiential learning course, or use some other experiential learning activity as the basis to receive credits through an independent study.

Detailed information about the Entrepreneurship minor, the list of approved electives, as well as information about the experiential learning options are available online at: <https://ivybusiness.iastate.edu/academics/undergraduate-programs/minors-and-certificates/entrepreneurship-minor/>.

FOR IVY COLLEGE OF BUSINESS STUDENTS ONLY: Students are limited to three business majors/degrees/certificates/minors within the Ivy College of Business. This limit is on business majors/degrees/certificates/minors only and does not apply to multiple majors/degrees/certificates/minors taken outside the Ivy College of Business.

GRADUATE CERTIFICATE

A graduate certificate in Entrepreneurship and Innovation offers post-undergraduate students the opportunity to learn the basics of starting a business. The certificate requires 4 courses (12 credits). The two required core courses are offered online by the Ivy College of Business. Elective courses are available across campus.

The graduate certificate in Entrepreneurship and Innovation focuses on strategies and resources for launching new ventures and helps students understand the role of innovation in entrepreneurship.

This interdisciplinary certificate provides a solid foundation in entrepreneurship and innovation through required core courses ENTSP 5660 Entrepreneurship and New Venture Startup and ENTSP 5830 Formulating and Implementing Innovation Strategies. At the same time, the program enables students to follow their own interests through electives offered by partners across campus.

For more information about the graduate certificate in Entrepreneurship and Innovation, please visit: <https://ivybusiness.iastate.edu/academics/graduate-programs/graduate-certificates/entrepreneurship-and-innovation/>.

CONTACTS

Entrepreneurship Faculty and Advisors

Faculty and advisors in each college are available to answer questions about the Entrepreneurship minor and course requirements. Please visit the link below for the contact in your college.

<https://ivybusiness.iastate.edu/academics/undergraduate-programs/minors-and-certificates/entrepreneurship-minor/entrepreneurship-faculty-and-advisors/>

Feed Technology Minor

The agricultural economy is heavily dependent on feed technology.

The Midwest is one of the largest feed production and grain processing regions in the world. Feed manufacturing is also a global business with a growing demand for qualified technical professionals.

Feed technology includes the areas of grain handling and storage, animal nutrition, feed formulation, feed manufacturing, biosecurity, and feed safety and quality. The Feed Technology minor (15 credits) covers the breadth of all these topics so that you can:

- Understand animal nutrition, feed mill operations management and their application to feed quality, safety, and profitability;
- Identify chemical, biological and physical hazards in grain and feed;
- Know practical ways to monitor, manage and mitigate hazards in grain handling and feed manufacturing facilities; and
- Be familiar with the importance, scope and trends of the global animal feed industry.

The minor requires 15 credits and must include at least 3 credits that are not used to meet any other department, college, or university requirement. Below is the list of courses used in the minor.

TSM 3220	Preservation of Grain Quality	3
or ABE 4690	Engineering for Grain Storage, Preservation, Handling, and Processing Systems	
TSM 4550	Feed Processing and Technology	3
TSM 4570	Feed Safety, Ingredient Quality and Analytics	3
ANS 3200	Animal Feeds and Feeding	3
or ANS 2190X	Survey of Animal Nutrition	
ANS 3240	Food Processing for Companion Animals	3
Total Credits		15

ANS 2190X, if offered, may be substituted for ANS 3200.

Genetics and Genomics GRADUATE MAJOR

Work is offered for the master of science and doctor of philosophy degrees with a major in Genetics and Genomics in fourteen cooperating departments: Agronomy; Animal Science; Biochemistry, Biophysics and Molecular Biology; Biomedical Sciences; Ecology, Evolution and Organismal Biology; Entomology; Food Science and Human Nutrition; Genetics, Development and Cell Biology; Horticulture; Materials Science and Engineering; Plant Pathology and Microbiology; Natural Resource Ecology and Management; Veterinary Microbiology and Preventive Medicine; and Veterinary Pathology.

Students are admitted by the approval of the Chair after review by the Genetics and Genomics Admissions Committee. Students are admitted either to participate in research rotations with several faculty before deciding on a major professor and laboratory, or by direct admission into a specific lab and department. First year students participating in rotations with Genetics and Genomics faculty will take GENET 6970 Graduate Research Rotation.

The diversity of faculty in the Genetics and Genomics major ensures a broad, well-balanced education from the best instructors, while offering flexibility in choice of research area. Genetics and Genomics faculty have strengths in many areas, from fundamental studies at the molecular, cellular, organismal, and population levels, to research with immediate practical application. Ongoing research projects span all the major areas of theoretical and experimental genetics, including genomics, molecular studies of gene regulation, gene mapping, genetics of disease, transposable element studies, developmental genetics, quantitative and statistical genetics, computational molecular biology, evolutionary genetics, and population genetics.

UNDERGRADUATE PREPARATION

Undergraduates wishing to prepare for graduate study in Genetics and Genomics should elect courses in basic biology, chemistry at least through organic chemistry, one year of college-level physics, mathematics at least through calculus, at least one thorough course in basic transmission and molecular genetics, one semester of upper level statistics and one semester of upper level biochemistry. Incoming students who have not completed an upper level statistics course and an upper level biochemistry course prior to beginning in the program will take STAT 5101 Statistical Methods for Data Analysis and BBMB 4040 Biochemistry I during their first year of graduate training. A waiver may be requested for these courses by providing appropriate documentation (catalog description and syllabus) to the curriculum committee showing completion of an upper level statistics and upper level biochemistry course equivalent to STAT 5101 Statistical Methods for Data Analysis and BBMB 4040 Biochemistry I.

See information from the College of Agriculture and Life Sciences or the College of Liberal Arts and Sciences for information on a bachelor of science degree in Genetics.

All Ph.D. candidates take a core curriculum comprising one course each from the following four categories and attend seminars and workshops as described:

Transmission Genetics	
GDCB 5100	Transmission Genetics
Molecular Genetics	
GDCB 5110	Advanced Molecular Genetics
Quantitative, Population, and Evolutionary Genetics	
ANS 5610	Population and Quantitative Genetics for Breeding
EEOB 5070	Advanced Animal Behavior
EEOB 5610	Evolutionary and Ecological Genomics
EEOB 5630	Molecular Phylogenetics
EEOB 5660	Molecular Evolution
EEOB 5670	Empirical Population Genetics
GDCB 5360	Statistical Genetics
Genomics, Bioinformatics and Statistical Genetics	
ANS 5560	Current Topics in Genome Analysis
BCB 5440	Fundamentals of Bioinformatics
STAT 5160	Statistical Design and Analysis of Gene Expression Experiments
STAT 5810	Analysis of Gene Expression Data for the Biological Sciences
BCB 5670	Bioinformatics Algorithms
BCB 5680	Statistical Bioinformatics
BCB 5690	Structural Bioinformatics
BCB 5700	Systems Biology
EEOB 5460	Computational Skills for Biological Data
COMS 5510	Genomic Data Science

Students will give two research presentations (GENET 6900 Graduate Student Seminar in Genetics), attend one genetics and genomics faculty seminar series (GENET 6910 Faculty Seminar in Genetics), and participate in two Workshops in Genetics and Genomics (GENET 5910 Workshop in Genetics) during their graduate training. First-year graduate students will take GENET 6920 Conceptual Foundations of Genetics.

Students may elect a computational molecular biology specialty within the genetics major. This requires that the research project be in the field of computational molecular biology. IGG majors will be expected to complete all of the courses required for the genetics and genomics major, except that one semester of BCB 6900 Student Seminar in Bioinformatics and Computational Biology can be substituted for GENET 6900 Graduate

Student Seminar in Genetics. Students will be expected to take additional courses in the area of specialization.

M.S. students will take the above core courses and seminars with the following changes: participate in one Workshop in Genetics (GENET 5910 Workshop in Genetics) and present their research once (GENET 6900 Graduate Student Seminar in Genetics). Additional coursework may be selected to satisfy individual interests or departmental requirements.

The course designator Genet applies to graduate courses taught by the interdepartmental major in Genetics and Genomics.

Students wishing to minor in genetics and genomics must submit a complete application to the graduate program. Requirements for the successful completion of a minor at the Ph.D. or M.S. levels are: completion of three of the four categories of the common-core required lecture courses listed above. One semester of Seminar in Genetics is recommended.

GENET 6900	Graduate Student Seminar in Genetics	1
GENET 6910	Faculty Seminar in Genetics	1
GENET 6920	Conceptual Foundations of Genetics	1

One member of the POS committee must be a Genetics faculty member.

Student Outcomes: Most students awarded doctoral degrees continue their training as postdoctoral associates at major research institutions in the U.S. or abroad in preparation for research and/or teaching positions in academia, industry, or government. A few go directly to permanent research positions in industry. Many students awarded master's degrees continue their training as doctoral students; however, some choose research support positions in academia, industry, or government. A more thorough list of outcomes is available at our web site.

Courses primarily for graduate students, open to qualified undergraduates:

GENET 5390: Ethics and Biological Sciences

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Introduction to Bioethics through case studies, discussion of contemporary work on central bioethics topics, and discussion of important emerging ethical issues associated with recent research or technological development. Issues covered will vary somewhat from year to year, but will include at least some of the following: ethics and responsible research practice, animal ethics and the use of animals in teaching and research, cloning, human reproductive and stem cell research, regulation of genetically modified crops and foods, plant biotechnology, gene patents. Students will be divided into groups to develop their own case study, to be presented in class at the end of the term. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

GENET 5900: Special Topics

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Contact individual faculty for special projects or topics. Graded. (Typically Offered: Fall, Spring, Summer)

GENET 5910: Workshop in Genetics

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Prereq: Instructor Permission for Course

Current topics in genetics research. Lectures by off-campus experts. Students read background literature, attend preparatory seminars, attend all lectures, meet with lecturers. (Typically Offered: Fall)

Courses for graduate students:

GENET 6900: Graduate Student Seminar in Genetics

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Research presentations by students to improve their ability to: orally present scientific work in a clear and meaningful way, critically evaluate oral presentations, and give and receive constructive criticism. Students may enroll in one seminar per school year. (Typically Offered: Fall, Spring)

GENET 6910: Faculty Seminar in Genetics

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Faculty research seminars that introduce students to the variety of genetics research projects on campus and provide an opportunity for students to become engaged in the scientific presentation to the point where they can think critically and ask meaningful questions. (Typically Offered: Fall)

GENET 6920: Conceptual Foundations of Genetics

Credits: 1. Contact Hours: Lecture 1.

Landmark papers in the development of genetics concepts. Papers are presented and discussions led by students, guided and mentored by the instructors. Instructors provide a broad overview and history of the development of fundamental concepts in genetics. (Typically Offered: Fall)

GENET 6930: Entrepreneurship for Graduate Students in Science and Engineering

(Cross-listed with AGRON 6930/ BCB 6930/ ENGR 6930/ EE 6930/ ME 6930).

Credits: 1. Contact Hours: Lecture 3.

Repeatable, maximum of 2 credits.

Understanding key topics of starting a technology based company, from development of technology-led idea to early-stage entrepreneurial business. Concepts discussed include: entrepreneurship basics, starting a business, funding your business, protecting your technology/ business IP. Subject matter experts and successful, technology-based entrepreneurs will provide real world examples from their experience with entrepreneurship. Learn about the world class entrepreneurship ecosystem at ISU and Central Iowa. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

GENET 6970: Graduate Research Rotation

Credits: 1-30. Repeatable.

Graduate research projects performed under the supervision of selected faculty members in the graduate Genetics major. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

GENET 6990: Research

Credits: 1-30. Repeatable.

Prereq: Department Permission for Course

Research. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

Honors Program

Honors Program

The University Honors Program brings together some of Iowa State University's brightest and most motivated students to take advantage of both intellectual and social opportunities. Honors scholars gain early exposure to research and leadership as well as benefit from creating an individualized educational path adding breadth and depth to their academic experience.

Students in the First-Year Honors Program (<https://www.honors.iastate.edu/program/fhp/>) typically enroll in five Honors credits in their first semester (ENGL 2500H, LIB 1600, Honors 1210) and may opt to participate in the First-Year Mentor Program (<https://www.honors.iastate.edu/program/fhp/first-year-mentor-program/>), a two-credit research experience during their second semester. In the University Honors Program, students receive a variety of academic opportunities to help them optimize their undergraduate experience. They create individualized programs of study with opportunities to incorporate independent study and research. Grants (<https://www.honors.iastate.edu/grant-funding/>) are available to support Honors

student research. Students who complete their work in the University Honors Program receive a notation on their transcript.

As Honors students progress into their upper-division coursework, they choose between two distinct tracks: 1) a College-specific Track or; 2) the Honors Program Innovation Track. In both pathways, students complete at least two Honors courses and two Honors seminars (HON 3210–3220), engage in an independent research or creative project (<https://www.honors.iastate.edu/honors-project/>), and maintain a minimum overall GPA of 3.5. Honors program requirements also fulfill graduation requirements, providing an enriched academic experience. Depending on the college of their primary major, students may need to fulfill additional requirements (<https://www.honors.iastate.edu/honors-advisory-program/>).

Honors credit for a course (<https://www.honors.iastate.edu/honors-courses/>) is denoted by "Honors" on the transcript and can be earned in the following ways: enrollment in an Honors section of a course; contracting an Honors Component within a course; or enrollment in a 5000-level graduate course.

Honors seminars (<https://www.honors.iastate.edu/honors-seminars/>) are one- or two-credit special topic courses offered only to Honors students. With enrollment generally limited to 17 students, these seminars promote a crucial atmosphere of intellectual exchange and a high level of student involvement in learning.

Oversight of Honors students' progress is carried out by the Honors Program staff in coordination with the undergraduate colleges. Each college's Honors Committee approves its students' College-specific Track advisory program and project proposals. The University Honors Program Committee approves the Honors Program Innovation Track advisory program and provides curricular oversight. The Honors Program Office is located at 2130 Jischke Honors Building. For additional information, visit www.honors.iastate.edu (<https://www.honors.iastate.edu/honors-seminars/>) or contact honors@iastate.edu.

HONORS PROGRAM

The Iowa State University Honors Program is designed for students who have demonstrated the ability and motivation to assume more than the usual responsibility for their undergraduate education. The program enables Honors students to gain the maximum benefit from their undergraduate education. Students who graduate in the Honors Program receive the Honors designation on their transcripts and diplomas.

Students who participate in a College-specific Track determine their educational objectives and devise an individualized advisory program to meet their goals. Students who opt to participate in the Honors Program Innovation Track will follow a more prescribed plan of study that centers a multi-disciplinary, team-based format to develop solutions to one or more of humanity's grand challenges. An Honors student's advisory

program may include substitutions for required courses, a combination of courses from several departments, Honors courses or seminars, independent study and research, and other forms of innovation.

Members of the Honors Program have 24-hour access to the Jischke Honors Building as a quiet place to study and visit with other Honors students. Students also have off-campus opportunities such as attending Honors seminars and conferences. Honors students receive extended loan privileges at the Library, priority scheduling, and the opportunity to apply for research funds.

ISU students who have a cumulative grade-point average of at least 3.5 become eligible to apply for admission to the Honors Program during their second semester in residence, and if they have at least 48 semester credits remaining before graduation. Transfer students with a G.P.A. of 3.5 or higher and more than 60 credits remaining are also eligible to apply.

FIRST-YEAR HONORS PROGRAM

Entering first-year students with outstanding high school records and academic ability may be eligible to participate in the First-Year Honors Program (FHP). The FHP, which introduces students to an Honors education, consists of Honors sections of English 2500 and Library 1600, an FHP seminar, and access to Honors advisors. Students may also choose to participate in the Honors Mentor Program, which introduces students to scholarship and research. Participants are matched with faculty members conducting research in an area of mutual interest. Admission to the FHP is limited and is based on past academic achievement, potential, and interest in an Honors education.

Further information concerning the University Honors Program and the First-Year Honors Program can be obtained from the Honors Program Office, 2130 Jischke Honors Building or www.honors.iastate.edu (<http://www.honors.iastate.edu/>).

Human Computer Interaction Interdepartmental Graduate Program

Human Computer Interaction is an interdepartmental graduate program that seeks to improve the way individuals and groups use computers through an understanding of the social and cognitive aspects of the design and use of computational devices. Students in the program learn about cognitive psychology, graphic design principles, the impacts of technology on society, evaluating system usability, and cutting edge computer programming for computational perception and language parsing.

Student research projects have explored the latest in virtual reality studies, improving natural interaction through touch screens and 3D camera gesture controls, virtual engineering using force feedback devices, and many other projects at the bleeding edge of technological

innovation. Graduates of the program have gone to work at many of the largest technology firms in the US and abroad while others have gone on to positions in academia.

Degrees are offered for the Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) degrees with a major in Human Computer Interaction (HCI). A Graduate Certificate and an Online Master of Human Computer Interaction (M.H.C.I.) degree are also offered; these degrees are especially targeted for the benefit of students working in business and industry wanting education in this field. The graduate program in Human Computer Interaction (HCI) welcomes applicants from a diverse collection of technical and creative fields whose unifying characteristic is the desire to develop new ways to bridge the gap between human and machine. The students must demonstrate skill in software development and proficiency in high-level, object-oriented programming. These skills can be acquired after admission to the program. Other entrance requirements will include an undergraduate degree and transcripts, test scores, and other indicators that the applicant can be successful at the graduate level. All students admitted to the Ph.D. program on campus must secure a graduate assistantship.

Program requirements can be found on the program's webpage (<http://www.vrac.iastate.edu/hci/>) and in the Human Computer Interaction Graduate Student Handbook.

All programs of study for the Ph.D. must include:

1. one core course of their choice from each of the categories of Implementation, Design, Evaluation, and Phenomena, if not completed as part of the student's master's program
2. two more HCI courses of their choice from a list of core courses or recommended electives
3. a minimum of nine research credits.

The M.S. degree calls for 30 credits of coursework, including appropriate credit for the master's thesis or the master's creative component. M.S. students must take one core course of their choice from each of the categories of Implementation, Design, Evaluation, and Phenomena. In addition to these courses, M.S. students will be required to take a minimum of 3 research credits.

The online M.H.C.I. program is most appropriate for individuals with a bachelor's degree in a scientific, engineering, business, or artistic discipline, who are pursuing a professional career, and who already have a strong base of information technology skills. Requirements for the online M.H.C.I. Program include taking four courses, one each from the Design, Implementation, Phenomena, and Evaluation categories. However, M.H.C.I. students must take two additional courses of their choice from the list of core courses or the list of recommended electives. M.H.C.I. students will therefore be required to take a total of six courses (18

credits) and the remaining four courses (12 credits) would be electives of your choosing.

Requirements for the HCI Graduate Certificate program include three core HCI courses plus one elective.

Information on application procedures and specific requirements of the major can be obtained on the program webpage: <http://www.vrac.iastate.edu/hci/>

Immunobiology

Immunobiology Interdepartmental Graduate Program

Work is offered for the master of science and doctor of philosophy degrees with a major in Immunobiology. Faculty are drawn from twelve university departments along with researchers from the National Animal Disease Center. Participating departments include: Animal Science; Biochemistry, Biophysics, and Molecular Biology; Biomedical Sciences; Chemical & Biological Engineering; Entomology; Food Science and Human Nutrition; Kinesiology; Natural Resource Ecology & Management; Veterinary Clinical Sciences; Veterinary Diagnostic & Production Animal Medicine; Veterinary Microbiology & Preventative Medicine; and Veterinary Pathology. The diversity of faculty expertise ensures a broad education while offering flexibility in choice of specialization. Ongoing research projects include areas such as: antibody and cell-mediated immunity, gene expression, immunochemistry, immunogenetics, immunomodulation, immunophysiology, mucosal immunity and nutritional immunology. Additional information about program faculty members is available at: www.immunobiology.iastate.edu (<http://www.immunobiology.iastate.edu/>).

Students may enter the Immunobiology program in one of two ways; prospective students may apply directly to the major, or current ISU graduate students may be admitted as a co-major or minor in Immunobiology. Ph.D. students admitted into the Interdepartmental Immunobiology major will take IMBIO 6970 Graduate Research Rotation during their first two semesters. From these rotations the student will select a major professor and join a home department. Affiliating with a major professor is done by the end of the second semester.

Before entering the Immunobiology program, prospective students should have a strong background in the biological sciences; typically including work in immunology, genetics and biochemistry. Prior research experience is highly encouraged.

Immunobiology students should include in their program of study a core of courses which will provide a broad coverage of the basic program in immunobiology. Formal courses should include immunology,

biochemistry, and statistics. Additional coursework may be selected to satisfy individual interests or departmental requirements.

Graduates of the Immunobiology program will have a broad understanding of the interdisciplinary field of immunobiology and will be able to effectively integrate the principles of immunology with related disciplines. They are able to effectively communicate with scientific colleagues and the general public in both formal and informal settings. Graduates are able to integrate theory and research to address complex problems facing scientific professionals studying animal and human health, taking into account related ethical, social, legal and environmental issues. They are skilled at carrying out research, communicating research results, and writing persuasive grant proposals.

GRADUATE STUDY IN IMMUNOBIOLOGY

Curriculum Requirements for Immunobiology Doctoral Students

Ph.D. candidates majoring in Immunobiology must take at least 72 graduate credits. This 72 credits includes the below core course requirements and applicable research credits earned. Credits taken during a student's M.S. program in Immunobiology at Iowa State University will count towards their Ph.D. in Immunobiology.

Ph.D. students should take each of the following:

BBMB 4050	Biochemistry II	3
IMBIO 6020	Current Topics Workshop in Immunology ^{Repeated each Fall}	1
IMBIO 6040	Seminar in Immunobiology ^{Repeated each Spring}	1
IMBIO 6990	Research	
STAT 5101	Statistical Methods for Data Analysis	4
VMPM 6150	Molecular Immunology	3
GRST 5650	Responsible Conduct of Research in Science and Engineering	1

Take one of the following two:

VMPM 5200	Principles of Immunology	3
VMPM 5750	Immunology	3

Take at least two courses from the following approved electives:

BBMB 5450	Molecular Cell Signaling	2
IMBIO 6610	Comparative Immunology and Infectious Disease	2
GDCB 5280	Advances in Molecular Cell Biology	3
VMPM 5400	Livestock Immunogenetics	2
VMPM 6080	Molecular Virology	3
VMPM 6250	Mechanisms of Bacterial Pathogenesis	3
VMPM 6290	Advanced Topics in Cellular Immunology	2
VPTH 6610	Comparative Immunology and Infectious Disease	2

Curriculum Requirements for Immunobiology Master's Students

All M.S. students majoring in Immunobiology are required to complete a minimum of 30 graduate credits. These 30 credits includes core course requirements and applicable research credits earned. The requirements for M.S. students are the same as that for Ph.D. students with the exception of the elective credits. M.S. students are required to take **at least one course from the list of electives** as opposed to the two course minimum for Ph.D. students.

Curriculum Requirements for a Minor in Immunobiology at the PhD Level

Graduate students studying at Iowa State University with an interest in completing an Immunobiology minor for their Ph.D. studies are required to take a total of 12 credit hours of coursework including core courses and approved electives.

Students must be approved for the minor by the Immunobiology program and must follow Graduate College guidelines for POS Committee membership.

Graduate students wishing to seek a minor in Immunobiology are encouraged to contact the Immunobiology Interdepartmental Graduate Program Coordinator for further information. Inquiries can be submitted to: idgp@iastate.edu.

Immunobiology Minor Curriculum at the Ph.D. Level Includes:

One course from each of the following two categories:

Category A:

VMPM 5200	Principles of Immunology	3
VMPM 5750	Immunology	3

Category B:

VMPM 6150	Molecular Immunology	3
VMPM 6290	Advanced Topics in Cellular Immunology	2

One enrollment in the following:

IMBIO 6020	Current Topics Workshop in Immunology	1

Minimum of 2 courses from any of the following approved electives:

BBMB 5450	Molecular Cell Signaling	2
GDCB 5280	Advances in Molecular Cell Biology	3
IMBIO 6610	Comparative Immunology and Infectious Disease	2
MICRO 4080	Virology	3
MICRO 5540	Virology	1
VMPM 5400	Livestock Immunogenetics	2
VMPM 6080	Molecular Virology	3
VMPM 6250	Mechanisms of Bacterial Pathogenesis	3

VMPM 6290	Advanced Topics in Cellular Immunology	2
VPTH 6610	Comparative Immunology and Infectious Disease	2

Interdisciplinary Graduate Studies

www.grad-college.iastate.edu/igs/ (<http://www.grad-college.iastate.edu/igs/>)

GRADUATE PROGRAM

The degree Master of Science or Master of Arts with a major in Interdisciplinary Graduate Studies (IGS) is available to graduate students who wish to have a more diversified program of advanced study than generally permitted for students who specialize in a single subject. The program is open to any qualified graduate student but is most useful to those who wish to improve their subject matter competence in more than one discipline.

Those who elect to pursue the Interdisciplinary Graduate Studies Program are allowed to take courses in three different graduate subject matter areas, each subject contributing a **minimum** of nine (9) semester credits toward the 35 graduate credits required for the degree. Courses which may be used for credit toward this degree are selected from those listed in the *Iowa State University Catalog*.

Both thesis and non-thesis options are available. In the thesis option, the student, with the guidance of a major professor, develops and reports in writing a research study. In the non-thesis option, a creative component is required in which the student demonstrates independent creativity such as a written report of laboratory, field, or library research, a project in fine arts, or some other original contribution. A minimum of three (3) and maximum of five (5) credits in either IGS 5990 Creative Component or IGS 6990 Thesis Research may be counted toward the total 35 semester credits.

The student, in consultation with their Program of Study Committee, will decide on the choice of option (i.e., thesis or non-thesis). The Program of Study Committee also aids the student in planning and approving a program of study and selecting appropriate courses.

A student majoring in Interdisciplinary Graduate Studies may participate in any one of the following areas of specialization:

- Arts and Humanities (<http://igs.grad-college.iastate.edu/areas-of-specialization/arts-and-humanities/>)
- Biological and Physical Sciences (<http://igs.grad-college.iastate.edu/areas-of-specialization/biological-and-physical-sciences/>)
- International Development Studies (<http://igs.grad-college.iastate.edu/areas-of-specialization/international-development-studies/>)

- Social Sciences (<http://igs.grad-college.iastate.edu/areas-of-specialization/social-sciences/>)

Because of the interdisciplinary nature of the Interdisciplinary Graduate Studies Program, students are expected to demonstrate that they can relate in a significant way at least two of the three chosen areas of study. This is usually done in the written work for the thesis research or creative component. In their final oral examination, students also are expected to be able to discuss the relationship among the three areas of study.

Courses primarily for graduate students, open to qualified undergraduates:

IGS 5990: Creative Component

Credits: 1-30. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Courses for graduate students:

IGS 6990: Thesis Research

Credits: 1-30. Repeatable.

Interdisciplinary Studies

INTERDISCIPLINARY STUDIES UNDERGRADUATE MAJOR

Administered by the College of Liberal Arts and Sciences

A major in interdisciplinary studies is offered in the College of Liberal Arts and Sciences for undergraduate students who have unique interdisciplinary educational goals. The student, a faculty review board, and an academic advisor design the major. Leading to either the Bachelor of Arts or the Bachelor of Science degree, the major includes 36 to 48 credits of coursework chosen to provide a coherent, carefully planned program in an area of interest that bridges two or more disciplines. This specialized area is identified on the diploma. Learning goals are individually crafted for each proposed major. All interdisciplinary studies majors must also satisfy the requirements of the liberal arts and sciences curriculum in the College of Liberal Arts and Sciences.

A degree in Interdisciplinary Studies may be particularly attractive to students who wish to develop an area of interest based upon one of the College's cross-disciplinary programs; the faculty of the cross-disciplinary studies programs in Classical Studies and U.S. Latino/a Studies have laid out an interdisciplinary track for study in those areas.

Students have also worked with faculty to propose Interdisciplinary Studies tracks in areas of interest such as International Relations, Ecology Studies, African American Cultural Studies, Asian Studies, and Cognitive Studies.

Learning Outcomes

As part of the proposal process students are expected to identify specific learning goals of their proposed interdisciplinary coursework. In addition to meeting the learning goals of the general education program of the College of Liberal Arts and Sciences and meeting university-wide learning goals, Interdisciplinary Studies majors graduates will be able to:

- Integrate knowledge and modes of thinking grounded in interdisciplinary inquiry.
- Use methods and tools from multiple disciplines to solve problems.
- Connect their learning to their professional goals.

Further information about the Interdisciplinary Studies major can be obtained from the LAS College Student Academic Services office.

HOW TO PROPOSE AN INTERDISCIPLINARY PROGRAM

A student seeking admission to the program in interdisciplinary studies develops a proposal in consultation with faculty and an advisor. The proposal will include a program of study and a letter of application that explains how the proposed major meets specific educational and learning goals. Since students are expected to earn at least 30 credits after they are admitted into the program, the proposal is ordinarily submitted to the LAS Associate Dean for Academic Programs during the sophomore or junior year. The proposal will be considered if the area of interest properly falls within the College of Liberal Arts and Sciences and if the student's educational goals cannot be met by a more traditional combination of existing majors, minors, and electives.

Specific Requirements for the Program of Study

The interdisciplinary studies major must meet College of Liberal Arts and Sciences and University-wide requirements for graduation. In addition, the proposed major must include 36 to 48 credits of coursework chosen to lead to a distinctive set of learning outcomes and bridge two or more disciplines. A major emphasizing the humanities or communicative arts normally leads to a B.A.; a major emphasizing the natural or social sciences normally leads to a B.S.

Courses listed in the individualized program of study may come from any department of the university with the following restrictions:

1. The selection of courses needs to focus on a single theme and be consistent with the career and educational goals of the student.
2. Half or more of the courses in the major must come from departments within the College of Liberal Arts and Sciences.
3. The courses will be chosen from at least two disciplines.
4. All courses in the major must be at the 2000-level or higher.
5. At least 15 credits must be at the 3000-level or higher with at least 6 credits at the 4000-level or higher.

An average grade of C or better must be earned in 15 credits at the 3000-level or higher in the major.

To meet the English and communication proficiency requirement, a grade of C or better must be earned in ENGL 2500 and in either an advanced English composition course or a course in the major with a significant writing component.

LAS majors require a minimum of 120 credits, including a minimum of 45 credits at the 3000/4000 level. You must also complete the LAS world language requirement and career proficiency requirement.

Students in all ISU majors must complete a three-credit course in U.S. Cultures and Communities and a three-credit course in International Perspectives. Check (<http://www.registrar.iastate.edu/courses/div-ip-guide.html>) for a list of approved courses. Discuss with your advisor how the two courses that you select can be applied to your graduation plan.

Forms and sample proposals are available here (<https://iastate.box.com/s/mf3126yjf7tobnjoq9lf4jw67jmxm8iv/>). Further information may be obtained from the LAS College Student Academic Services office.

INTERDISCIPLINARY STUDIES MAJOR WITH A TRACK IN CLASSICAL STUDIES

Students may pursue an Interdisciplinary Studies Major with a track in Classical Studies by completing a program of study defined by faculty who work in this interdisciplinary program. Additional information is available on the Classical Studies page of the catalog.

INTERDISCIPLINARY STUDIES MAJOR WITH A TRACK IN U.S. LATINO/A STUDIES

Students may pursue an Interdisciplinary Studies Major with a track in U.S. Latino/a Studies (<http://catalog.iastate.eduhttps://collegeofliberalartsandsciences/uslatino-a-studies/#interdisciplinarymajortext>) by completing a program of study defined by faculty who work in this cross-disciplinary program. Additional information is available on the U.S. Latino/a Studies page of the catalog.

Iowa Lakeside Laboratory INTERINSTITUTIONAL PROGRAM

Iowa Lakeside Laboratory is run cooperatively by the Iowa Lakeside Laboratory Consortium whose members include Drake University, Iowa State University, the University of Northern Iowa, and the University of Iowa. Lakeside courses can be taken for credit through all Consortium members. Students should check with their advisors to determine whether Lakeside courses can be used to satisfy major or minor requirements or college or university general education requirements.

The Laboratory was established in 1909 for the conservation and study of the rich flora and fauna of northwest Iowa, especially those of the

Iowa Great Lakes region with its numerous lakes, wetlands, and prairies. Its campus is located on approximately 140 acres of restored prairie, wetland, and gallery forest along the west shore of West Okoboji Lake. Lakeside's mission is to provide undergraduate and graduate students an opportunity to get hands-on experience working with a variety of natural and human environments through its field-oriented summer courses and to provide research facilities and support for graduate students and faculty working on research projects in northwestern Iowa. Each summer, Iowa Lakeside Laboratory offers students a unique educational experience: small, full-immersion, field-oriented courses in the natural sciences (archaeology, ecology, environmental science, hydrology, evolution, geology, soils, taxonomy). All courses meet all day from Monday through Friday. The majority of courses run for 4 weeks. Enrollments in most courses are limited to 8 to 10 students.

Courses are taught at the undergraduate (sophomore and junior) and the senior/graduate level. Students obtain one credit for each week (40 hours) in class. One and two week courses are also available, including courses designed especially for teachers. Weather permitting, students normally spend at least part of each day doing field work, either as part of their class work or working on individual or group projects. Because some courses are offered intermittently, the current Iowa Lakeside Laboratory summer brochure or the Lakeside Lab Website (www.lakesidelab.org) should be consulted for the list of courses being offered in a given summer session. The Lakeside Lab Website (www.lakesidelab.org) also contains additional information about the Laboratory and about each course being offered.

Research projects by undergraduates, graduate students and faculty can be done either on the campus or at many nearby natural areas. Undergraduate and graduate students are strongly encouraged to do independent projects at Lakeside and graduate students are welcome to use it as a base for their thesis and dissertation research. Laboratory space and other facilities are available for long-term or short-term research projects.

Teaching and research facilities include eight laboratory buildings, a library, and a lecture hall. Living accommodations include cottages, motel-style units, and a large mess hall. All students are encouraged to stay at Lakeside while they are taking courses to take full advantage of its educational, professional, and social life.

Financial Aid

Iowa Lakeside Laboratory Scholarships are available to both undergraduates and graduate students. All scholarships cover room and board. Information about how to apply for Iowa Lakeside Laboratory Scholarships is included on the Website (www.lakesidelab.org) (<http://www.lakesidelab.org>). Students should also consult the Student

Financial Aid Office for other scholarship, work study, and loan programs for which they are eligible.

Registration

Students can only enroll in Iowa Lakeside Lab courses by submitting an Iowa Lakeside Lab Registration and Scholarship form and Housing form to the Iowa Lakeside Laboratory Administrative Office. These forms are found on the Iowa Lakeside Laboratory Website:(www.lakesidelab.org (<http://www.lakesidelab.org>)).

Early registration is advisable. Because enrollment in Lakeside courses is limited, students should register before May 1 for the following summer session. Housing is also limited and students must apply for housing or indicate that they plan to live off campus at the time of registration.

IOWA LAKESIDE LABORATORY

Iowa Lakeside Laboratory is an off-campus teaching and research facility situated on a 140-acre campus on West Okoboji Lake in Northwest Iowa. It is run cooperatively by Iowa State University, the University of Iowa, the University of Northern Iowa, and Drake University. Each summer Iowa State University students can take up to three undergraduate and/or graduate courses in archaeology, biology, ecology, environmental science, and/or geology for credit at Lakeside (see course listings under Iowa Lakeside Laboratory). All Lakeside courses are small, full-immersion, field-oriented courses that run for 1-4 weeks. Lakeside also offers a variety of short courses for teachers and a series of nontechnical short courses on various aspects of the natural history of Iowa. Information about Lakeside courses as well as registration and housing information can be obtained from the Biology Program Office, 103 Bessey Hall or on the Lakeside Web site, <https://iowalakesidelab.org/>.

Molecular, Cellular, and Developmental Biology
MCDB Interdepartmental Graduate Program

Work is offered for the doctor of philosophy degree with a major in Molecular, Cellular, and Developmental Biology. Faculty are drawn from sixteen university departments along with researchers from the National Animal Disease Center. Participating departments include: Agronomy; Animal Science; Biochemistry, Biophysics & Molecular Biology; Biomedical Sciences; Chemistry; Chemical & Biological Engineering; Ecology, Evolution, & Organismal Biology; Entomology; Food Science & Human Nutrition; Genetics, Development & Cell Biology; Horticulture; Kinesiology; Physics & Astronomy; Plant Pathology; Veterinary Microbiology & Preventive Medicine; and Veterinary Pathology. Facilities and qualified faculty are available in these departments for conducting fundamental research in the various aspects of molecular, cellular, and developmental biology. Ongoing research projects include molecular and cellular studies of viral, prokaryotic, fungal, plant, and

animal systems. Additional information about the program and faculty is available at: www.mcdb.iastate.edu (<http://www.mcdb.iastate.edu/>).

Prospective students are admitted by the MCDB program following receipt of a complete application and after review by the MCDB Admissions Committee. Students are admitted either to participate in research rotations with several faculty before deciding on a major professor and laboratory, or by direct admission into a specific lab and department. Ph.D. students typically enter via rotation and are required to complete a minimum of three research lab rotations with faculty of interest and take MCDB 6970 Graduate Research Rotation during their first two semesters. At the end of their second semester, students on rotation must select a major professor from the faculty participating in the program. Current ISU graduate students may be admitted as a co-major or minor with MCDB.

Before entering the MCDB program, prospective students should have a strong background in the biological sciences; typically including work in biological sciences (two years), organic chemistry (one year), physics (one year), and mathematics (through one year of calculus). Prior research experience is highly encouraged.

UNDERGRADUATE STUDY

A special program in Molecular, Cellular, and Developmental Biology is not offered for the baccalaureate. Undergraduates wishing to prepare for graduate study in molecular, cellular, and developmental biology should elect courses in biochemistry, biology, genetics, microbiology; and mathematics through calculus; chemistry through organic; and one year of physics.

The following are recommended to undergraduates desiring an introduction to this area:

BIOL 3130	Principles of Genetics	3
BIOL 3130L	Genetics Laboratory	1
BIOL 3140	Principles of Molecular Cell Biology	3
BIOL 4230	Developmental Biology	3
BIOL 4230L	Developmental Biology Laboratory	1
BIOL 4280	Cell Biology	3

CURRICULUM REQUIREMENTS FOR MCDB

Ph.D. candidates majoring in MCDB must take at least 72 graduate credits. These 72 credits include the core course requirements (below) and applicable research credits earned.

Additional coursework may be selected by the student in consultation with their Program of Study (POS) Committee to meet departmental requirements and to satisfactorily prepare the student for their research project.

Graduate credits of B or better earned in another Iowa State program, or at another institution, may be transferred at the discretion of the POS Committee and with the approval of the MCDB Program and the ISU Graduate College.

Additional information relating to credits required for graduate degrees can be found in the ISU Graduate College Handbook (<http://www.grad-college.iastate.edu/common/handbook/>).

MCDB Core Curriculum requirements include:

BBMB 4040	Biochemistry I	3
BBMB 4050	Biochemistry II	3

Students with a Biochemistry background can elect to take the 500-level sequence (two of the following courses):

BBMB 5040	Amino Acids and Proteins	2
BBMB 5050	Bioenergetics and Metabolism	2
BBMB 5060	Membrane Biochemistry	2
BBMB 5070	Biochemistry of Nucleic Acids	2

All Ph.D. students must take one course from each of the following areas: A) Cellular Biology, B) Developmental Biology, & C) Molecular Biology.

A. Cellular Biology

GDCB 5280	Advances in Molecular Cell Biology	3
GDCB 5450	Plant Molecular, Cell and Developmental Biology	3
BMS 5750	Cell Biology	3
BBMB 5450	Molecular Cell Signaling	2

B. Developmental Biology

GDCB 5330	Advances in Developmental Biology	3
GDCB 5450	Plant Molecular, Cell and Developmental Biology	3

C. Molecular Biology

MICRO 5020	Microbial Genetics and Genomics	3
GDCB 5110	Advanced Molecular Genetics	3
GDCB 5450	Plant Molecular, Cell and Developmental Biology	3
VMPM 6080	Molecular Virology	3

***Footnote: GDCB 5450 - Plant Molecular, Cellular, and Developmental Biology may be used to fulfill any one of the required component areas.**

In addition to the above course requirements, MCDB graduate students are required to take:

1. Two semesters of research seminar every year.

Fall semester students will enroll in 1) a "for credit" research seminar series offered by the student's home department, 2) a workshop comprised of a research seminar series, or 3) another ISU research seminar series, typically chosen from one of the following departments: Agronomy, Animal Science; Biochemistry,

Biophysics & Molecular Biology; Biomedical Sciences; Chemistry; Chemical & Biological Engineering; Ecology, Evolution, & Organismal Biology; Entomology; Food Science & Human Nutrition; Genetics, Development & Cell Biology; Horticulture; Kinesiology; Physics & Astronomy; Plant Pathology; Veterinary Microbiology & Preventive Medicine; and Veterinary Pathology. (Options 2 and 3 are subject to approval by the POS committee).

Spring semester register for MCDB 6980, Seminar in Molecular, Cellular, and Developmental Biology. In seminar, students will make journal and research presentations and attend MCDB seminars. Three semesters of MCDB 6980 are required. Beyond this requirement, students must enroll in additional semesters of MCDB 6980 or enroll in seminar series as described above for fall semesters.

2. One credit hour of ethics training.

GRST 5650	Responsible Conduct of Research in Science and Engineering	1

Not required, but highly recommended for MCDB graduate students:

BCB 5440	Fundamentals of Bioinformatics	4

Non-native English speakers must pass the English Requirement as established by the university. Depending on the results of this exam additional courses may be required to meet English proficiency standards.

MCDB graduate students need to teach one semester as part of their training for an advanced degree. Students whose first language is not English must take and pass the Oral English Certification Test (OECT) to be eligible to teach.

Curriculum Requirements for Graduate Students Seeking a MCDB Minor

Graduate students studying at Iowa State University with an interest in completing a MCDB minor for their Ph.D. are required to complete the following curriculum requirements.

Students must be approved for the minor by the MCDB program and must follow Graduate College guidelines for POS Committee membership.

Graduate students wishing to seek a minor in MCDB are encouraged to contact the MCDB Interdepartmental Graduate Program Coordinator for further information. Inquiries can be submitted to idgp@iastate.edu.

MCDB Minor Curriculum at the Ph.D. Level Includes:

BBMB 4040	Biochemistry I	3
BBMB 4050	Biochemistry II	3

Students with a Biochemistry background can elect to take the 500-level sequence (two of the following courses):

BBMB 5040	Amino Acids and Proteins	2
BBMB 5050	Bioenergetics and Metabolism	2
BBMB 5060	Membrane Biochemistry	2
BBMB 5070	Biochemistry of Nucleic Acids	2

One course in each of two of the following three areas: A) Cellular Biology, B) Developmental Biology, & C) Molecular Biology.

A. Cellular Biology

GDCB 5280	Advances in Molecular Cell Biology	3
GDCB 5450	Plant Molecular, Cell and Developmental Biology	3
BMS 5750	Cell Biology	3
BBMB 5450	Molecular Cell Signaling	2

B. Developmental Biology

GDCB 5330	Advances in Developmental Biology	3
GDCB 5450	Plant Molecular, Cell and Developmental Biology	3

C. Molecular Biology

MICRO 5020	Microbial Genetics and Genomics	3
GDCB 5110	Advanced Molecular Genetics	3
GDCB 5450	Plant Molecular, Cell and Developmental Biology	3
VMPM 6080	Molecular Virology	3

***Footnote: GDCB 545 - Plant Molecular, Cellular, and Developmental Biology may be used to fulfill any one of the required component areas.**

In addition to the above course requirements, MCDB graduate minors are required to register once for:

MCDB 6980	Seminar in Molecular, Cellular, and Developmental Biology	1-2

Courses primarily for graduate students, open to qualified undergraduates:

MCDB 5110: Advanced Molecular Genetics

(Cross-listed with GDCB 5110).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Mechanisms of molecular genetic processes in eukaryotes and prokaryotes, including DNA replication and repair, transcription, translation and regulation of gene expression. Critical evaluation and discussion of current primary literature, methodologies and experimental data. (Typically Offered: Spring)

MCDB 5280: Advances in Molecular Cell Biology

(Cross-listed with GDCB 5280).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Cell biological processes including cell signaling, cell division, intracellular trafficking, biogenesis of organelles, cell adhesion and motility. Offered even-numbered years. (Typically Offered: Fall)

MCDB 5330: Advances in Developmental Biology

(Cross-listed with GDCB 5330).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Fundamental principles in multicellular development. Emphasis on cellular and molecular regulation of developmental processes, and experimental approaches as illustrated in the current literature. Offered odd-numbered years. (Typically Offered: Fall)

MCDB 5450: Plant Molecular, Cell and Developmental Biology

(Cross-listed with GDCB 5450/ PLBIO 5450).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Plant nuclear and organelle genomes; regulation of gene expression; hormone signaling; organization, function, and development of plant cells and subcellular structures; regulation of plant growth and development. Offered odd-numbered years. (Typically Offered: Fall)

MCDB 5900: Special Topics

Credits: 1-30. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Courses for graduate students:

MCDB 6970: Graduate Research Rotation

Credits: 1-6. Repeatable.

Graduate research projects performed under the supervision of selected faculty members in the molecular, cellular, and developmental biology program. (Typically Offered: Fall, Spring)

MCDB 6980: Seminar in Molecular, Cellular, and Developmental Biology

(Cross-listed with BBMB 6980/ GDCB 6980/ MICRO 6980/ VMPM 6980).

Credits: 1-2. Contact Hours: Lecture 2.

Repeatable.

Student and faculty presentations. (Typically Offered: Spring)

MCDB 6990: Research

Credits: 1-30. Repeatable.

Prereq: Department Permission for Course

Neuroscience

Neuroscience Interdepartmental Graduate Program

Work is offered for the master of science and doctor of philosophy degrees with a major in neuroscience. Cooperating departments include Biochemistry, Biophysics and Molecular Biology; Biomedical Sciences; Chemical and Biological Engineering; Food Science and Human Nutrition; Genetics, Development and Cell Biology; Kinesiology; Mechanical Engineering, Psychology; Veterinary Clinical Sciences; and Veterinary Diagnostic and Production Animal Medicine.

The diversity of faculty in the Interdepartmental Neuroscience major provides students with a variety of research opportunities and reflects the structure of contemporary neuroscience which has become a diverse and interdisciplinary field. Facilities and faculty are committed to research in the following areas: neuronal membrane functions, signal transduction, neuroanatomy, neurodegenerative diseases, neuroendocrinology, neurotoxicology, neuropathology, developmental neurobiology, neurogenetics, computational neuroscience, neural networks, behavioral neuroscience, tissue engineering, neuroregeneration and brain repair. Additional information about program faculty members is available at: www.neuroscience.iastate.edu (<http://www.neuroscience.iastate.edu/>).

An undergraduate or advanced degree in one of the basic or applied sciences is ordinarily a prerequisite for admission to the program. Typical program disciplines include majors in biochemistry, biology, biomedical sciences, human medicine, immunology, neurobiology, physiology, pharmacology, psychology, veterinary medicine, or zoology. Appropriate undergraduate coursework includes mathematics, chemistry, physics, and biological sciences. Prior research experience is highly encouraged. The submission of GRE General Test scores is NOT required for admission.

Prospective students are admitted by the Neuroscience program following an internal application process and after review by the Neuroscience Admissions Committee. Students are admitted either to participate in research rotations with several faculty before deciding on a major professor and laboratory, or by direct admission into a specific lab and department. Ph.D. students typically enter via rotation and M.S. students typically enter via a direct admit. Those students entering through a rotation admit are required to complete a minimum of three research lab rotations with faculty of interest. At the end of their second semester, students on rotation must select a major professor from the faculty participating in the program.

CURRICULUM REQUIREMENTS FOR NEUROSCIENCE GRADUATE STUDENTS

M.S. Curriculum

Students seeking an M.S. degree must take a total of 30 credits, with not less than 22 credits earned at ISU. The following courses are the core curriculum. In addition, students are required to take a minimum of 6 credits of elective courses and an ethics course.

BMS 5370	Neuroanatomy	3
GDCB 5560	Cellular, Molecular and Developmental Neuroscience	3
KIN 5720	Neural Basis of Human Movement	2-3
	or NEURO 5890 Systems Neuroscience: Brain, Behavior, and Nutrition-Related Integrative Physiology	
NEURO 6960	Neuroscience Seminar	1
NEURO 6990	Research	1-13
NEURO 5570	Rotations in Neuroscience	2
NEURO 6610	Advanced Topics in Neuroscience	3
PSYCH 5190	Cognitive Neuropsychology	3
STAT 5101	Statistical Methods for Data Analysis	4

Ph.D. Curriculum

Ph.D. candidates majoring in Neuroscience must take at least 72 graduate credits. These 72 credits includes the below core course requirements and applicable research credits earned. Credits taken during a student's M.S. program in Neuroscience at Iowa State University will count towards their Ph.D. in Neuroscience.

BMS 5370	Neuroanatomy	3
KIN 5720	Neural Basis of Human Movement	2-3
	or NEURO 5890 Systems Neuroscience: Brain, Behavior, and Nutrition-Related Integrative Physiology	
GDCB 5560	Cellular, Molecular and Developmental Neuroscience	3
NEURO 5570	Rotations in Neuroscience	2
NEURO 6610	Advanced Topics in Neuroscience (Repeatable)	3
NEURO 6960	Neuroscience Seminar (Taken every fall & spring)	1
NEURO 6990	Research	1-13
PSYCH 5190	Cognitive Neuropsychology	3
STAT 5101	Statistical Methods for Data Analysis	4
MANDATORY ETHICS TRAINING: All Neuroscience students are also required to complete 1 credit hour of ethics training.		1

In addition to the above coursework, all Neuroscience majors are expected to take a minimum of six credits of approved elective neuroscience courses.

Additional coursework for both Ph.D. and M.S. degrees is selected by the student in consultation with their Academic Plan Committee to meet departmental requirements and to satisfactorily prepare the student for their research project.

Graduate credits of B or better earned at another institution may be transferred at the discretion of the Academic Plan Committee and with the approval of the Neuroscience Program and the ISU Graduate College.

Additional information relating to credits required for graduate degrees can be found in the ISU Graduate College Handbook (<http://www.grad-college.iastate.edu/common/handbook/>).

Curriculum Requirements for Graduate Students Seeking a Neuroscience Minor

Graduate students interested in completing a Neuroscience minor are required to complete 12 credits from the list below.

Students must be approved for the minor by the Neuroscience Program and must follow Graduate College guidelines for Academic Plan Committee membership.

Graduate students wishing to seek a minor in Neuroscience are encouraged to contact the Neuroscience Interdepartmental Graduate Program Coordinator for further information. Inquiries can be submitted to idgp@iastate.edu.

Approved Neuroscience Minor Courses

BMS 5370	Neuroanatomy	3
KIN 5720	Neural Basis of Human Movement	3
GDCB 5560	Cellular, Molecular and Developmental Neuroscience	3
NEURO 5890	Systems Neuroscience: Brain, Behavior, and Nutrition-Related Integrative Physiology	2
NEURO 6960	Neuroscience Seminar	1
PSYCH 5190	Cognitive Neuropsychology	3

Courses primarily for graduate students, open to qualified undergraduates:

NEURO 5560: Cellular, Molecular and Developmental Neuroscience

(Cross-listed with BMS 5560/ GDCB 5560).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Fundamental principles of neuroscience including cellular and molecular neuroscience, nervous system development, and regulatory systems. Offered odd-numbered years. (Typically Offered: Fall)

NEURO 5570: Rotations in Neuroscience

(Cross-listed with GDCB 5570).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Rotation experiences in various neuroscience research methods and techniques related to our current faculty specialties. (Typically Offered: Fall, Spring)

NEURO 5890: Systems Neuroscience: Brain, Behavior, and Nutrition-Related Integrative Physiology

(Cross-listed with FSHN 5890/ GERON 5890/ NUTRS 5890/ PSYCH 5890).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Qualified Undergraduate with Permission of Instructor

Structural, functional, and biochemical aspects of brain and non-motor behavior across the human lifespan. Types of neuroimaging used to assess the brain. Current research is leveraged to gauge how nutrition, diseases related to nutrition, and associated physiological processes influence the brain, particularly for common developmental, psychological, and neurological disorders. (Typically Offered: Spring)

Courses for graduate students:

NEURO 6610: Advanced Topics in Neuroscience

(Cross-listed with BBMB 6610/ KIN 6610/ GDCB 6610).

Credits: 3. Contact Hours: Lecture 3.

Students will present three journal articles and two overview lectures on topics in neuroscience that are related but outside of their own research interest. Offered even-numbered years. (Typically Offered: Spring)

NEURO 6960: Neuroscience Seminar

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Seminar in neuroscience, current research interests, and/or professional development. (Typically Offered: Fall, Spring)

NEURO 6990: Research

Credits: 1-13. Repeatable.

Prereq: Instructor Permission for Course

Nutritional Sciences GRADUATE PROGRAM

The Interdepartmental Graduate Program in Nutritional Sciences, administered through the Graduate College, under the auspices of the Chairs of Food Science and Human Nutrition (FS HN) and Animal Science, will provide the structure for coordinating and enhancing interdisciplinary nutrition research and graduate education. M.S. and Ph.D. degrees in Nutritional Sciences will be offered with three

specializations: Animal Nutrition, Human Nutrition, or Biochemical & Molecular Nutrition.

The following undergraduate course work is recommended of all applicants who are applying to the Interdepartmental Graduate Program in Nutritional Sciences, but may be modified depending upon the student's area of emphasis. Recommended course work includes organic chemistry with laboratory, physics, analytical chemistry, a nutrition course that requires biochemistry or organic chemistry as a prerequisite, and a course in biology/physiology or anatomy. Under certain circumstances students can be admitted or provisionally admitted with course work deficiencies. Students with an undergraduate degree will be generally admitted into the M.S. program and upon completion, they can then apply for admission into the Ph.D. program. However, exceptional students with experience can apply directly to the Ph.D. program.

The general requirements of the Nutritional Sciences degree at the M.S. level, in addition to those of Graduate College, are:

NUTRS 5100	Advanced Nutrition and Metabolism in Health and Disease: Macronutrients	2
NUTRS 5110	Advanced Nutrition and Metabolism in Health and Disease: Micronutrients	2
BBMB 4040	Biochemistry I	3
BBMB 4050 or BBMB 4200	Biochemistry II Mammalian Biochemistry	3
STAT 5101	Statistical Methods for Data Analysis	4
ANS 6030 or FSHN 6820	Seminar in Animal Nutrition Research Presentation and Discussion	1
FSHN 6810	Seminar (or AN S equivalent)	1
FSHN 5900C or ANS 5900L	Special Topics: Teaching Special Topics: Teaching	1-3

Successful completion and defense of thesis

Students are expected to complete the course work established by the Program of Study (POS) committee based on specialization with a minimum of 30 graduate-level semester credits, not less than 22 of which must be earned at Iowa State University.

The general requirements of the Nutritional Sciences degree at the Ph.D. level, in addition to those of the Graduate College, are:

- Completion of all requirements of the M.S. degree in Nutritional Sciences
- 3 additional credits of graduate-level biochemistry (6 credits total including those for the M.S.), graduate-level statistics (STAT 4212 Experimental Design and Data Analysis), and physiology (if not taken for the M.S.)

- Additional graduate-level courses in the field of study as deemed appropriate by the POS Committee and specialization, and additional teaching assistant requirements (FSHN 5900C Special Topics: Teaching).

Satisfactory completion of a preliminary examination, a written dissertation, seminar presentation of dissertation research, and defense of the dissertation is also required. Overall a minimum of 72 graduate-level semester credits, no less than 36 of which must be earned at Iowa State University

Plant Biology

(Interdepartmental Graduate Major)

The Interdepartmental Plant Biology major (IPB) coordinates graduate education and research in the areas of plant biology including but not limited to plant biochemistry, plant cellular and molecular biology and plant physiology. Graduate study in IPB, leading to the M.S. and Ph.D. Degrees, is offered through eight participating departments: Agronomy, Biochemistry, Biophysics & Molecular Biology, Chemical and Biological Engineering, Chemistry, Ecology, Evolution and Organismal Biology, Genetics Development & Cell Biology, Horticulture, and Plant Pathology.

Research conducted by the faculty and students of the major represents both basic and applied aspects of plant physiology, biochemistry and molecular biology. The experimental approaches represented in the major span the range of complexity from molecular studies, to cellular, organismal and the ecological level (crop monocultures and natural populations). Graduates have a broad understanding of basic, functional plant biology with emphases on fundamental biology, biochemistry, and molecular biology. They are able to address complex research and policy problems in agriculture, biotechnology, and basic plant biology.

M.S. Program

A total of 36 credits, which includes a minimum of 16 course credits and at least a B grade or better, are required for an M.S.

All M.S. candidates take a core curriculum comprising courses recommended from the following four categories, attend research seminars (PLBIO 6960), take research credits (PLBIO 6990 Research), and attend the annual Loomis Distinguished Lecture and mini-symposium and retreats. Students will take additional courses of interest as directed by their Program of Study (POS) Committee members.

Required: Complete the following core courses:

STAT 5101	Statistical Methods for Data Analysis	4
BBMB 3160	Principles of Biochemistry	3-6
or BBMB 4040	Biochemistry I	
& BBMB 4050	and Biochemistry II	

or BBMB 5040 Amino Acids and Proteins & BBMB 5050 and Bioenergetics and Metabolism		
GDCB 5130	Plant Metabolism	2
GDCB 5450	Plant Molecular, Cell and Developmental Biology	3
GRST 5650	Responsible Conduct of Research in Science and Engineering	1
PLBIO 6960	Research Seminar *	1
PLBIO 6990	Research	1-30
Optional Courses		
AGRON 5160	Crop Physiology	
AGRON 6250	Genetic Strategies in Plant Breeding	
BBMB 5310	Plant Biochemistry	
BBMB 5450	Molecular Cell Signaling	
BBMB 6750	Nucleic Acid Structure and Function	
BIOL 4540	Plant Anatomy	
BIOL 4740	Plant Ecology	
EEOB 5530	Agrostology	
EEOB 5630	Molecular Phylogenetics	
EEOB 5660	Molecular Evolution	
GDCB 5100	Transmission Genetics	
GDCB 5110	Advanced Molecular Genetics	
GDCB 5280	Advances in Molecular Cell Biology	
STAT 5810	Analysis of Gene Expression Data for the Biological Sciences	

* Required enrollment each semester; must present 2 talks; a maximum of 2 credits of 6960 seminars are counted toward MS degree POSC. Make two seminar presentations and enroll each term in the Interdepartmental Plant Biology seminar PLBIO 6960 Research Seminar. The first seminar must be during the student's first year and is a 20-minute seminar. The last presentation must be an exit seminar. In addition to the required core courses, a wide selection of courses is available to IPB graduate students for broadening their scientific education, and increasing knowledge in topics related to their research. Decisions about which courses are taken and when they are taken are made by the student, initially in consultation with their temporary advisor, and then with their major advisor and eventually with POS Committee, which also serves as the Thesis or Dissertation Committee.

Ph.D. Program

A total of 72 credits, which includes a minimum of 24 course credits and at least a B grade or higher, are required for a Ph.D.

All Ph.D. candidates take a core curriculum comprising courses recommended from the following four categories, attend research seminars, research credits (PLBIO 6990 Research), annual Loomis

Distinguished Lecture in Plant Biology and mini-symposium and retreats. Students will take additional courses of interest as directed by their Program of Study (POS) Committee members.

Required: Complete the following core courses:

STAT 5101	Statistical Methods for Data Analysis	4
BBMB 3160	Principles of Biochemistry	3-6
or BBMB 4040 Biochemistry I & BBMB 4050 and Biochemistry II		
or BBMB 5040 Amino Acids and Proteins & BBMB 5050 and Bioenergetics and Metabolism		
GDCB 5130	Plant Metabolism	2
GDCB 5450	Plant Molecular, Cell and Developmental Biology	3
GRST 5650	Responsible Conduct of Research in Science and Engineering	1
PLBIO 6960	Research Seminar *	1
PLBIO 6990	Research	1-30

Optional Core Courses: Must take one of the following

GDCB 5100	Transmission Genetics	
GDCB 5110	Advanced Molecular Genetics	
EEOB 5510	Plant Evolution and Phylogeny	
EEOB 5660	Molecular Evolution	
Optional Courses		
AGRON 5160	Crop Physiology	
AGRON 6250	Genetic Strategies in Plant Breeding	
BBMB 5310	Plant Biochemistry	
BBMB 5450	Molecular Cell Signaling	
BBMB 6750	Nucleic Acid Structure and Function	
BIOL 4540	Plant Anatomy	
BIOL 4740	Plant Ecology	
EEOB 5530	Agrostology	
EEOB 5630	Molecular Phylogenetics	
EEOB 5660	Molecular Evolution	
GDCB 5100	Transmission Genetics	
STAT 5810	Analysis of Gene Expression Data for the Biological Sciences	

* Required enrollment each semester; must present 4 talks; up to 5 credits of 6960 seminars are counted toward Ph.D. Enroll each term in the Interdepartmental Plant Biology seminar PLBIO 6960 Research Seminar or its listed equivalent. The first seminar must be during the student's first year and is a 20-minute seminar. The last presentation must be an exit seminar. In addition to the required core courses, a wide selection of courses is available to IPB graduate students for broadening their scientific

education, and increasing knowledge in topics related to their research. Decision about which courses to take and when they are to be taken are made by the student, initially in consultation with their temporary advisor, and then with their major advisor and eventually with their POS Committee, which also serves as the Thesis or Dissertation Committee.

Requirements for students seeking a Minor in Plant Biology:

Ph.D. and M.S. candidates in other programs who desire a graduate minor in Plant Biology must take the required courses listed below, achieving a grade of B or better. One member of the student's POS committee must have IPB faculty membership.

Prerequisite Courses:

STAT 5101	Statistical Methods for Data Analysis	4
BBMB 4040	Biochemistry I	3
9 credits from the following:		
AGRON 5160	Crop Physiology	
BIOL 4540	Plant Anatomy	
GDCB 5130	Plant Metabolism	
GDCB 5450	Plant Molecular, Cell and Developmental Biology	

Courses primarily for graduate students, open to qualified undergraduates:

PLBIO 5130: Plant Metabolism

(Cross-listed with GDCB 5130).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Photosynthesis, respiration, and other aspects of plant metabolism.

Offered even-numbered years. (Typically Offered: Fall)

PLBIO 5450: Plant Molecular, Cell and Developmental Biology

(Cross-listed with MCDB 5450/ GDCB 5450).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Plant nuclear and organelle genomes; regulation of gene expression; hormone signaling; organization, function, and development of plant cells and subcellular structures; regulation of plant growth and development.

Offered odd-numbered years. (Typically Offered: Fall)

Courses for graduate students:

PLBIO 6960: Research Seminar

(Cross-listed with AGRON 6960/ BBMB 6960/ FOR 6960/ GDCB 6960/ HORT 6960).

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Research seminars by faculty and graduate students. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

PLBIO 6990: Research

Credits: 1-30. Repeatable.

Seed Science

Administered by the Departments of Agricultural and Biosystems Engineering, Agronomy, Horticulture, and Plant Pathology.

Seed Science must be taken as a secondary major in conjunction with a primary major. The seed science program is designed for students with career interests in one or more aspects of the seed industry. Areas of study focus on seeds including production, conditioning, pathology, physiology, quality control, marketing, and seed plant designs.

Student Learning Outcomes

Upon graduation, students should be able to:

1. Demonstrate understanding of the science and principles of seed production systems, including seed quality assessment and conditioning, and clearly communicate the importance of seeds to our society.
2. Articulate the opportunities in the seed industry for seed-related careers.
3. Apply seed science and technology knowledge for solving seed quality and production problems encountered in the seed industry.

CURRICULUM IN SEED SCIENCE (SECONDARY MAJOR)

Total Degree Requirement: 128 cr.

COMPLETE COMMUNICATION AND LIBRARY REQUIREMENTS OF PRIMARY MAJOR AND 3 CR. FROM THE FOLLOWING:

ENGL 3020	Business Communication	3
ENGL 3090	Proposal and Report Writing	3
ENGL 3120	Communicating Science and Public Engagement	3
ENGL 3140	Technical Communication	3
SPCM 3120	Business and Professional Speaking	3

BIOLOGICAL SCIENCES: 7 CR.

BIOL 2110	Principles of Biology I	4
& 2110L	and Principles of Biology Laboratory I	
or BIOL 2120	Principles of Biology II	
& 2120L	and Principles of Biology Laboratory II	

AGRON 3200	Genetics, Agriculture and Biotechnology	3
or BIOL 3130	Principles of Genetics	

PHYSICAL SCIENCES: 8-9 CR.

CHEM 1630	College Chemistry	5
& 1630L	and Laboratory in College Chemistry	
or CHEM 1770	General Chemistry I	
& 1770L	and Laboratory in General Chemistry I	

One of the following:

AGRON 2590	Organic Compounds in Plants and Soils	3
BBMB 2210	Structure and Reactions in Biochemical Processes	3
CHEM 2310	Elementary Organic Chemistry	4
& 2310L	and Laboratory in Elementary Organic Chemistry	

MATHEMATICAL SCIENCES 6 CR.

MATH 1400	College Algebra	3
or MATH 1500	Discrete Mathematics for Business and Social Sciences	

Statistics course		3

AGRICULTURAL SCIENCES: 28-29 CR.

AGRON 1810	Introduction to Crop Science	3
or HORT 2210	Principles of Horticulture Science	
AGRON 1820	Introduction to Soil Science	3
AGRON 2060	Introduction to Weather and Climate	3
AGRON 2170	Weed Identification	1-2
or AGRON 3310	Crops Practicum	
AGRON 3160	Crop Structure-Function Relationships	3
or HORT 3210	Horticulture Physiology	
AGRON 3540	Soils and Plant Growth	3
9 credits from AGRON, HORT, or TSM (6 credits at 3000-4000 level)		9

ECONOMICS AND BUSINESS: 9 CR.

ECON 1010	Principles of Microeconomics	3
Six credits from the following:		6
ACCT 2840	Financial Accounting	
ECON 1020	Principles of Macroeconomics	
ECON 2300	Farm Business Management	
ECON 2340	Small Business Management	
ECON 2350	Introduction to Agricultural Markets	
ECON 2360	Agricultural Selling	
ECON 3340	Entrepreneurship in Agriculture	
MGMT 3700	Managing Organizations	
MKT 3400	Principles of Marketing	

SEED SCIENCE: 16 CR.

AGRON 3170	Principles of Weed Science	3
AGRON 3380	Seed Science and Technology	3
AGRON 4210	Introduction to Plant Breeding	3
ENT 3760	Fundamentals of Entomology and Pest Management	3
PLP 4080	Principles of Plant Path	3
One of the following:		
AGRON 3110	Professional Internship in Agronomy (seed related)	1
AGRON 4910	Seed Science Internship Experience	1-2
HORT 3910	Horticultural Management Experience	1

HUMANITIES: 3 CR.

3 cr. from approved humanities list: <http://www.cals.iastate.edu/student-services/humanities> (<http://www.cals.iastate.edu/student-services/humanities/>)

SOCIAL SCIENCES: 3 CR.

3 cr. from approved social sciences list: <http://www.cals.iastate.edu/student-services/social-sciences> (<http://www.cals.iastate.edu/student-services/social-sciences/>)

ETHICS: 3 CR.

3 cr. from approved ethics list: <http://www.cals.iastate.edu/student-services/ethics> (<http://www.cals.iastate.edu/student-services/ethics/>)

REMAINING CREDITS (STUDENT CHOICE).

Because seed science is a secondary major, the courses taken by the student during the first year will vary, depending on the primary major (see typical program for the primary major).

Seed Technology and Business

(Interdepartmental Graduate Major)

The Graduate Program in Seed Technology and Business (STB) offers students advanced study in the seed science and technology and business management appropriate for application in the seed sector.

The STB program is focused on preparing students for seed-related management roles by training the next generation of seed leaders. The program is offered by departments in the Ivy Colleges of Business and Agriculture and Life Sciences: Accounting, Agronomy, Finance, Horticulture, Agricultural Biosystems Engineering, Management Information Systems, Management, Marketing and Plant Pathology.

This multidisciplinary program offers a focused online curriculum for a Master of Science in Seed Technology and Business, along with Graduate Certificates in Seed Science and Technology and in Seed Business Management.

ONLINE GRADUATE PROGRAM IN SEED TECHNOLOGY & BUSINESS

The curriculum offers a set of scientific and technical courses that are focused on seed, with a set of basic management courses, similar to those in the core courses of an MBA program. The business courses will use examples drawn from the seed industry. A creative component is required for the Master of Science degree.

Prerequisite for the program is a bachelor's degree in business, agriculture, other biological discipline, or related degrees. Graduate training in these disciplines will also be considered.

Graduates of the Graduate Program in Seed Technology and Business will be prepared for roles in management and leadership within private and public seed and seed-related organizations.

All of the courses listed below are required for the Master of Science degree. The pace of the course sequence is designed to allow the students with work and other commitments to participate. Students will complete the creative component under the guidance of their Program of Study Committee. In many cases, the creative component topic will be associated with the student's work.

Graduates of the Master of Science curriculum will be prepared for roles in management and leadership within seed related organizations, private and public.

Master of Science in Seed Technology and Business

STB 5010	Strategic Management	2
STB 5030	Information Systems	2
STB 5040	Marketing and Logistics	3
STB 5070	Organizational Behavior	2
STB 5080	Accounting and Finance	3
STB 5090	International Seed Business Practices, Policies, & Regulation	3
STB 5100	Crop Improvement	3
STB 5130	Data Science for Agricultural Professionals	3
STB 5340	Seed and Variety, Testing and Technology	2
STB 5350	Introduction to the Seed Industry	1
STB 5390	Seed Conditioning and Storage	2
STB 5430	Seed Physiology	2
STB 5470	Seed Production	2
STB 5920	Seed Health Management	2
STB 5950	Seed Quality, Production, and Research Management	2
STB 5990	Creative Component	2-3

The program also offers two graduate certificates:

Graduate certificate in Seed Science and Technology

STB/AGRON 5100	Crop Improvement	3
STB/AGRON 5130	Data Science for Agricultural Professionals	3
STB/AGRON 5340	Seed and Variety, Testing and Technology	2
STB 5350	Introduction to the Seed Industry	1
STB/AGRON 5390	Seed Conditioning and Storage	2
STB/HORT 5430	Seed Physiology	2
STB/AGRON 5470	Seed Production	2
STB/PLP 5920	Seed Health Management	2
STB/AGRON 5950	Seed Quality, Production, and Research Management	2

Graduate certificate in Seed Business Management

STB 5350	Introduction to the Seed Industry	1
STB/BUSAD 5010	Strategic Management	2
STB/BUSAD 5030	Information Systems	2
STB/BUSAD 5040	Marketing and Logistics	3
STB/BUSAD 5070	Organizational Behavior	2
STB/BUSAD 5080	Accounting and Finance	3
STB/BUSAD 5090	International Seed Business Practices, Policies, & Regulation	3

Graduate certificate courses may be applied to the Master of Science in Seed Technology and Business. Those interested in these graduate certificates should contact the Program for details.

Information on application procedures and specific requirements of the major can be obtained at our website: <http://www.seedgrad.iastate.edu> or by writing to seedgrad@iastate.edu ([//seedgrad@iastate.edu](mailto:seedgrad@iastate.edu)).

Courses primarily for undergraduates:

STB 4940: Seed Pathology

(Dual-listed with PLP 5940). (Cross-listed with PLP 4940).

Credits: 2. Contact Hours: Lecture 2.

Prereq: PLP 4080

Significance of biotic and abiotic diseases that affect the production and utilization of seeds, during each phase of the seed life cycle: growing, harvesting, conditioning, storing, and planting seed. Mechanisms of seed infection and seed-to-seedling transmission are considered for fungi, bacteria, viruses/viroids, and nematodes. Aspects of epidemiology, management, and host-pathogen relationships are discussed. Emphases include the role of seed health testing in the global seed industry for quality control and phytosanitary certification, as well as the use of seed treatments to manage seedborne and soilborne pathogens and pests. Concurrent enrollment in PLP 4940L/5940L (Seed Pathology Laboratory) is strongly encouraged (on-campus students only). Graduation Restriction: Credit may not be obtained for both PLP/STB 5920 and PLP 5940. Offered odd-numbered years. (Typically Offered: Fall)

STB 4940L: Seed Pathology Laboratory

(Dual-listed with PLP 5940L). (Cross-listed with PLP 4940L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: PLP 4080

Laboratory in seed pathology. Seed health testing methods; effects of seed treatments and seed conditioning on seedborne pathogens. Offered odd-numbered years. (Typically Offered: Fall)

Courses primarily for graduate students, open to qualified undergraduates:

STB 5010: Strategic Management

(Cross-listed with BUSAD 5010).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Admission to the Graduate Program in Seed Technology and Business or Permission of Instructor

Critical analysis of current practice and case studies in strategic management with an emphasis on integrative decision making. Strategy formulation and implementation will be investigated in the context of complex business environments.

STB 5030: Information Systems

(Cross-listed with BUSAD 5030).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Admission to the Graduate Program in Seed Technology and Business or Permission of Instructor

Introduction to a broad variety of information systems (IS) topics, including current and emerging developments in information technology (IT), IT strategy in the context of corporate strategy, and IS planning and development of enterprise architectures. Cases, reading, and discussions highlight the techniques and tactics used by managers to cope with strategic issues within an increasingly technical and data-driven competitive environment.

STB 5040: Marketing and Logistics

(Cross-listed with BUSAD 5040).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Admission to the Graduate Program in Seed Technology and Business or Permission of Instructor

Integration of the business functions concerned with the marketing and movement of goods along the supply chain with the primary goal of creating value for the ultimate customer. Coordination of marketing, production, and logistics activities within the firm and with outside suppliers and customers in the supply chain.

STB 5070: Organizational Behavior

(Cross-listed with BUSAD 5070).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Admission to the Graduate Program in Seed Technology and Business or Permission of Instructor

Understanding human behavior in organizations, and the nature of organizations from a managerial perspective. Special emphasis on how individual differences, such as perceptions, personality, and motivation, influence individual and group behavior in organizations and on how behavior can be influenced by job design, leadership, groups, and the structure of organizations.

STB 5080: Accounting and Finance

(Cross-listed with BUSAD 5080).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Admission to the Graduate Program in Seed Technology and Business or Permission of Instructor

Survey of fundamental topics in accounting and finance. Financial statement reporting and analysis for agriculture firms, corporate governance issues related to financial reporting, (e.g., Sarbanes-Oxley). Basic tools and techniques used in financial management, including stock and bond valuation. How to assess and use capital budgeting methods to evaluate proposed firm investments.

STB 5090: International Seed Business Practices, Policies, & Regulation

(Cross-listed with BUSAD 5090).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Admission to the Graduate Program in Seed Technology and Business or Permission of Instructor

Cultural, financial, economic, political, legal/regulatory environments shaping an organization's international business strategy. Topics include entry (and repatriation) of people, firms, goods, services, and capital. Special attention to the institutions of seed regulation and policy. Ethical issues facing managers operating in an international context.

STB 5100: Crop Improvement

(Cross-listed with AGRON 5100).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

A study of agriculture from its origins with the domestication of crop plants through basic genetics, demonstrating the challenges and elements of breeding strategies intended to manage gene x environmental interactions. Elements of biotechnology including use of molecular markers, development of genetically modified cultivars, gene mapping, cloning, and gene editing will be covered. Methods to measure the effectiveness of plant breeding (genetic gain) and the impact of improved agronomic practices contributing to increased agricultural productivity will be covered. Use of intellectual property protection, and the conservation and utilization of exotic genetic resources.

STB 5110: Crop Improvement

(Cross-listed with AGRON 5110).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Basic principles in the genetic improvement of crop plants. Methods of cultivar development in self-pollinated and cross-pollinated crop species. (Typically Offered: Fall, Spring)

STB 5130: Data Science for Agricultural Professionals

(Cross-listed with AGRON 5130).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (AGRON 1810 or equivalent, MATH 1400, STAT 1040) OR Graduate Classification

Quantitative methods for analyzing and interpreting agronomic information. Principles of experimental design, hypothesis testing, analysis of variance, regression, correlation, and graphical representation of data. Use of SAS and Excel for organization, analyzing, and presenting data. (Typically Offered: Fall, Spring)

STB 5340: Seed and Variety, Testing and Technology

(Cross-listed with AGRON 5340).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Admission to the Graduate Program in Seed Technology and Business or Permission of Instructor

The components of seed quality and how they are assessed in the laboratory, including traits derived from modern biotechnology. The impact of new technologies on seed quality testing. Variety maintenance procedures and breeder seed. Variety identification: phenotype and grow-out trials, isozyme testing, and DNA marker testing. Procedures for evaluating varieties. The variance tests appropriate for fixed effects analysis of variance. Statistical inference and stratification for yield trials. Use of strip plot testing. (Typically Offered: Summer)

STB 5350: Introduction to the Seed Industry

Credits: 1. Contact Hours: Lecture 1.

Prereq: Admission to the Graduate Program in Seed Technology and Business or Permission of Instructor

This introductory course is a quick overview of the academic program and the seed industry. It describes how the STB program components relate to the seed industry scope; the role of the seed industry in global agriculture and society; public and private institutions involved in seed research, development, and regulation; quality management for seed products. Current issues including industry consolidation, ethical and economic issues related to biotechnology, and incorporation of digital technology in the seed business will be discussed by course instructors and guest lecturers from the seed industry.

STB 5360: Quantitative Methods for Seed

(Cross-listed with AGRON 5360).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Quantitative Methods for analyzing and interpreting agronomic and business information for the seed industry. Principles of experimental design and hypothesis testing, regression, correlation, analysis of variance, and graphical representation of data. Use of spreadsheets and statistical software for manipulating, analyzing and presenting data. (Typically Offered: Fall)

STB 5390: Seed Conditioning and Storage

(Cross-listed with AGRON 5390).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Admission to the Graduate Program in Seed Technology and Business or Permission of Instructor

The technical operations which may be carried out on a seed lot from harvest until it is ready for marketing and use. The opportunities for quality improvement and the risks of deterioration which are present during that time. Analysis of the costs of and benefits of operations. Evaluation of equipment based on benefits to the customer and producer. Interpretation of the role of the conditioning plant and store as a focal points within the overall operations of a seed company. (Typically Offered: Spring)

STB 5430: Seed Physiology

(Cross-listed with HORT 5430).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Admission to the Graduate Program in Seed Technology and Business or Permission of Instructor

Brief introduction to plant physiology. Physiological aspects of seed development, maturation, longevity, dormancy and germination. Links between physiology and seed quality. (Typically Offered: Fall)

STB 5470: Seed Production

(Cross-listed with AGRON 5470).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Admission to the Graduate Program in Seed Technology and Business or Permission of Instructor

Survey of crop production; including management of soil fertility, planting dates, populations, weed control, and insect control. Analysis of the principles of seed multiplication and the key practices which are used to ensure high quality in the products. Field inspection procedures and production aspects that differ from other crop production. Foundation seed production. Analysis of the typical organization of field production tasks. Survey of the differences in seed production strategies between crops and the impact of these differences on seed production.

STB 5900: Special Topics

Credits: 1-3. Repeatable.

Prereq: Admission to the Graduate Program in Seed Technology and Business or Permission of Instructor

Guided instruction and self-study on special topics relevant to seed technology and business. (Typically Offered: Fall, Spring, Summer)

STB 5920: Seed Health Management

(Cross-listed with PLP 5920).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Occurrence and management of diseases during seed production, harvest, conditioning, storage, and planting. Emphasis on epidemiology, disease management in the field, seed treatment, effects of conditioning on seed health, and seed health testing. Graduation Restriction: Credit may not be obtained for both PLP/STB 5920 and PLP 5940. Offered even-numbered years. (Typically Offered: Spring)

STB 5940: Seed Pathology

(Dual-listed with PLP 4940). (Cross-listed with PLP 5940).

Credits: 2. Contact Hours: Lecture 2.

Prereq: PLP 4080 or Graduate Classification

Significance of biotic and abiotic diseases that affect the production and utilization of seeds, during each phase of the seed life cycle: growing, harvesting, conditioning, storing, and planting seed. Mechanisms of seed infection and seed-to-seedling transmission are considered for fungi, bacteria, viruses/viroids, and nematodes. Aspects of epidemiology, management, and host-pathogen relationships are discussed. Emphases include the role of seed health testing in the global seed industry for quality control and phytosanitary certification, as well as the use of seed treatments to manage seedborne and soilborne pathogens and pests. Concurrent enrollment in PLP 4940L/5940L (Seed Pathology Laboratory) is strongly encouraged (on-campus students only). Graduation Restriction: Credit may not be obtained for both PLP/STB 5920 and PLP 5940. Offered odd-numbered years. (Typically Offered: Fall)

STB 5940L: Seed Pathology Laboratory

(Dual-listed with PLP 4940L). (Cross-listed with PLP 5940L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: PLP 4080 or Graduate Classification

Laboratory in seed pathology. Seed health testing methods; effects of seed treatments and seed conditioning on seedborne pathogens. Offered odd-numbered years. (Typically Offered: Fall)

STB 5950: Seed Quality, Production, and Research Management

(Cross-listed with AGRON 5950).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Admission to the Graduate Program in Seed Technology and Business or Permission of Instructor

Advanced survey of the organization, staff capabilities and management characteristics typical in seed production and crop improvement in seed enterprises. Analysis of the use of quality information in the management of seed operations and sales. Process management applications for seed. Production planning for existing capacity. Analysis of the manager's tasks in the annual cycle and how the tasks of these managers relate to the general categories of business management roles. Difference in management strategies used with different situations and groups of employees.

STB 5990: Creative Component

Credits: 1-3. Repeatable.

Prereq: Admission to the Graduate Program in Seed Technology and Business or Permission of Instructor

A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

Sustainability Minor

OVERVIEW OF THE MINOR IN SUSTAINABILITY

Sustainability is often defined as "meeting the needs of today without compromising the ability of future generations to meet their own needs."

The minor in sustainability at Iowa State University is available to any ISU student who wants to further learn about sustainability issues affecting humans today and in the future.

The interdisciplinary minor in sustainability exposes students to ideas and issues related to a sustainable, balanced and ethical future for the planet and its inhabitants. The minor is at the interplay between environmental, social and economic factors in improving the quality of human life within the capacity of supporting ecosystems.

The minor will help students understand the dynamics of biological population growth and decline in the natural world, predator-prey models, over-exploitation of natural resources, energy balances, and much more. Students also will study how human behavior affects the natural world and the ability of earth to sustain life and understand how the decisions they make as consumers, workers, resource owners, citizens and policymakers affect human welfare in this and future generations.

Student Learning Outcomes

As a result of their coursework for the sustainability program students will be able to:

- Articulate why some environmental, social and economic profiles are sustainable and others are not.
- Apply sustainable practices in their personal and professional lives.

The colleges of Agriculture and Life Sciences, Design, Engineering, and Liberal Arts and Sciences sponsor the minor in sustainability.

REQUIREMENTS FOR THE MINOR IN SUSTAINABILITY

The minor in sustainability may be earned by completing a total of 15 credits including two required courses and nine elective credits from an approved list. Of the nine elective credits, at least six credits must be at the 3000 level or higher. The minor must include at least 9 credits that are not used to meet any other department, college, or university requirement.

Required courses:

MATE 2200	Globalization and Sustainability	3
ANTHR 2300	Globalization and the Human Condition	3

Emphasis Electives:

ABE 3250	Biorenewable Systems	3
ABE 3800	Principles of Biological Systems Engineering	3
EE 3880	Sustainable Engineering and International Development	3
ABE 4800	Engineering Analysis of Biological Systems	3
AGRON 1200	Introduction to Renewable Resources	3
AGRON 1600	Water Resources of the World	3
AGRON 3420	World Food Issues: Past and Present	3
AGRON 4040	Global Change	3
AGRON 4500	Issues in Sustainable Agriculture	3
ANTHR 3360	Culture and Capitalism	3
ARCH 3450	Building Science and Technology I	2
ARCH 3460	Building Science and Technology II	3
ARCH 3460L	Building Science and Technology II Lab	2
ARCH 3470	Building Science and Technology III	3
ARCH 3470L	Building Science and Technology III Lab	2
ARCH 3480	Building Science and Technology IV	3
ARCH 3480L	Building Science and Technology IV Lab	2
ARCH 4450	Building Science and Technology V	2
ARCH 5580	Sustainability and Green Architecture	3
ARCH 5750	Contemporary Urban Design Theory	3
ARCH 5970	Seminar on the Built Environment III: Theory	3
ART 4600	Sustainable Design and Fabrication of Furniture	3
ART 4650	Artists, Designers and Sustainable Development	3

ART 4660	Studio Abroad: Africa	3	ENVS 3420	World Food Issues: Past and Present	3
BIOL 2040	Biodiversity	2	ENVS 3450	Population and Society	3
BIOL 3190	Analysis of Environmental Systems	3	ENVS 3550	Literature and the Environment	3
BIOL 3550	Plants and People	3	ENVS 3800	Energy, Environmental and Resource Economics	3
BIOL 4710	Introductory Conservation Biology	3	ENVS 3820	Environmental Sociology	3
BIOL 4840	Ecosystem Ecology	3	ENVS 4040	Global Change	3
CE 3880	Sustainable Engineering and International Development	3	ENVS 4240	Sustainable and Environmental Horticulture Systems	3
CRP 2010	The North American Metropolis	3	ENVS 4500	Issues in Sustainable Agriculture	3
CRP 2910	World Cities and Globalization	3	ENVS 4840	Sustainable Communities	3
CRP 2930	Environmental Planning	3	ENVS 4910	Environmental Law and Planning	3
CRP 3200	Urban Geography	3	FOR 4520	Ecosystem Management: Integrating Ecology, Society, and Policy	3
CRP 4170	Urban Revitalization	3	FSHN 2420	The US Food System	3
CRP 4290	Planning in Developing Countries	3	FSHN 3420	World Food Issues: Past and Present	3
CRP 4450	Transportation Policy and Planning	3	FSHN 4600	Global Nutrition, Health and Sustainability	3
CRP 4840	Sustainable Communities	3	GEOL 1010	Environmental Geology: Earth in Crisis	3
CRP 4910	Environmental Law and Planning	3	GEOL 1080	Introduction to Oceanography	3
ECON 3800	Energy, Environmental and Resource Economics	3	GEOL 1600	Water Resources of the World	3
ECON 3850	Economic Development	3	GEOL 3240	Energy and the Environment	3
ECON 4800	Intermediate Environmental and Resource Economics	3	GEOL 4020	Watershed Hydrology	3
EE 3880	Sustainable Engineering and International Development	3	GLOBE 2010	Introduction to Global Resource Systems	3
ENGL 3550	Literature and the Environment	3	GLOBE 3850	Economic Development	3
ENGL 2010	Introduction to Literature	3	GLOBE 4020	Responses to Global Resource System Challenges	3
ENSCI 3190	Analysis of Environmental Systems	3	HORT 4240	Sustainable and Environmental Horticulture Systems	3
ENSCI 4020	Watershed Hydrology	3	JLMC 3470	Science Communication	3
ENSCI 4040	Global Change	3	JLMC 4740	Communication Technology and Social Change	3
ENSCI 4800	Engineering Analysis of Biological Systems	3	LA 2700	Foundations in Natural Resource Policy and History	3
ENSCI 4840	Ecosystem Ecology	3	LA 3020	Ecological Design	6
ENT 4710	Insect Ecology	3	LA 4910	Environmental Law and Planning	3
ENVS 1010	Environmental Geology: Earth in Crisis	3	ME 4330	Alternative Energy	3
ENVS 1080	Introduction to Oceanography	3	ME 4840	Technology, Globalization and Culture	3
ENVS 1200	Introduction to Renewable Resources	3	GEOL 1600	Water Resources of the World	3
ENVS 1600	Water Resources of the World	3	MTEOR 3240	Energy and the Environment	3
ENVS 2010	Introduction to Environmental Issues	2	NREM 4020	Watershed Hydrology	3
ENVS 2040	Biodiversity	2	MTEOR 4040	Global Change	3
ENVS 2700	Foundations in Natural Resource Policy and History	3	NREM 1200	Introduction to Renewable Resources	3
ENVS 2930	Environmental Planning	3	NREM 2700	Foundations in Natural Resource Policy and History	3
ENVS 3190	Analysis of Environmental Systems	3	NREM 4020	Watershed Hydrology	3
ENVS 3240	Energy and the Environment	3			
ENVS 3340	Environmental Ethics	3			

NREM 4520	Ecosystem Management: Integrating Ecology, Society, and Policy	3
NREM 4710	Agroforestry Systems	3
PHIL 3340	Environmental Ethics	3
PHIL 3430	Philosophy of Technology	3
RUS 3750	Russia Today	3
SOC 3450	Population and Society	3
SOC 3480	Global Poverty, Resources and Sustainable Development	3
SOC 3820	Environmental Sociology	3
SOC 4110	Social Change in Developing Countries	3
SUSE 5010	Sustainable Design in Communities	5
SUSE 5110	Sustainable Design Colloquium I	3
SUSE 5210	Foundation of Sustainable Design	3
SUSE 5310	Human Dimensions of Sustainability	3
SUSE 5400	Methods for Sustainable Design	3
SUSE 5500	Making Resilient Environments	3
TSM 3240	Soil and Water Conservation Management	3
TSM 3250	Biorenewable Systems	3
WLC 4840	Technology, Globalization and Culture	3

Toxicology

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Interdepartmental Graduate Major

Toxicology is the science of studying the adverse effects of substances on living organisms. Students observe, gather data and predict risks and outcomes in populations. Whole organism research and cellular and molecular approaches are used to determine toxicant exposure and mechanisms. Work is offered for the degrees doctor of philosophy and master of science. Students majoring in toxicology will be affiliated with one of the following cooperating departments: Agricultural and Biosystems Engineering; Animal Science; Biochemistry, Biophysics and Molecular Biology; Biomedical Sciences; Chemistry; Earth, Atmosphere, and Climate; Entomology; Food Science and Human Nutrition; Genetics, Development and Cell Biology; Natural Resource Ecology and Management; Physics; Plant Pathology and Microbiology; Veterinary Diagnostic and Production Animal Medicine; Veterinary Microbiology and Preventive Medicine; and Veterinary Pathology.

The prerequisites for entrance into the graduate toxicology major include an undergraduate degree in a relevant area of study; for example, chemical engineering, biology, biochemistry, chemistry, ecology, entomology, food science and technology, microbiology, nutritional

science, zoology, or veterinary medicine. Minimum undergraduate coursework should include the following or their equivalent:

- 1 year of college mathematics, including calculus
- 1 year of inorganic chemistry with quantitative analysis
- 1 course in physics
- 1 year of organic chemistry
- 2 years of biological sciences including 1 course in physiology

Other courses that are considered desirable in undergraduate preparation include: biochemistry, physical chemistry, qualitative analysis, and some specialized courses such as histology or advanced physiology.

Facilities and faculty are available for fundamental research in such areas as agricultural toxicology, drug discovery and prevention, ecotoxicology, environmental fate and effects of chemicals, insect toxicology, aquatic toxicology, food safety, nutritional toxicology, mycotoxins, neurotoxicology, cellular and molecular toxicology, reproductive toxicology, and veterinary toxicology.

Ph.D. and M.S. Students should register for TOX 6890 (R) every fall and spring semester during their training.

Curriculum

Students majoring in toxicology will be affiliated with a cooperating department. All Ph.D. students take a core curriculum consisting of:

TOX 5010	Principles of Toxicology	3
TOX 5020	Toxicology Methods	3
TOX 5040	Toxicology Seminar (taken twice)	1
7 additional credits in approved toxicology courses		7
BBMB 4050	Biochemistry II (2 additional credits of biochemistry courses)	
BBMB 4040	Biochemistry I	
2 additional credits of upper level BBMB coursework. 3 credits in physiology, histology, pathology, neuroscience, immunobiology or cellular and molecular biology.		2 and 3
STAT 5101	Statistical Methods for Data Analysis	4
STAT 5212	Experimental Design and Data Analysis	3
GRST 5650	Responsible Conduct of Research in Science and Engineering (or)	1
VPTH 5540	Ethics in Scientific Research and Writing	1

M.S. students take a core of:

TOX 5010	Principles of Toxicology	3
TOX 5020	Toxicology Methods	3
TOX 5040	Toxicology Seminar	1
3 additional credits in approved toxicology courses		3

BBMB 4040	Biochemistry I	3
BBMB 4050	Biochemistry II	3
STAT 5101	Statistical Methods for Data Analysis	4
Additional coursework is selected to meet departmental requirements and to satisfy individual student research interests		
GRST 5650	Responsible Conduct of Research in Science and Engineering (or)	1
VPTH 5540	Ethics in Scientific Research and Writing	1

A graduate minor in toxicology is available for students enrolled in other majors.

A minor for an M.S. degree includes one semester of TOX 6890 and:

TOX 5040	Toxicology Seminar	1
TOX 5010	Principles of Toxicology	3
3 credits in other approved toxicology courses		3

A minor at the Ph.D. level includes one semester of TOX 6890 and:

TOX 5040	Toxicology Seminar	1
TOX 5010	Principles of Toxicology	3
6 credits in other approved toxicology course work		6

One member of the student's program of study committee will be a member of the toxicology faculty.

Most students awarded doctoral degrees continue their training as postdoctoral associates at major research institutions in the U.S. or abroad in preparation for research and/or teaching positions in academia, industry, the military, veterinary research, or government environmental and public health institutions. A few go directly to permanent research positions in industry. Many students awarded master's degrees continue their training as doctoral students; however, some choose research support positions (i.e., technician, chemist, research associate) in academia, industry, or government. A more thorough list of outcomes is available at our Web site.

Graduates of the Toxicology major will be able to carefully design, execute and analyze experiments that extend the knowledge of toxicology and closely related sciences. They will be able to clearly communicate research findings, and thoroughly evaluate the literature of toxicology, contributing significantly to the advancement of the field.

Courses primarily for undergraduates:

TOX 4010: Principles of Toxicology

(Dual-listed with TOX 5010).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BBMB 4040

Principles of toxicology governing entry, fate, and effects of toxicants on living systems. Includes toxicokinetics and foreign compound metabolism relative to toxification or detoxification. Fundamentals of foreign compound effects on metabolism, physiology, and morphology of different cell types, tissues, and organ systems. (Typically Offered: Fall)

TOX 4190: Foodborne Hazards

(Cross-listed with MICRO 4190/ FSHN 4190).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MICRO 2010 or MICRO 3020; 3 credits in BBMB

Pathogenesis of human microbiological foodborne infections and intoxications, principles of toxicology, major classes of toxicants in the food supply, governmental regulation of foodborne hazards. Assessed service-learning component. Offered even-numbered years. Graduation Restriction: Only one of FSHN 4190 and FSHN 5190 may count toward graduation. (Typically Offered: Spring)

TOX 4200: Food Microbiology

(Cross-listed with MICRO 4200/ FSHN 4200).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MICRO 2010 or MICRO 3020

Effects of microbial growth in foods. Methods to control, detect, and enumerate microorganisms in food and water. Foodborne infections and intoxications. (Typically Offered: Fall)

TOX 4500: Pesticides in the Environment

(Dual-listed with ENT 5500/ TOX 5500). (Cross-listed with ENT 4500).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 6 credits of BIOL or Permission of Instructor

Fate and significance of pesticides in soil, water, plants, animals, and the atmosphere. (Typically Offered: Spring)

TOX 4900: Independent Study

Credits: 1-2. Repeatable.

Prereq: Instructor Permission for Course

Independent study with a faculty mentor. Intended for students enrolled in the Pharmacology and Toxicology minor. Graduation Restriction: Students in the Pharmacology and Toxicology minor may use no more than 9 credits of university-wide 4900 credits towards the total of 120 credits required for graduation. (Typically Offered: Fall, Spring, Summer)

TOX 4990: Undergraduate Research

Credits: 1-3. Repeatable, maximum of 3 credits.

Prereq: Instructor Permission for Course

Independent research under faculty guidance. Intended for students enrolled in the Pharmacology and Toxicology minor. Graduation Restriction: Students may use no more than 9 credits of university-wide 4990 credits towards the total of 120 credits required for graduation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

TOX 5010: Principles of Toxicology

(Dual-listed with TOX 4010).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Principles of toxicology governing entry, fate, and effects of toxicants on living systems. Includes toxicokinetics and foreign compound metabolism relative to toxification or detoxification. Fundamentals of foreign compound effects on metabolism, physiology, and morphology of different cell types, tissues, and organ systems. (Typically Offered: Fall)

TOX 5020: Toxicology Methods

Credits: 3.

Prereq: Graduate Standing or Permission of Instructor

Provides demonstrations or laboratory experience in the application of methods used in toxicology, including safety procedures, calculation and data analysis, teratologic and morphologic evaluation, cellular/molecular toxicological techniques, electrophysiologic measures, in vitro enzyme induction/biotransformation, neural and behavioral toxicology testing. Offered even-numbered years. (Typically Offered: Spring)

TOX 5040: Toxicology Seminar

Credits: 1. Contact Hours: Lecture 1.

Repeatable, maximum of 2 credits.

Prereq: Graduate Standing or Permission of Instructor

Presentation of a seminar about a current topic in toxicology as part of a weekly series of seminars by graduate students, faculty, and guest lecturers from off campus. Graduate student speakers will meet with the instructor at least one week prior to their formal presentation. (Typically Offered: Fall, Spring, Summer)

TOX 5150: Regulatory Toxicology

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

A survey course on risk analysis approaches used by toxicologists and other life and social scientists in government, industry and non-governmental organizations to inform regulatory policies and decisions under U.S. Federal statutes, including the Federal Food Drug and Cosmetic Act; the Food Quality Protection Act; the Federal Fungicide, Insecticide and Rodenticide Act; the Endangered Species Act; the Plant Protection Act; the National Environmental Policy Act; and the Toxic Substances Control Act. Topics covered include an overview of the roles and responsibilities of different U.S. Government Departments and Agencies in analyzing human; livestock and companion animal; and/or environmental risks and benefits of food products and food additives, cosmetics, drugs, pesticides, and consumer and industrial products. Offered odd-numbered years. (Typically Offered: Fall)

TOX 5290: Foodborne Toxicants

(Cross-listed with FSHN 5290).

Credits: 2. Contact Hours: Lecture 2.

Mechanisms of action, metabolism, sources, remediation/detoxification, risk assessment of major foodborne toxicants of current interest, design of HACCP plans for use in food industries targeting foodborne toxicants, discussion of toxicants from a food defense perspective. Offered online only. (Typically Offered: Fall, Spring, Summer)

TOX 5440: Aquatic Toxicology

Credits: 2. Contact Hours: Lecture 1, Discussion 1.

Prereq: Graduate Standing or Permission of Instructor

An overview of interactions between anthropogenic chemicals and aquatic ecosystems. Topics include history of aquatic toxicology, methods of toxicity testing, and species responses to toxicants. Emphasis is on aquatic pollutants of emerging concern (e.g., nanoparticles, microplastics). Offered odd-numbered years. (Typically Offered: Spring)

TOX 5460: Clinical and Diagnostic Toxicology

(Cross-listed with VDPAM 5460).

Credits: 1-3. Contact Hours: Laboratory 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Advanced study of current problems and issues in veterinary toxicology. Emphasis on problem solving and interpreting clinical cases while utilizing clinical, epidemiological, and laboratory resources. Course consists highly of clinical case based material. (Typically Offered: Fall, Spring, Summer)

TOX 5500: Pesticides in the Environment

(Dual-listed with ENT 4500/ TOX 4500). (Cross-listed with ENT 5500).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 9 credits in BIOL or Graduate Classification

Fate and significance of pesticides in soil, water, plants, animals, and the atmosphere. (Typically Offered: Spring)

TOX 5540: General Pharmacology

(Cross-listed with BMS 5540).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

General principles; drug disposition; drugs acting on the nervous, cardiovascular, renal, gastrointestinal, and endocrine systems. (Typically Offered: Spring)

TOX 5650: Methods in Biostatistics and Epidemiology

(Cross-listed with STAT 5650).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Statistical methods commonly used in epidemiology and human and animal health studies. Overview of cohort studies, case-control studies and randomized clinical trials. Topics include inference procedures for disease risk factors, analysis of time-to-event and survival data, analysis of longitudinal studies of disease progression and health status, diagnostic test evaluation, and meta-analysis. Examples will come from recent studies of physical and mental health, nutrition and disease progression in human and animal populations. Use of statistical software: SAS or R. Offered even-numbered years. (Typically Offered: Fall)

TOX 5690: Reproductive and Developmental Toxicology

(Cross-listed with ANS 5690).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Chemical agents that target developmental and reproductive systems in animals and humans, both male and female. The influence that timeline of developmental in utero and what part of reproductive organ have on outcome of environmental exposures will be developed. The physiological changes due to exposure, and mechanistic pathways activated by xenobiotics will be defined and the consequences of these changes will be explored. Offered even-numbered years. (Typically Offered: Fall)

TOX 5700: Risk Assessment for Food, Agriculture and Veterinary Medicine

(Cross-listed with AGRON 5700/ VDPAM 5700).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Risk assessment principles as applied to biological systems. Exposure and effects characterization in human and animal health and ecological risk assessment. Risk analysis frameworks and regulatory decision-making. Introduction to quantitative methods for risk assessment using epidemiological and distributional analysis. Uncertainty analysis. Offered odd-numbered years. (Typically Offered: Fall)

TOX 5750: Cell Biology

(Cross-listed with BMS 5750).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

A multi-instructor course covering major topics in cell structure and function, including: universal features of prokaryotic and eukaryotic cells, types of utilization and conversion of energy, genetic control of cell shape and functionality, internal organization of cells, communication between cells and their environment, development of multicellular systems. Students have to write a term paper. (Typically Offered: Fall)

TOX 5900: Special Topics

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Contact individual faculty for special projects or topics. Graded.

Courses for graduate students:**TOX 6260: Advanced Food Microbiology**

(Cross-listed with MICRO 6260/ FSHN 6260).

Credits: 3. Contact Hours: Lecture 3.

Prereq: FSHN 4200 or FSHN 4210 or FSHN 5040

Topics of current interest in food microbiology, including new foodborne pathogens, rapid identification methods, effect of food properties and new preservation techniques on microbial growth, and mode of action of antimicrobials. Offered odd-numbered years. (Typically Offered: Spring)

TOX 6560: Cellular and Molecular Pathology II

(Cross-listed with VPTH 6560).

Credits: 3. Contact Hours: Lecture 3.

Cellular and molecular mechanisms of carcinogenesis. Offered even-numbered years. (Typically Offered: Spring)

TOX 6750: Insecticide Toxicology

(Cross-listed with ENT 6750).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: ENT 5550 or TOX 5010 or Graduate Classification

Principles of insecticide toxicology; classification, mode of action, metabolism, and environmental effects of insecticides. Offered even-numbered years. (Typically Offered: Fall)

TOX 6890: Current Topics in Toxicology

Credits: Required. Contact Hours: Lecture 1.

Repeatable.

Lecture and discussion participation on current topics in toxicology.

An 80% attendance is expected to satisfactorily complete the course.

Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

TOX 6970: Graduate Research Rotation

Credits: 1-12. Contact Hours: Laboratory 12.

Repeatable, maximum of 12 credits.

Graduate research projects performed under the supervision of selected faculty members in the graduate Toxicology major. (Typically Offered: Fall, Spring, Summer)

TOX 6990: Research

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Research. (Typically Offered: Fall, Spring, Summer)

Courses primarily for professional curriculum students:

TOX 7354: General Pharmacology

(Dual-listed with TOX 3540). (Cross-listed with BMS 7354).

Credits: 3. Contact Hours: Lecture 3.

General principles; drug disposition; drugs acting on the nervous, cardiovascular, renal, gastrointestinal, and endocrine systems. (Typically Offered: Spring)

Wind Energy Science, Engineering and Policy

Graduate Study

Wind Energy Science, Engineering and Policy (WESEP) is an interdisciplinary Ph.D. program that prepares graduates for wind energy related careers in industry, academia, and government institutions. WESEP is a unique integration of engineering, science, and policy-related disciplines that provides students with an opportunity for breadth and depth in their program of study.

Students take a set of 11 courses and participate each semester in a one-credit seminar course. Of the 11 courses, two courses are introductory wind energy courses, eight are core courses, and one is an advanced specialization course in wind energy. The seminar course will address

research methods and communications in science and engineering.

Students are also required to pass a qualifying examination in the first 18 months of their program, a preliminary oral examination generally taken by the end of year three, and a final oral defense with written dissertation to complete the program.

Of the eight core courses, students select five courses from a primary thrust area, providing disciplinary depth, and three courses from a secondary thrust area, providing interdisciplinary breadth. Students can take additional courses within the other thrust areas as needed for their research, but this requirement ensures students are research-capable in two thrust areas.

WESEP Thrust areas

- Wind resource characterization and aerodynamics of wind farms
- Wind energy conversion system and grid operations
- Manufacturing, construction, and supply chain
- Turbine reliability & health monitoring
- Economics, policy and public perception

Admission Requirements

Applicants should have an undergraduate GPA of at least 3.0 (B average) and a B.S. degree from a calculus-based undergraduate curriculum. A calculus-based undergraduate curriculum is one in which students take the equivalent of two years of calculus, covering differential and integral calculus, multivariable and vector calculus, and differential equations, and one year of physics, covering mechanics, thermodynamics, electric circuits, electromagnetics, and optics. The GRE is not required. Applicants who do not meet these general standards will be evaluated on an individual basis.

GRADUATE COLLEGE

www.grad-college.iastate.edu/ (<http://www.grad-college.iastate.edu/>)

William R. Graves, Dean

Elena Cotos, Associate Dean of Professional Development

Heather Greenlee, Associate Dean of Student & Scholar Success

Michelle Soupir, Associate Dean of Operations

The Graduate College and graduate faculty at Iowa State University are responsible for the quality of graduate education, for administering students' graduate programs, and for promoting research support from various governmental, industrial, and private agencies.

The graduate faculty in various programs handle admission and classification of graduate students, establish requirements for advanced degrees, and have charge of instruction and research at the graduate level. Graduate faculty members also teach graduate courses, serve on Academic Plan Committees, and direct work of master's and doctoral students. All graduate courses offered for major or nonmajor credit are taught by graduate faculty members or graduate lecturers.

Graduate study was offered soon after the university was founded, and the first graduate degree was conferred in 1877. Experimentation and research also started early, first in agriculture and shortly thereafter in home economics, engineering, science, and veterinary medicine. In 1913, the graduate faculty was organized formally and an executive graduate committee was appointed. In 1915, the graduate faculty held its first meeting, and in 1916, it granted the first doctor of philosophy degree.

Graduate education is vital to the quality of university teaching. The creative efforts of graduate faculty members and graduate students result in knowledge necessary to help society solve problems in educational, scientific, technological, and socio-economic areas. The Graduate College encourages educational exchange and contact with undergraduate areas of the university to promote improved teaching on both the undergraduate and graduate levels. A part of this exchange is accomplished by the publication of books and technical articles which are made possible by graduate research.

The degrees Master of Arts, Master of Science, and Doctor of Philosophy are research oriented. In many fields master's degrees are also awarded without a thesis, but a written report of independent study, called a creative component, is generally required. Coursework only degrees are also available for students wishing to earn an advanced degree by completing content-rich coursework only.

The Graduate College Handbook (<https://www.grad-college.iastate.edu/handbook/>) lists policies and procedures of the Graduate College.

Graduate Appointments

Graduate assistantships, fellowships, and research grants have been established at Iowa State University to encourage graduate work and to promote research. Such appointments and research opportunities are available through the various departments of instruction and the research centers on campus.

Graduate assistantships, the most common form of graduate student support, are available in three categories: the research assistantship, the teaching assistantship, or the administrative assistantship. A half-time graduate assistantship (20 hours per week) permits the holder to enroll for a maximum of 12 semester credits. Recipients of these assistantships are assessed fees at full Iowa resident rates regardless of the number of credits for which they register. These students may also be eligible for tuition scholarship awards. Students who are graduates of a regionally accredited college or university in the United States or of a recognized institution in another country whose requirements for the bachelor's degree are substantially equivalent to those of Iowa State University, and who present the requisite undergraduate or graduate preparation, may apply for these appointments.

Starting in Fall 2024, master's scholarship awards are:

- 75% of full-time tuition per semester for each student on an assistantship appointment of 1/2-time or more or
- 37.5% of full-time tuition per semester for each student on assistantship appointment of 1/4-time or more, but less than 1/2-time.

For fall and spring semesters, a student must be on appointment for at least three months to qualify for a tuition scholarship. For summer session, a student must be on appointment for at least four weeks during the term to qualify for a tuition scholarship. For all terms, appointments must have been processed by the Graduate College before the end of the first full month of classes (i.e., usually around the fifth week of the fall or spring semesters). Graduate tuition scholarships not used by the due date of the second fee payment installment will be forfeited. Students who will not be on appointment for the summer session may still be eligible for the resident (GA) tuition rate. This tuition rate is restricted to a summer session following a nine-month appointment. No action is required to receive the resident tuition rate in the summer for students who held assistantships the prior fall and spring terms.

Students placed on academic probation are eligible for assistantship appointment only on a term-by-term basis and need special permission to be approved for tuition scholarships. Students admitted as nondegree students are not eligible for assistantship appointments. Further information may be obtained by contacting the appropriate graduate program.

The satisfactory completion of one appointment, plus satisfactory academic performance, will ordinarily make a student eligible for reappointment. After a period of three years of full-time study for the master's degree or five years for the doctorate, the student will not normally be continued on assistantship support (shorter periods may be stipulated by the student's program or department).

Postdoctoral Study

Opportunities are provided for postdoctoral study through the extensive research programs of the university. Inquiries should be directed to the appropriate program, institute, or to the Postdoctoral Scholar Coordinator in the Graduate College.

Graduate Study by Staff Members

Any full-time member of the research, instructional, or extension staff at the rank of instructor, research associate, or assistant scientist may carry up to six course credits per semester and three credits per summer session, subject to the approval of the head of the program or section and provided it does not interfere with other duties. This privilege may be extended to members of the research, instructional, or extension staffs at the rank of assistant professor with approval of the college dean and the Dean of the Graduate College. Staff members at the rank of professor or associate professor cannot become candidates for graduate degrees from ISU.

Distance Education

Iowa State offers many graduate degree and certificate programs off-campus. For a listing of the degree programs, registrations for courses, and more information about distance education, consult the Iowa State University Web site at <https://iowastateonline.iastate.edu/>.

Other information about graduate requirements is available in the Graduate College Handbook at <https://www.grad-college.iastate.edu/handbook/>.

Graduate Courses Taken by Undergraduates

Courses at the 4000 and 5000 levels listed in the ISU Catalog may be used in the Academic Plan (AP) even though they were taken by the student as an undergraduate at ISU.

- Up to 9 credits earned as an ISU undergraduate may be used to meet the requirements of the graduate degree.
- These credits must be approved by the student's APC and DOGE. Up to 6 of these credits may be at the 4000 level.
- Up to 6 of these credits could have been used to meet the undergraduate degree requirements.
- Grades of B or better are required in the courses that led to these credits.

- These credits must have been earned when the student was classified as an undergraduate, not as a nondegree undergraduate (special) student.

Graduate programs may accept 3000-level courses taken by the student as an undergraduate at ISU to meet background deficiencies or to demonstrate proficiencies in subject matter necessary for the degree. These courses are not eligible for inclusion on the Academic Plan but may be articulated for transfer internally in the program. The student would be required to meet the minimum number of credits required for the degree without the inclusion of these undergraduate-level courses.

Courses Taken as a Nondegree Undergraduate Student

A person classified as a "nondegree undergraduate" student may not use courses taken under that status in a graduate degree program. A student who has received the baccalaureate degree must register as a graduate student if they are to receive graduate credit for courses.

Graduate Majors

A complete list of all graduate majors can be found on the Graduate College website, <https://www.grad-college.iastate.edu/programs>, with links to admission requirements and program websites.

The Graduate College oversees the admission of students to pursue a graduate degree or credential or to take graduate courses in nondegree student status. The Office of Admissions and the various graduate programs partner with the Graduate College to sustain an admissions process that respects institutional standards and the diverse needs of faculty and students across all realms of advanced study and scholarship. The Graduate College sets baseline admission requirements for the university and makes admission decisions. Graduate programs share specific admissions requirements to prospective students via their websites and the Graduate College Program Pages (<https://www.grad-college.iastate.edu/academics/programs/apprograms.php>).

Application process

All application materials for graduate study are submitted via the online application.

The Graduate College establishes dates to open and close applications for particular academic terms. Graduate programs may establish deadlines earlier than the date on which the application closes by which applicants must submit all required materials to be considered for admission.

Departments and programs convey recommendations concerning admission to the Graduate College. Final decisions regarding admission rest with the Dean of the Graduate College. The Graduate College, or the Office of Admissions acting on behalf of the Graduate College, will seek

to ensure the authenticity of application materials. Graduate programs are expected to uphold ethical practices as they evaluate applicants by using principles of holistic review. Official letters to applicants to report the outcomes of their applications are sent from the Dean of the Graduate College.

Application requirements

Required Application Documents

1. Online graduate application
2. Unofficial transcripts from all previously attended institutions for undergraduate and post-baccalaureate study.
 - a. Official transcripts are only required from applicants admitted to the Graduate College. Electronic copies provided by the applicant are not considered official.
3. Applicants whose first language is not English must submit a valid, official test report from the Test of English as a Foreign Language (TOEFL) or from an approved alternative examination. Applicants who otherwise will need to submit scores are exempt if they hold baccalaureate or higher degrees from countries where the only official language is English.
4. A statement of purpose for each major to which the applicant is applying.
5. Additional documents such as letters of recommendation, résumé/ curriculum vitae (CV), statement of purpose, writing samples, publications, portfolio, etc. may be required by programs.

Admission standards and requirements

A baccalaureate degree, or equivalent from a suitably accredited college or university is required. Evidence of a conferred baccalaureate is needed by the start of the second semester of graduate study. Any exceptions to this admission standard must be approved by the Dean of the Graduate College.

A cumulative grade point average of 3.00 on a 4.00 scale, or equivalent, in undergraduate work or in previous graduate work is expected. Recommendations from graduate programs to admit applicants who do not meet this standard will be reviewed by the Graduate College. The GPA may also be met through one of the following:

- Undergraduate degree with GPA greater than 3.00 (on a 4.00 scale)
- Completed 9 to 14 credits of graduate coursework with grade B or better in all courses.
- Completed 15 or more credits of graduate coursework with GPA above 3.00 and no F grades.

Minimum scores for tests of English are shown below. Graduate programs may set higher minima for applicants to their programs.

Students whose first language is English or those who earned degree from countries where the only official language is English (<https://secure.grad-college.iastate.edu/tools/graduate/international-scores/Graduate%20English%20Information.pdf>) are exempt from the language proficiency requirements.

Applicants whose native language is not English must demonstrate proficiency in English equivalent to a Test of English as a Foreign Language (TOEFL) score of at least 550 on the paper-based test, or 79 on the internet-based test as a part of the admissions process. International students may also submit IELTS (International English Language Testing System) scores in lieu of the TOEFL. The ISU Graduate College minimum is 6.5. PTE scores of at least 53 and Duolingo scores of at least 105 are also acceptable for meeting the English requirement for admission, but not for meeting the Graduate College English requirement. Duolingo is approved for admission through Spring 2025.

Special applicants

Non-degree seeking - Nondegree seeking graduate students are those who are not seeking a graduate degree. There is a limit of nine credits taken in this status that may be used to satisfy graduate degree requirements. Non-degree seeking students are not eligible for financial aid.

Undeclared - Undeclared graduate students are those who meet the Graduate College minimum requirements for admission but have not been admitted to a degree-seeking program. There is a limit to the number of courses taken in this status that may be used to satisfy degree requirements. Admission as an undeclared graduate student can only be recommended by the program if the applicant is not accepted for degree-seeking admission to that major. [effective fall 2024]

Re-admission - Previous applicants to the Graduate College who did not enroll within one academic year of admission must submit a new application and pay the required fee because the prior application is no longer valid.

Re-entry - Applicants who previously were active students within the Graduate College, have not registered for four or more consecutive fall and spring semesters, and seek readmission to the same degree program should submit a re-entry application through the reinstatement process.

In-Session - Current graduate students who seek to pursue additional graduate degrees should complete an in-session status change application. The DOGE or DOCS (or designee) is responsible for approving the admission to the new major.

Registration

Registration processes are administered through the Office of the Registrar. Policies regarding tuition, fees, and residency should be directed to the Registrar.

All students who attend classes at ISU must register and pay assessed tuition and fees. The ISU Office of the Registrar's website at <http://www.registrar.iastate.edu/students/registration> (<http://www.registrar.iastate.edu/students/registration/>) is the official source of information about registration for all students at ISU. Specific dates for registration are listed:

- on the Registrar's Web page, and
- on the University Calendar

Full-Time Status

During the academic year, graduate students not on assistantship must be registered for a minimum of nine credits to be considered full-time students or five credits to be considered half-time students. Students on an assistantship appointment during the academic year are considered full-time.

CREDIT LIMITS

Registration in credit courses is limited to a maximum of 15 credits per semester (10 credits for summer session) for graduate students, per Board of Regents. See the Graduate College Handbook Ch.2.1.2 (<https://www.grad-college.iastate.edu/handbook/chapter.php?id=2>) at for more details.

Doctoral Post Prelim (Required Registration)

Even when doctoral graduate students have completed coursework, they are required to register and pay tuition and fees after successfully passing their preliminary oral examination, whether or not university facilities and equipment are used, or staff is consulted—either in person or in absentia.

After the preliminary oral examination is passed (with either full or conditional pass) and if university facilities, equipment, and staff time are used, the doctoral candidate must register for the appropriate number of credits in the major program and pay the appropriate graduate tuition and fees. The doctoral candidate may register for GRST 6810 and pay the Doctoral Required Registration tuition and fees if all other coursework is completed.

The doctoral candidate must be aware that registration for GRST 6810 is allowed only after the doctoral candidate passes the preliminary oral examination; is required only in the fall and spring semesters, and not

during the summer term; is not allowed after the completion of the final oral examination; and does not defer student loans.

If students take the final examination during the interim between terms (including the first day of classes), registration can be for the term either before or after the examination is held.

Auditing

Audit registration means taking courses without receiving formal credit. Audit provisions are as follows: Instructors must approve ALL audits; students must register for audits by day 10 of the semester; changes to or from an audit must be made in the first 10 days of the semester; students are assessed tuition and fees as though they were taking the course for credit; and the course DOES NOT count in determining full-time student status.

Audited courses do not appear on the student's permanent record unless the "Request for Audit(s) to Appear on Transcript" form is completed and signed by the student, course instructor, and major professor. Copies of this form, which are available from the Graduate College or from the Graduate College's web site at <https://www.grad-college.iastate.edu/student/forms/> must be filed with the Graduate College.

After the fifth-class day, if a student changes a regular course to an audit, that course will appear on the student's permanent record as a drop. Audits are not acceptable as registration for loan deferments or for meeting visa requirements.

Grading

Grades are the permanent official record of a student's academic performance. Iowa State uses A through F grading for most courses. S, P, and NP grades are given in some courses. The standard four-point scale is used to calculate a grade point average.

Grade Point Average (GPA)

All courses taken as a graduate student will be calculated into the graduate GPA, except for Creative Component/Research (5990 and 6990) credits, which are not used in the calculation of the GPA. The GPA is determined by dividing the number of grade points earned by the total number of ISU cumulative hours. The grade given when an incomplete (I) is resolved is figured into the cumulative grade point average, but not into a particular semester's average. Marks of I, S, P, NP, T, and X are not counted in the grade point average; a mark of F (even if taken S/F) is counted in the grade point average. In the case of repeated courses, only the grade achieved the most recent time the course is taken is used in computing the grade point average. (However, grades in courses that are noted as repeatable courses in the catalog, such as certain repeatable seminars, will all be used in calculating the grade point average.)

Grading Research and Creative Component Credits

Creative Component/Research credits may be graded as A, B, C, D, I, S, or F. Plus and minus grades are optional. These credits are not calculated in a student's GPA.

Pass (P)/Not Pass (NP) Course Credit

Pass/Not Pass courses are those that a student, with the approval of the major professor, may take for personal enrichment, but not for satisfying prerequisites or deficiencies in the undergraduate background. P/NP marks may not be used in a POS (except for the Spring 2020 semester), nor do P/NP marks contribute to the student's GPA. Full credit for P/NP courses is used in calculating tuition assessment and credit load limitations. For more information, see the Graduate College Handbook.

Satisfactory/Fail (S/F) Grading

S/F grading is not the same as P/NP grading. S/F grading is by instructor option; all students in a particular course receive S/F grading. P/NP grading is generally a student option. A P mark is equivalent to at least a C grade whereas an S mark is equivalent to at least a B grade at the graduate level. No special registration procedures are required for S/F grading. An S mark in a course taken S/F is not counted in the grade point average, but an F mark in a course taken S/F is counted in the grade point average and is equivalent to an F in a regularly graded (A-F) course. No more than 20 percent of the total credits (excluding creative component, thesis or dissertation research) in the program of study may be earned on an S/F basis.

S/F grading may be used only for approved courses offered as seminars, symposia, workshops, special topics, and research. Programs must submit requests for S/F grading to the Dean of the Graduate College. The Graduate College Catalog and Curriculum Committee reviews and approves or rejects all S/F courses.

Grievances about Grades

A graduate student who feels that a course grade has been unjustly assigned, and whose attempts to resolve the matter with the instructor have failed, may appeal through the grievance procedures described in Ch.8.5.1. of the Graduate College Handbook (<https://www.grad-college.iastate.edu/handbook/chapter8-responsibilities/>).

Probation

If a graduate student does not maintain a cumulative 3.00 grade point average on all coursework taken, exclusive of research credit, they may be placed on academic probation by the Dean of the Graduate College. Grades earned by graduate students in undergraduate courses are included in the calculation of the grade point average. Academic probation judgments are made on the basis of grades in coursework only. New, first-term, degree seeking graduate students who fall below a 3.00 GPA at the end of their first semester will be given a one term grace period to bring their grades back to a 3.00 GPA. These students will

receive an academic probation warning, but not be placed on academic probation unless their cumulative GPA is below a 3.00 in a subsequent semester.

While on academic probation a student will not be admitted to candidacy for a degree and, if appointed to a graduate assistantship, the student will not receive a graduate tuition scholarship unless approval is given by the student's home department's academic college. If a student is to qualify for a tuition scholarship, they must be removed from probation by the tenth-class day of the term.

To ensure that registration does not take place without a review by the program, the Graduate College places a hold on future registrations by a student on probation. Before the student registers for each term, the program must review the student's record and recommend if the Graduate College should permit further registration. Before graduation is approved, the student must complete all courses listed on the Academic Plan with a minimum grade of C and have achieved a 3.00 GPA or greater.

English Proficiency - Admission

Applicants whose native language is not English must demonstrate proficiency in English equivalent to a Test of English as a Foreign Language (TOEFL) score of at least 550 on the paper-based test, or 79 on the internet-based test as a part of the admissions process. International students may also submit IELTS (International English Language Testing System) scores in lieu of the TOEFL. The ISU Graduate College minimum is 6.5. PTE scores of at least 53 and Duolingo scores of at least 105 are also acceptable for meeting the English requirement for admission, but not for meeting the Graduate College English requirement. Duolingo is approved for admission through Spring 2025.

English Requirement - graduation

Graduate students whose native language is not English and who did not graduate from a U.S. institution must take an English Placement Test at the beginning of their first semester of enrollment. This test is administered by the Department of English. A student who does not pass this examination is assigned to one or more courses in the English 990 and 1010 series. This course work must be completed during the first year of study. (There is a developmental course fee for the English 990 course.). Non-native English speaking ISU graduate students who meet or exceed the TOEFL scores (640 or above on the paper-based test or 105 on the internet-based test) are exempted from taking the English Placement Test. (Self-enrollment in English 99 or 101 courses remains possible).

Oral english certification test - teaching assistantships

New teaching assistants (TAs) whose native language is not English are evaluated for their ability to communicate effectively in English before their assistantship assignments are made. The Oral English

Certification Tests (OECT) are given before the beginning of each semester. The testing dates are announced on the International Teaching Assistants (ITA) program website. Registration for the test is held online through links posted on the ITA program homepage, <https://cce.grad-college.iastate.edu/oect> two to three weeks before the test is administered. TAs and faculty with questions about OECT testing should contact the Center for Communication Excellence (CCE) in the Graduate College. A prospective teaching assistant who does not pass these tests is required to successfully complete coursework and be retested. GRST 1800 is a series of communication courses designed to help new teaching assistants. Students focus on pronunciation, listening, question-handling, teaching and lecturing skills, and analyzing the culture of U.S. university life. Because enrollment is restricted, TAs cannot register for the courses online. TAs must contact the CCE immediately after they receive the test scores to obtain permission to enter the course.

Changes in graduate program or status

Students who have been admitted to a graduate program and to the Graduate College may request to transfer at a later date to another major or degree.

Prospective graduate students who wish to change their program of study (POS) in their application may do so, under certain conditions, by contacting their graduate program. Once approved by the program, the Office of Admissions can then make the change in Workday.

Applicants will be allowed to request a change to their Program of Study when the following conditions are met:

1. The original and new Program of Study are housed within the same department.

e.g., An applicant who applied to the Analytical Chemistry, Ph.D. POS changes to the Physical Chemistry, Ph.D. POS. Both of these POSs are housed in the Chemistry department. Similarly, an applicant who applied to the Ph.D. program in Analytical Chemistry may instead be recommended for admission in the M.S. program in Analytical Chemistry instead.

2. The applicant is seeking admission to a POS that is housed in more than one department and they are switching departments. In other words, the student's departmental home, or academic unit has changed, but their major and degree pursuit has not.

e.g., An applicant is interested in the Ecology and Evolutionary Biology, Ph.D. program in EEOBA (CALS), but they want to switch to EEOBS (LAS)

3. An applicant seeking admission to the Double Degree program may choose to pursue only one of the two programs that make up the double degree program upon graduate program request.

e.g., A student is applying to the Business Administration, M.B.A. & Architecture, M.Arch. Graduate Double Degree, but they decide to pursue only the Business Administration, M.B.A.

Applicants must submit a new application in the following situations:

1. The original and new Program of Study are housed within different departments.
2. The student is adding another degree/certificate to a current degree/certificate pursuit.

Most Program of Study changes will be completed through a new application for admission submitted by the applicant or admitted student. A new application is required because the new department or interdepartmental program needs the opportunity to review the student's information before deciding whether to accept the student in their desired program of study. The standard application fees and fee-payment options will apply for all students new to graduate school at Iowa State.

The Office of Admissions will include previously submitted transcripts, exam scores, and other materials from the prior application in the new application, completing any action items the student has already provided at the request of the program. This should be included in the email to request the change.

The student will be prompted in the MyAccount to submit materials required of their new program of study that were not brought over or required by their previous program. Programs can waive any actions items that they require in the Admissions Staff Portal should they choose to.

After a student has been admitted, they will need to submit a new application for admission to change their program of study in most cases.

In the following situations, students can request to change their programs of study after matriculation:

1. The student was admitted to a degree program and is recommended by the program to "level-down" to a master's or certificate program. With program approval, the Graduate College will administratively change the student's program of study in this situation.
2. The student is in a POS that is housed in more than one department, and they are switching departments. In other words, the student's departmental home, or academic unit, has changed, but their major and degree pursuit has not. With program approval, the Graduate College will administratively change the student's program of study in this situation.
3. The student is changing their program focus or adding/removing a graduate co-major or minor. With program approval, the Graduate College will administratively change the student's program of study.

4. The student no longer wishes to pursue one of their degrees/certificates.

For all changes made by the Graduate College, an email with approval from the DOGE must be sent to gcol_workday@iastate.edu.

Graduate students will be able to initiate changes to their program foci, co-majors, and minors in Workday, and approvals will route to program DOGEs and the Graduate College for review.

Curriculum Change from Active Graduate to Active Undergraduate Status

Individuals who are in good standing in the Graduate College and who wish to transfer to an undergraduate curriculum must contact Office of the Registrar.

Curriculum Change from Inactive Graduate to Active Undergraduate Status

Individuals who were admitted to the Graduate College more than one year ago and who do not have active graduate status but who wish to change their status from inactive graduate to active undergraduate must follow the same procedures required of reentering undergraduate students. When considering reinstatement, the undergraduate college may consider the student's overall fitness for continued studies including information about the student's conduct, employment, and education since the student's last enrollment.

Undergraduate Admission to Concurrent Graduate Degree/Certificate Programs

Several programs provide opportunities for qualified ISU juniors and seniors majoring in those curricula to apply for admission to a master's degree before they complete their bachelor's degree.

The graduate degree will be awarded only at the same time as, or after, the undergraduate degree is conferred. For a complete listing of the concurrent degree programs, consult Ch.4.3.2 (<https://www.grad-college.iastate.edu/handbook/chapter.php?id=4#4.3>) of the Graduate College Handbook.

Interested students must submit an application for admission to the concurrent program for consideration.

Students interested in a research career may apply for graduate research assistantships during their last two years of study. Students should contact the graduate programs about applying to the graduate program early in their undergraduate careers. For more information about seeking admission to concurrent undergraduate/graduate degree programs that are not pre-approved by the Graduate College, or "individualized

programs", the application process, and transferring credits, consult Ch. 4.3.2 of the Graduate College Handbook.

GRADUATE STUDENTS IN CONCURRENT UNDERGRADUATE PROGRAMS

Graduate students interested in enrolling in a concurrent undergraduate program should contact the Office of Admissions to obtain admission information (even if the student has been previously admitted as an undergraduate).

- Official enrollment and fee payment will be as a graduate student.
- The graduate credential will be awarded at the same time or after the undergraduate degree is conferred.
- Students may be appointed to graduate research assistantships.
- With approval of a student's Academic Plan Committee, up to 6 ISU credits taken while in concurrent status may be applied to a bachelor's degree and a graduate credential that requires up to 41 credits. For master's degree programs that require at least 42 credits, students may instead, with Academic Plan Committee approval, count up to 12 such ISU credits.
- For students pursuing a concurrent bachelor's degree and graduate certificate, with POS committee approval, up to 3 or 6 credits may be double counted when the certificate requires 15 or 18 credits or more, respectively. No double counting is permitted for certificates that require fewer than 15 credits.
- A student in a bachelor's and master's concurrent degree program cannot be on a doctoral track during the concurrent program.

Veterinary Medicine Students in Concurrent Graduate Degree/Certificate Programs

Students may be concurrently enrolled in the professional curriculum leading to the D.V.M. degree and in a graduate program leading to the M.S. or Ph.D. degree after completion of 90 undergraduate semester credits. The graduate program may be in the College of Veterinary Medicine or in another college.

Interested students must submit an application for admission to the concurrent program for consideration.

Concurrent Master's Degrees

Students may complete two-degree programs that lead to two concurrently awarded master's degrees by following these requirements:

- Apply to both graduate programs through the Office of Admissions.
- Create separate Academic Plans (APs) and Academic Plan Committees (APCs) for each degree and receive approval for both.

- File separate Applications for Program Completion (https://iastate.service-now.com/esc/?id=kb_article&sysparm_article=KB0022792) for each degree.
- Complete separate projects or theses for each degree, if applicable.
- File separate Final Oral Exam Requests (https://iastate.service-now.com/esc/?id=kb_article&sysparm_article=KB0022884) for each degree, if applicable, and
- Pass separate final oral examinations (if applicable) and complete a separate Graduate Student Approval/Coursework Only Final Check request for each degree.

Two awarded master's degrees require at least 22 hours of non-overlapping graduate credit in each major. If the two degrees are thesis or non-thesis degrees, they require two terminal projects (theses or creative components, respectively). Coursework-only degrees do not require a final project. These two degrees do not have to be awarded during the same term, since requirements for each are completed separately.

Master's Degrees

General requirements for all master's degrees are as follows:

General Requirements

The Graduate College Handbook outlines the general requirements for completion of a graduate degree at ISU. Faculty in a major field have the responsibility for establishing educational objectives for their graduate program, including specific course requirements and research requirements appropriate to the master's programs in the major. These requirements may place additional responsibilities on the student, the major professor, or the student's Academic Plan Committee beyond those listed in the Graduate College Handbook as deemed appropriate to the goals of the major program.

Faculty and graduate students are active participants in the academic programs of Iowa State University. As active participants, they have a collective impact on the success of those programs and of the university in fulfilling its mission. Each graduate program is encouraged to implement a mechanism for responding to feedback from graduate students as a valuable resource for continuing improvement.

Appointment of the Student's Academic Plan Committee (APC)

New graduate students at ISU may be assigned a temporary academic advisor by the major program in the first semester of the student's residence. This faculty member guides the student in selection of a field of study and in development of a graduate program of study until the major professor and the rest of the Academic Plan Committee are selected. After the committee has been selected, it guides and evaluates the student during the remainder of graduate study.

Master's Academic Plan Committee (APC) Makeup

Master's with thesis: The master's APC for a student completing a thesis consists of at least three members of the graduate faculty. It must include two members, including the major professor, from the major or program. The committee must include member(s) from different fields of emphasis to ensure diversity of perspectives. An associate member of the graduate faculty may participate in the direction of a student's master's research as a co-major professor if a full member of the graduate faculty serves as a co-major professor and jointly accepts responsibility for the direction of a program of study. Non-ISU Associate Graduate Faculty Members may comprise no more than 34% of the APC of a master's with thesis student, meaning that only one non-ISU member may serve on the committee of three.

Master's with creative component: The master's APC for a student completing a creative component consists of at least one member of the graduate faculty as the major professor. Individual programs should consider whether the minimum number of committee members should be increased for the benefit of the students. The number of committee members in addition to the major professor will be established and monitored by the program.

Master's with coursework only: The master's APC for a student completing a coursework-only program consists of at least one member of the graduate faculty in the designated major. This is often the Director of Graduate Education (DOGE) of the coursework-only program. The student must complete a committee in Workday, but only the single committee member (usually the DOGE) is required.

For information on duties and makeup of the committee as well as changes to the committee makeup, see Ch.6 (<https://www.grad-college.iastate.edu/handbook/chapter.php?id=6>) of the Graduate College Handbook.

Academic Plan. The student and major professor develop the academic plan with the consultation and approval of the Academic Plan Committee. This agreement between the student and the Graduate College should be submitted as early as possible for approval. It is recommended that the committee be formed, and the committee and academic plan be submitted as early as the second semester of graduate study. In no case can the committee and academic plan be formed later than the term before the final oral examination for master's students.

Credits. Unless otherwise noted, at least 30 credits of acceptable graduate work must be completed in all master's programs. At least 22 graduate credits must be earned from Iowa State University.

Transfer Credits. At the discretion of the Academic Plan Committee, and with the approval of the program and the Graduate College, graduate credits earned as a graduate student at another institution may be transferred if the grade was B or better. Such courses must have been

acceptable toward an advanced degree at that institution and must have been taught by individuals having graduate faculty status at the institution. If a student wishes to transfer credits from graduate courses taken at or through another university as an undergraduate student, it is the student's responsibility to provide verification by letter from that institution that these graduate courses were not used to satisfy undergraduate requirements for a degree.

A transcript must accompany the academic plan in order to transfer credits. The Academic Plan Committee may ask for other materials, such as a course outline or accreditation of the institution, to evaluate the course. Transfer courses not completed when the academic plan is submitted must be completed the term before the student graduates. A transcript must then be submitted to the Graduate College for review and final approval.

Research credits earned at another institution are generally not transferred. In rare circumstances, the transfer of S or P marks may be accepted for research credits only. It is the responsibility of the Academic Plan Committee to obtain a letter from the responsible faculty member at the other institution stating that research credits recommended for transfer with S or P marks are considered to be worthy of a B grade or better.

Major. A major is an approved area of study leading to a graduate degree. The exact number of credits in a major is not prescribed.

Minor. Minors are available in many disciplinary and interdepartmental graduate programs. Some programs offer only a minor. In other programs, students may declare either a major or a minor. Programs offering a major are not required to offer a minor. A student may not major and minor in the same discipline for a single degree or across multiple degrees. To illustrate, a student earning a Ph.D. in computer science may not minor in statistics for their Ph.D. program if they are also pursuing an M.S. in statistics.

The minor subject area must be tested at the final oral examination and cannot be placed on the transcript after graduation unless it was approved as part of the student's academic record. A minor cannot be added to a degree that has already been received.

Specific Master's Degrees

The number of credits in a major for a master's degree will vary according to various degrees. General credit requirements for all master's degrees include: a minimum of 30 graduate credits is required for all master's programs at ISU; at least 22 graduate credits must be earned at ISU; any transfer of graduate credits from another institution must be recommended in the academic plan by the Academic Plan Committee; and graduate credit earned as a graduate student will be approved for transfer only if a B grade or better was earned. A transcript must accompany the Academic Plan. A complete listing of all master's degrees

can be found online at <https://www.grad-college.iastate.edu/programs> (<https://www.grad-college.iastate.edu/programs/>).

Master's Double Degree Programs

A double degree requires fulfillment of the requirements for two graduate majors for which two differently named master's degrees and two diplomas are granted at the same time. For double degrees with a thesis or creative component, the final project (thesis or creative component) must integrate subject area from both majors.

The requirements for all students who are interested in pursuing double degree programs are listed below:

- The interested student must apply to one of the available Double Degree programs through the University Admissions Application.
- Only one Academic Plan Committee (APC) and Academic Plan (AP) needs to be formed for the two degrees.
- For double degrees involving a creative component, there must be at least two graduate faculty members on the double degree APC. For double degrees involving a thesis, there must be at least three graduate faculty members on the double degree Academic Plan Committee. Such APCs for double degrees must include co-major professors from each of the majors.
- Although specific degree programs may require more, the AP must include at least 48 credit hours of non-overlapping graduate credit (24 for each major) in the two degrees, and no less than 75% of the sum of the credits from each separate degree.
- If one or both of the degrees has a thesis or creative component, one final oral examination must be held covering the combined thesis or creative component. One thesis is submitted to satisfy the requirements of both degrees.
- If a thesis or non-thesis is combined with a coursework only degree, the thesis/non-thesis project should include information for both degrees.
- One Graduate Student Approval/Coursework Only Final Check request must be completed for both degrees.

Doctor of Philosophy General Requirements

The degree Doctor of Philosophy is strongly research oriented. The primary requirements for the degree are:

- High attainment and proficiency of the candidate in their chosen field.
- Development of a dissertation which is a significant contribution to knowledge and which shows independent and creative thought and work.

- Successful passing of detailed examinations over the field of the candidate's major work with a satisfactory showing of preparation in related courses. General requirements for Ph.D. candidates follow.

The Graduate College Handbook outlines the general requirements for completion of a Ph.D. degree at ISU. Faculty in a major field have the responsibility for establishing educational objectives for their graduate program, including specific course requirements and research requirements appropriate to the Ph.D. programs in the major. These requirements may place additional responsibilities on the student, the major professor, or the student's Academic Plan Committee beyond those listed in the Graduate College Handbook as deemed appropriate to the goals for the major program.

Faculty and graduate students are active participants in the academic programs of Iowa State University. As active participants, they have a collective impact on the success of those programs and of the university in fulfilling its mission. Each graduate program is encouraged to implement a mechanism for responding to feedback from graduate students as a valuable resource for continuing improvement.

Appointment of the Student's Academic Plan Committee (APC)

The Academic Plan Committee for a doctoral program consists of at least five members of the graduate faculty. It must include at least three members, including the major professor, from within the student's major or program. The committee must include member(s) from different fields of emphasis so as to ensure diversity of perspectives. An associate member of the graduate faculty may participate in the direction of a student's dissertation research as a co-major professor if a member of the graduate faculty serves as a co-major professor and jointly accepts responsibility for direction of the dissertation.

Changes to the Academic Plan Committee

Recommendations for changes in the Academic Plan Committee must have the approval of the student, the Graduate College, major professor, DOGE, and all active committee members involved in the change.

These changes must be approved before the preliminary or final oral examination is held.

Academic Plan

The student and the major professor develop the academic plan with the consultation and approval of the Academic Plan Committee. Early selection of a major professor, appointment of a committee, and development of an Academic Plan are very important. It is recommended that the committee be formed as early as the second semester of graduate study. In no case can the committee be formed later than three months before the preliminary oral examination.

Credits

A minimum of 72 graduate credits must be earned for a Ph.D. degree.

At least 36 graduate credits, including all dissertation research credits, must be earned at Iowa State University. There is no specific university requirement regarding the number of credits to be taken inside or outside the major/program.

Transfer Credits

At the discretion of the Academic Plan Committee, and with the approval of the program and the Graduate College, graduate credits earned as a graduate student at another institution may be transferred if the grade was B or better. Such courses must have been acceptable toward an advanced degree at that institution and must have been taught by individuals having graduate faculty status at that institution. If a student wishes to transfer credits from graduate courses taken at or through another university as an undergraduate student, it is that student's responsibility to provide verification by letter from that institution that those graduate courses were not taken to satisfy undergraduate requirements for a degree.

A transcript must accompany the Academic Plan in order to transfer credits. The Academic Plan Committee may ask for other materials, such as a course outline or accreditation of the institution, to evaluate the course. Transfer courses not completed when the academic plan is submitted must be completed before the term in which the student graduates. A transcript must then be submitted to the Graduate College for review and final approval.

Research credits earned at another institution are generally not transferred. In rare circumstances, the transfer of S or P marks may be accepted for research credits only. It is the responsibility of the Academic Plan Committee to obtain a letter from the responsible faculty member at the other institution stating that research credits recommended for transfer with S or P marks are considered to be worthy of a B grade or better.

Major

A major is the area of study or academic concentration in which a student chooses to qualify for the award of a graduate degree. Majors are listed on the Graduate College website here: <https://www.grad-college.iastate.edu/programs> (<https://www.grad-college.iastate.edu/programs/>). Opportunities also exist for majoring in more than one area of study (co-major programs).

Minor

Students may request a minor in any program approved to grant a graduate degree so long as the graduate program offers a minor and in programs approved to offer only a minor. Requirements for declared minors are determined by the minor program and the faculty member representing the minor field on the student's Academic Plan Committee.

The minor subject area must be tested at the preliminary oral and final oral examinations. A minor cannot be added to a program of study after the preliminary oral examination has been taken, nor can a minor be placed on the transcript after graduation, unless it was approved on the graduate student's academic record. A student may not minor and major in the same field. A minor cannot be added to a degree that has already been awarded.

Time Limits

The Graduate College's time-to-degree limit for all graduate students, both master's and doctorate, is seven years. **Graduate programs may establish more restrictive time-to-degree limits.** For example, at the program's discretion, a student beginning a Ph.D. degree program at ISU with a master's degree could be expected to complete the program within three or four or five years, while a student beginning a Ph.D. degree program without the master's degree could be expected to complete the program within five or six or seven years. This is an option that would be enforced at the department level. Requests to extend the seven-year time limit will be considered in situations involving medical or other extenuating circumstances. Cases in which the student leaves ISU during their graduate career and later returns are dealt with individually by the Academic Plan Committee and the Graduate College.

The inclusion in the Academic Plan of coursework that is beyond the time limits ("expired" courses) must be justified in the Expired Course Petition. This petition will be required for students with expired courses are part of the academic plan submission process.

Preliminary Examination

The Graduate College requires a preliminary oral examination of Ph.D. degree students; most programs add a written portion to the preliminary oral examination. The Ph.D. degree preliminary oral examination rigorously tests a graduate student's knowledge of major, minor, and supporting subject areas as well as the student's ability to analyze, organize, and present subject matter relevant to the field. A "Graduate Request for Preliminary Examination" must be submitted in Workday to the Graduate College at least two weeks before the proposed date of the examination.

The following conditions should be met before the "Graduate Request for Preliminary Examination" is submitted to the Graduate College:

- Committee and Academic Plan approved no later than 3 months before the preliminary oral examination,
- English requirement met,
- Not on probation,
- Time limit not exceeded (see Chapter 4 (<https://www.grad-college.iastate.edu/handbook/chapter.php?id=4&search=preliminary%20oral%20exam&section=4.4#ttd>)),
- Qualifying examination (if required by program) passed,

- Registration for a minimum of one credit, or for Examination Only (GRST 6810B) if no course work is needed, during the term in which the preliminary oral examination is taken.

A preliminary oral examination will not be scheduled for a student on academic probation. Upon successful completion of the preliminary oral examination, the student is admitted to candidacy for the Ph.D. degree. If the graduate student fails all or part of the preliminary oral examination, the committee provides two options: gives a not pass and allows the student to retake the examination after six months or gives a not pass and does not allow the student to retake the examination. Six months must elapse between the first attempt and the next. The entire Academic Plan Committee must be convened for the preliminary oral examination. The preliminary oral examination must be passed at least six months prior to the final oral examination. An exception to the rule is allowed by request from the major professor to the Graduate College.

Dissertation

A doctoral dissertation must demonstrate conclusively the ability of the author to conceive, design, conduct, and interpret independent, original, and creative research. It must attempt to describe significant original contributions to the advancement of knowledge and must demonstrate the ability to organize, analyze, and interpret data. In most instances, a dissertation includes a statement of purpose, a review of pertinent literature, a presentation of methodology and results obtained, and a critical interpretation of conclusions in relation to the findings of others. When appropriate, it involves a defense of objectives, design, and analytical procedures. Dissertation research should be worthy of publication and should appear in appropriate professional journals or in book form.

Responsibility for writing and editing of the dissertation rests with the student, under the supervision of the major professor, and not with the Graduate College. The Graduate College does not permit joint authorship of dissertations. It is the responsibility of the major professor to supervise the preparation of preliminary and final drafts of the dissertation, so as to assure the highest level of quality when the student presents the dissertation to the committee for final approval. Copies of the dissertation must be submitted to the Academic Plan Committee at least two weeks before the final oral examination.

All theses and dissertations will be submitted electronically after the final oral examination is held. Please refer to the Graduate College Dissertation/Thesis website (<http://www.grad-college.iastate.edu/current/thesis/>) for requirements, fees, and other pertinent information.

Shortly after the submission of the "Application for Program Completion," a thesis fee is billed by the university accounting system.

Final Oral Examination

The Ph.D. final oral examination, conducted after the dissertation is finished, is oral and often limited to a defense of the dissertation. To receive the degree at the end of a given semester, the student must hold the final oral examination before the final oral examination deadline for the semester.

The candidate is responsible for initiating the "Graduate Request for Final Oral Examination," which must be submitted to the Graduate College at least two weeks before the examination. The entire Academic Plan Committee must be convened for the final oral examination. For more information on the final oral examination, see Ch. 7.1.2 of the Graduate College Handbook.

Graduate Student Approval for Graduation

The Graduate College requires final approval from the student's program, which includes approval from the the major professor(s) and the DOGE(s), including co-major DOGE if applicable, after the student has passed the final oral examination and completed any necessary changes on the dissertation requested by the committee. A paper dissertation/thesis signature page is not required.

- A student must submit their final dissertation/thesis to ProQuest.
- Once the Graduate College receives approval from the program that the student is ready to graduate, a student's dissertation will be reviewed for final approval.
- Final clearance of academic requirements will be made when current term grades have been submitted and evaluated by the Graduate College.

All incompletes from previous terms must be completed by the deadline for completion. An incomplete, non-report, or failing grade that a student receives for the term of graduation will result in removal from that term's graduation list. The student will need to complete a new Application for Program Completion for the new term of graduation.

If a conditional pass was recommended at the final oral examination, the major professor and the committee members, if so specified, must notify the Graduate College that the conditions have been met before a degree will be conferred.

Graduate Programs

The Graduate College Handbook outlines the general requirements for completion of a graduate degree or credential at ISU. Faculty in a major field have the responsibility for establishing educational objectives for their graduate program, including specific course requirements and research requirements appropriate to the doctoral, master's, and certificate programs in the major. These requirements may place additional responsibilities on the student, the major professor, or the student's Academic Plan Committee beyond those listed in the Graduate

College Handbook as deemed appropriate to the goals of the major program.

Faculty and graduate students are active participants in the academic programs of Iowa State University. As active participants, they have a collective impact on the success of those programs and of the university in fulfilling its mission. Each graduate program is encouraged to implement a mechanism for responding to feedback from graduate students as a valuable resource for continuing improvement.

Academic Program definitions

- **Program** - administrative infrastructure supporting the curriculum.
- **Curriculum** - the requirements for a major, certificate, or minor.
- **Major** - subject area of study that results in a named baccalaureate, master's, or doctoral degree upon completion of a set of requirements. A major appears on the academic transcript.
- **Certificate** - an academic credential in a focused area of study. A certificate appears on the academic transcript and may be earned concurrently with a degree or on its own.
- **Minor** - an academic area of emphasis that is in addition to a major. A minor appears on the academic transcript and must be earned in conjunction with a degree.

Doctoral Programs

A complete list of Doctoral Programs can also be found on the Graduate College Programs page: <https://www.grad-college.iastate.edu/programs> (<https://www.grad-college.iastate.edu/programs/>).

Aerospace Engineering (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=2>)

Agricultural and Biosystems Engineering (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=5>)

Agricultural Economics (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=3>)

Agricultural Education (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=4>)

Agricultural Meteorology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=7>)

Analytical Chemistry (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=9>)

Animal Breeding and Genetics (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=10>)

Animal Physiology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=11>)

Animal Science (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=12>)

Apparel, Merchandising, and Design (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=14>)

Applied Linguistics and Technology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=15>)

Applied Mathematics (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=16>)

Applied Physics (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=17>)

Astrophysics (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=19>)

Biochemistry (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=20>)

Bioinformatics and Computational Biology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=21>)

Biomedical Sciences (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=22>)

Biophysics (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=23>)

Business and Technology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=26>)

Chemical Engineering (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=27>)

Chemistry (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=28>)

Civil Engineering (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=29>)

Computer Engineering (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=31>)

Computer Science (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=32>)

Condensed Matter Physics (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=33>)

Crop Production and Physiology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=35>)

Earth Science (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=37>)

Ecology and Evolutionary Biology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=38>)

Economics (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=39>)

Education (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=40>)

Electrical Engineering (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=41>)

Engineering Mechanics (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=43>)

Entomology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=45>)

Environmental Science (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=46>)

Fisheries Biology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=49>)

Food Science and Technology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=50>)

Forestry (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=51>)

Genetics and Genomics (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=52>)

Geology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=53>)

Gerontology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=118>)

High Energy Physics (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=55>)

Horticulture (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=58>)

Hospitality Management (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=59>)

Human Computer Interaction (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=60>)

Human Development and Family Studies (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=61>)

Immunobiology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=62>)

Industrial and Agricultural Technology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=63>)

Industrial Engineering (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=65>)

Inorganic Chemistry (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=68>)

Kinesiology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=73>)

Materials Science and Engineering (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=75>)

Mathematics (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=76>)

Meat Science (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=77>)

Mechanical Engineering (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=78>)

Meteorology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=79>)

Microbiology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=80>)

Molecular, Cellular and Developmental Biology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=81>)

Neuroscience (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=82>)

Nuclear Physics (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=83>)

Nutritional Sciences (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=84>)

Organic Chemistry (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=85>)

Physical Chemistry (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=86>)

Physics (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=87>)

Plant Biology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=88>)

Plant Breeding (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=89>)

Plant Pathology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=90>)

Population Sciences in Animal Health (<https://www.grad-college.iastate.edu/academics/programs/apresults.php?id=141>)

Psychology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=93>)

Rhetoric and Professional Communication (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=96>)

Rural, Agricultural, Technological and Environmental History (<https://www.grad-college.iastate.edu/academics/programs/apresults.php?id=139>)

Rural Sociology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=97>)

Sociology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=101>)

Soil Science (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=102>)

Statistics (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=103>)

Sustainable Agriculture

Toxicology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=108>)

Veterinary Microbiology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=112>)

Veterinary Pathology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=113>)

Wildlife Ecology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=115>)

Wind Energy Science, Engineering, and Policy (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=116>)

Master's Programs

A complete list of Master's programs is available on the Graduate College Programs page: <https://www.grad-college.iastate.edu/programs> (<https://www.grad-college.iastate.edu/programs/>).

Accounting (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=1>)

Accounting Analytics (https://www.grad-college.iastate.edu/programs/accounting_analytics/)

Aerospace Engineering (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=2>)

Agricultural and Biosystems Engineering (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=5>)

Agricultural Economics (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=3>)

Agricultural Education (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=4>)

Agricultural Meteorology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=7>)

Agronomy (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=8>)

Analytical Chemistry (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=9>)

Animal Breeding and Genetics (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=10>)

Animal Physiology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=11>)

Animal Science (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=12>)

Anthropology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=13>)

Apparel, Merchandising, and Design (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=14>)

Applied Mathematics (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=16>)

Applied Physics (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=17>)

Architecture (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=18>)

Artificial Intelligence (<https://www.grad-college.iastate.edu/academics/programs/apresults.php?id=146>)

Astrophysics (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=19>)

Athletic Training (<https://www.grad-college.iastate.edu/academics/programs/apresults.php?id=145>)

Biochemistry (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=20>)

Bioinformatics and Computational Biology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=21>)

Biomedical Sciences (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=22>)

Biophysics (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=23>)

Business Administration (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=25>)

Business Analytics (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=119>)

Chemical Engineering (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=27>)

Chemistry (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=28>)

Civil Engineering (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=29>)

Community and Regional Planning (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=30>)

Community Development (<https://www.agonline.iastate.edu/programs/community-development-ms/>)

Computer Engineering (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=31>)

Computer Science (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=32>)

Condensed Matter Physics (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=33>)

Creative Writing and Environment (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=34>)

Crop Production and Physiology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=35>)

Cyber Security (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=66>)

Diet and Exercise (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=36>)

Digital Health (https://www.grad-college.iastate.edu/programs/digital_health/)

Earth Science (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=37>)

Ecology and Evolutionary Biology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=38>)

Economics (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=39>)

Education (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=40>)

Electrical Engineering (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=41>)

Energy Systems Engineering (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=117>)

Engineering Management (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=42>)

Engineering Mechanics (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=43>)

English (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=44>)

Entomology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=45>)

Entrepreneurship (<https://www.grad-college.iastate.edu/academics/programs/apresults.php?id=152>)

Environmental Science (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=46>)

Event Management (<https://www.grad-college.iastate.edu/academics/programs/apresults.php?id=144>)

Family and Consumer Sciences (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=47>)

Finance (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=48>)

Fisheries Biology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=49>)

Food Science and Technology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=50>)

Forestry (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=51>)

Genetics and Genomics (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=52>)

Geology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=53>)

Gerontology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=118>)

Graphic Design (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=54>)

Healthcare Analytics and Operations (<https://www.grad-college.iastate.edu/academics/programs/apresults.php?id=149>)

High Energy Physics (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=55>)

History (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=56>)

Horticulture (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=58>)

Hospitality Management (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=59>)

Human Computer Interaction (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=60>)

Human Development and Family Studies (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=61>)

Immunobiology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=62>)

Industrial and Agricultural Technology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=63>)

Industrial Design (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=64>)

Industrial Engineering (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=65>)

Information Systems (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=67>)

Inorganic Chemistry (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=68>)

Integrated Visual Arts (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=69>)

Interdisciplinary Graduate Studies (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=70>)

Interior Design (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=71>)

Journalism and Mass Communication (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=72>)

Kinesiology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=73>)

Landscape Architecture (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=74>)

Materials Science and Engineering (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=75>)

Mathematics (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=76>)

Mathematics Education (<https://www.grad-college.iastate.edu/academics/programs/apresults.php?id=147>)

Meat Science (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=77>)

Mechanical Engineering (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=78>)

Meteorology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=79>)

Microbiology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=80>)

Molecular, Cellular and Developmental Biology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=81>)

Neuroscience (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=82>)

Nuclear Physics (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=83>)

Nutritional Sciences (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=84>)

Organic Chemistry (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=85>)

Physical Chemistry (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=86>)

Physics (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=87>)

Plant Biology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=88>)

Plant Breeding (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=89>)

Plant Pathology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=90>)

Political Science (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=91>)

Professional Practice in Dietetics (<https://www.grad-college.iastate.edu/academics/programs/apresults.php?id=140>)

Psychology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=93>)

Real Estate Development (<https://www.grad-college.iastate.edu/academics/programs/apresults.php?id=142>)

Rhetoric, Composition, and Professional Communication (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=95>)

Rural Sociology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=97>)

Science Education (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=99>)

Secondary Education (<https://www.grad-college.iastate.edu/academics/programs/apresults.php?id=148>)

Seed Technology and Business (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=100>)

Sociology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=101>)

Soil Science (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=102>)

Special Education (https://www.grad-college.iastate.edu/programs/special_education/)

Statistics (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=103>)

Sustainable Agriculture

Sustainable Environments (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=105>)

Systems Engineering (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=106>)

Teaching English as a Second Language/Applied Linguistics (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=107>)

Toxicology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=108>)

Urban Design (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=110>)

Veterinary Clinical Science (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=111>)

Veterinary Microbiology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=112>)

Veterinary Pathology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=113>)

Veterinary Preventive Medicine (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=114>)

Wildlife Ecology (<http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=115>)

Graduate Certificates

A complete list of Graduate level programs is available on the Graduate College Programs page: <https://www.grad-college.iastate.edu/programs> (<https://www.grad-college.iastate.edu/programs/>).

Advanced Manufacturing (<http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=1>)

Agronomy (<http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=50>)

Applied Research Methods in the Human Sciences (<http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=2>)

Biochemistry (<https://www.grad-college.iastate.edu/academics/programs/acresults.php?id=52>)

Breeding for Organic Crops (<https://www.grad-college.iastate.edu/academics/programs/acresults.php?id=64>)

Business Analytics (<http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=51>)

Computational Fluid Dynamics (<http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=6>)

Computer Networking (<http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=7>)

Construction Management (<http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=8>)

Cyber Security (<https://www.grad-college.iastate.edu/academics/programs/acresults.php?id=28>)

Data Driven Food, Energy, and Water Decision Making (<https://www.grad-college.iastate.edu/academics/programs/acresults.php?id=63>)

Developmental and Family Sciences Advanced Research Design and Methods (<http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=9>)

Digital Marketplace Analytics (<https://www.grad-college.iastate.edu/academics/programs/acresults.php?id=66>)

Early Childhood and Family Policy (<https://www.grad-college.iastate.edu/academics/programs/acresults.php?id=67>)

Education and Outreach in Agriculture and Natural Resources (<https://www.grad-college.iastate.edu/academics/programs/acresults.php?id=65>)

Education for Social Justice (<http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=40>)

Embedded Systems (<http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=13>)

Energy Systems Engineering (<http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=14>)

Enterprise Cyber Security Management (<https://www.grad-college.iastate.edu/academics/programs/acresults.php?id=62>)

Entrepreneurship and Innovation (<https://www.grad-college.iastate.edu/academics/programs/acresults.php?id=15>)

Environmental Engineering (<https://www.grad-college.iastate.edu/academics/programs/acresults.php?id=16>)

Environmental Systems (<https://www.grad-college.iastate.edu/academics/programs/acresults.php?id=17>)

Family Financial Planning (<http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=18>)

Family Well-Being in Diverse Society (<http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=19>)

Finance (<https://www.grad-college.iastate.edu/academics/programs/acresults.php?id=61>)

Food Safety and Defense (<http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=21>)

Geographic Information Systems (<http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=23>)

Gerontology (<http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=24>)

Graduate Student Teaching (<http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=25>)

Human Computer Interaction (<http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=26>)

Infant and Early Childhood Mental Health (<http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=27>)

Instructional Design (<http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=29>)

Lifespan Development (<http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=30>)

Literacy Coaching Certificate (<https://www.grad-college.iastate.edu/academics/programs/acresults.php?id=31>)

Mathematics (<https://www.grad-college.iastate.edu/academics/programs/acresults.php?id=60>)

Meat Science (<https://www.grad-college.iastate.edu/academics/programs/acresults.php?id=59>)

Nondestructive Evaluation (<https://www.grad-college.iastate.edu/academics/programs/acresults.php?id=55>)

Postsecondary Teaching (<https://www.grad-college.iastate.edu/academics/programs/acresults.php?id=68>)

Power Systems Engineering (<https://www.grad-college.iastate.edu/academics/programs/acresults.php?id=34>)

Preservation and Cultural Heritage (<https://www.grad-college.iastate.edu/academics/programs/acresults.php?id=53>)

Public Management and Policy (<http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=36>)

Quantitative Psychology (<http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=37>)

Seed Business Management (<http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=38>)

Seed Science and Technology (<http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=39>)

Special Education (<http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=42>)

Supply Chain Management (<https://www.grad-college.iastate.edu/academics/programs/acresults.php?id=54>)

Systems Engineering (<http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=45>)

Teaching English as a Second Language/Teaching English as a Foreign Language (<http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=46>)

Veterinary Preventive Medicine (<http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=47>)

Youth Development Specialist (<http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=48>)

Youth Program Management and Evaluation (<http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=49>)

Graduate Minors

Minors are available in many disciplinary and interdepartmental graduate programs. Some programs offer only a minor. In other programs, students may declare either a major or a minor. Programs offering a major are not required to offer a minor. A student may not major and minor in the same discipline for a single degree or across multiple degrees. To illustrate, a student earning a Ph.D. in computer science may not minor in statistics for their Ph.D. program if they are also pursuing an MS in statistics.

Graduate Minor Only Programs

The following programs are available as minor only. These minors do not have an associated graduate major.

Applied Scientific Computing (<http://asc.aere.iastate.edu/>)

Criminal Justice (<https://soc-cj.iastate.edu/>)

Linguistics (<https://apling.engl.iastate.edu/>)

Philosophy

Spanish (<http://catalog.iastate.edu/collegeofliberalartsandsciences/worldlanguagesandcultures/>)

Speech Communication (<http://www.engl.iastate.edu/graduate-students/>)

Women's and Gender Studies (<https://womensstudies.las.iastate.edu/graduate/>)

COLLEGE OF VETERINARY MEDICINE

Dan Grooms, Dean of Veterinary Medicine

Jared A. Danielson, Senior Associate Dean for Academic and Student Programs Success and Innovation

vetmed.iastate.edu/ (<http://vetmed.iastate.edu/>)

Departments of the College

- Biomedical Sciences
- Veterinary Clinical Sciences
- Veterinary Diagnostic and Production Animal Medicine
- Veterinary Microbiology and Preventive Medicine
- Veterinary Pathology

Other units of the college include the Lloyd Veterinary Medical Center, Veterinary Diagnostic Laboratory, Veterinary Medical Research Institute, CVM Information Technology and The Office of Curricular Assessment and Teaching Support. The college participates in interdisciplinary graduate programs in genetics; molecular, cellular and developmental biology; toxicology; immunobiology; and neuroscience.

Objectives of the Curriculum

The instructional objective of the College of Veterinary Medicine is to enable students to assume vital roles in society as productive health care providers and biomedical scientists. Such an education provides students with general learning, communication, and problem solving abilities; veterinary medical practice and research skills; and professional and ethical values.

The curriculum incorporates basic biomedical and clinical principles, clinical decision making skills, and exceptional clinical experience in small animal medicine and surgery, equine medicine and surgery, food animal medicine and surgery, and production animal medicine. Companion animal medicine and surgery are provided within the regionally recognized referral hospital through the community practice unit and equine field services. The college is located in one of the most intensive livestock producing areas in the United States. Because of this, students have the opportunity to engage in extensive food supply veterinary medicine experiences and to experience numerous diagnostic cases.

The professional curriculum is a four-year course of study leading to the doctor of veterinary medicine degree. Each of the first three years of the curriculum consists of two semesters while the fourth year has three semesters. Students are admitted into the professional curriculum after

completing a minimum of 64 semester credits of required undergraduate coursework.

A strong and reputable basic science education during the first two years of the professional curriculum prepares veterinary students for a wide range of clinical experience during the last two years of the educational program. Fourth year students may choose to enhance their education by earning clinical elective credits at approved government agencies, research laboratories, veterinary practices and other university hospitals. Outstanding research programs in infectious diseases, food safety, neuroscience, immunoparasitology, evidence-based medicine, and many other areas provide opportunities for qualified students to participate in research.

Concurrent DVM/MS, DVM/PhD, DVM/MPH and DVM/MBA programs are available for qualified students who wish to obtain both veterinary and graduate degrees. Students must have a bachelor's degree or a minimum of 128 semester credits in undergraduate and professional curricula in order to participate in the concurrent DVM/graduate degree program. Admission to the concurrent degree program is subject to the approval of the deans of the College of Veterinary Medicine and the Graduate College.

The college is an important recruiting center for employers seeking veterinarians for private practice; industry; educational institutions; international agencies; federal, state and local governments; the armed forces; departments of public health; zoological gardens; and other related fields of professional activity. Graduates are highly sought after and typically have multiple employment offers upon graduation. Career services and an online job board are available for students.

Pre-Veterinary Medicine Preparation Admission Requirements

The College of Veterinary Medicine seeks students with diverse backgrounds and encourages students to enroll in baccalaureate programs in the college of their choice. A Bachelor's degree is not required for admission to the College of Veterinary Medicine. However, students must have a strong science foundation found in the required pre-veterinary coursework (<https://vetmed.iastate.edu/future-dvm-students/apply-to-the-college/pre-veterinary-requirements/course/>).

Veterinarians have varied career options. When deciding on an undergraduate major, the student should consider the area of veterinary medicine which interests them. For example, those who desire a career in clinical practice may wish to pursue a degree in biological science, animal science, agricultural economics, business, social science or humanities. Students with an interest in zoo or wildlife veterinary medicine may want to look at animal ecology, environmental studies or zoology. Future researchers may wish to consider genetics, molecular biology, microbiology, or biochemistry. Students who desire a career in public health (USDA, FDA, etc) or government (legislative/policy) may

find benefit in any of the biological sciences or in political science. A degree in education may be valuable to those who envision themselves as educators in a College of Veterinary Medicine. These examples are only suggestions and are but a few of the many possibilities.

For the most current information regarding application and admission to the College of Veterinary Medicine, please refer to the College web site at www.vetmed.iastate.edu/ (<http://www.vetmed.iastate.edu/>).

Applicants for admission to the College of Veterinary Medicine must have attended an accredited college or university and have completed 64 semester credits prior to the end of the spring term of the year in which they seek to be admitted to the College of Veterinary Medicine.

All science requirements should be fulfilled by the time of application or scheduled for completion by the end of the fall term in which the applicant applies. However, if necessary, the applicant may complete up to two required science courses after the fall term providing a transcript with the courses and grades listed is postmarked by July 1 of the year the applicant would enter. There is no maximum number of non-science required courses that may be completed but the deadline of having a transcript with these course grades posted by July 1 also applies. The July 1 deadline for transcripts and grades is firm.

Required courses must be completed with a grade of C (2.00) or better. A grade of C- (1.67) does not fulfill the requirement.

Credits earned must include the following Iowa State semester course offerings or their equivalents:

English Composition 6 cr.

One year of composition or writing emphasis courses. May include business or technical writing. Two of the following courses would fulfill the requirement.

ENGL 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
ENGL 3020	Business Communication	3
ENGL 3090	Proposal and Report Writing	3
ENGL 3140	Technical Communication	3

Oral Communications 3 cr.

May include public speaking, interpersonal communication, group or organizational communication or speaking emphasis courses. One of the courses below will fulfill the requirement.

SPCM 2120	Fundamentals of Public Speaking	3
AGEDS 3110	Presentation and Sales Strategies for Agricultural Audiences	3
SPCM 3120	Business and Professional Speaking	3
COMST 2140	Professional Communication	3

General Chemistry with Laboratory* 7 cr.

One year series for science majors with one semester lab.

CHEM 1770 & 1770L	General Chemistry I and Laboratory in General Chemistry I	5
CHEM 1780	General Chemistry II	3
Total Credits		8

Organic Chemistry with Laboratory* 4 cr.

The first in a two-semester series of Organic Chemistry with lab. The second semester of organic chemistry will not fulfill this requirement.

CHEM 3310	Organic Chemistry I	3
CHEM 3310L	Laboratory in Organic Chemistry I	1
Total Credits		4

Biochemistry* 3 cr.

One semester (no lab required). One of the courses below will fulfill the requirement. Must be metabolic biochemistry and cannot be biochemistry of proteins and enzymes alone.

BBMB 3010	Survey of Biochemistry	3
BBMB 3030	General Biochemistry	3
BBMB 3160	Principles of Biochemistry	3
BBMB 4040	Biochemistry I	3
BBMB 4200	Mammalian Biochemistry	3

General Physics with Laboratory* 4 cr.

First semester of a two-semester series with lab. Must include mechanics, fluids, heat and thermodynamics, vibrations, waves and sound. The second semester of Physics will not fulfill this requirement.

PHYS 1310	General Physics I	4
PHYS 1310L	General Physics I Laboratory	1
PHYS 1150	Physics for the Life Sciences	4
PHYS 1150L	Laboratory in Physics for the Life Sciences	1
PHYS 2310	Introduction to Classical Physics I	4
PHYS 2310L	Introduction to Classical Physics I Laboratory	1

General Biology with Laboratory* 8 cr.

Two semester series with lab each semester. If a series is not available a course in organismal biology with lab and a course in cellular biology and lab will fulfill this requirement. In addition, a bachelor's degree in biology fulfills this requirement.

BIOL 2110	Principles of Biology I	3
BIOL 2110L	Principles of Biology Laboratory I	1
BIOL 2120	Principles of Biology II	3

BIOL 2120L	Principles of Biology Laboratory II	1
Total Credits		8

Genetics * 3 cr.

Must include Mendelian and molecular genetics. A general genetics course is preferred, but animal breeding/livestock improvement courses will be accepted. One of the courses below will fulfill the requirement.

ANS 3520	Genetic Improvement of Domestic Animals	3
ANS 3510	Principles of Domestic Animal Genetics	3
BIOL 3130	Principles of Genetics	3
GEN 3200	Genetics, Agriculture and Biotechnology	3

Mammalian Anatomy or Physiology* 3 cr.

Human anatomy or physiology will also fulfill this requirement (no lab required). Must be an overview of all organ systems. If you take an Anatomy and/or Physiology I course, you must also take the second course, Anatomy and/or Physiology II, in order to fulfill the requirement. One of the courses below will fulfill the requirement.

ANS 2140	Domestic Animal Physiology	3
BIOL 1550	Human Biology	3
BIOL 2550	Fundamentals of Human Anatomy	3
BIOL 2560	Fundamentals of Human Physiology	3
BIOL 3350	Principles of Human and Other Animal Physiology	3
BIOL 3500	Comprehensive Human Anatomy	4
BIOL 3510	Comparative Vertebrate Anatomy	3
BMS 3290	Anatomy and Physiology of Domestic Animals	3
BMS 4470	Introduction to Human Gross Anatomy	4
BMS 5380	Principles of Physiology	4

Upper-level biomedical courses (junior or senior level only)* 9 cr.

Upper division biomedical science courses (junior-level (300/3000) undergraduate courses or higher-level courses). Approved upper-level biomedical science courses which give the applicant the best required science course GPA will be used. Click here (<https://vetmed.iastate.edu/future-dvm-students/still-exploring/pre-veterinary-requirements/foundational-course-requirements/>) for a list of approved and not approved topics as well as some of the Iowa State courses that fulfill this requirement.

Humanities or Social Sciences 6 cr.**Electives 8 cr.****Total Credits Required 64 cr.**

Courses above marked with an asterisk (*) are the required science courses. The required science course GPA is calculated from these courses.

Credits in the previously specified courses will normally be earned on the traditional four-letter grading system with A as the highest grade and D

as the lowest passing grade. All required courses must be completed with a grade of C (2.0) or better. It is generally expected that required courses have been completed within the past eight (8) years. AP or CLEP credits must be documented by original scores submitted to the College of Veterinary Medicine or by credits for specific coursework on another undergraduate institution transcript. CLEP credits may be accepted only for arts, humanities and social sciences. Credits in the preceding specified courses will not be accepted if earned under the pass-not pass grading system or similar options. Please see COVID-19 exceptions (<https://vetmed.iastate.edu/sites/default/files/COVID-19-ImpactStatementRevised-10-23-2020.pdf>).

Application and Admission

Applicants must apply using the Veterinary Medical College Application Service (VMCAS). The VMCAS application may be found online at the VMCAS website (<https://www.aavmc.org/becoming-a-veterinarian/how-to-apply/>).

Those applying through VMCAS also need to complete the ISU Supplemental Application (<https://vetmed.iastate.edu/future-dvm-students/apply-to-the-college/application-requirements/supplemental-application/>) found at the College of Veterinary Medicine website. The deadline for filing the VMCAS and Supplemental Application is typically mid-September.

A list of courses in progress at the time of submission and/or scheduled for completion by the end of spring term should be entered in the VMCAS application. Undergraduate college credits must average at least 2.50 on a 4.00 marking system for the application to be eligible for review. The preceding scholastic requirements are minimum and do not assure admission even though these requirements have been fulfilled.

Admission to the College of Veterinary Medicine is on a competitive and selective basis. GPA, animal, veterinary, research and other employment experiences, essays, recommendations and personal development (leadership, citizenship, volunteerism, etc.) are given consideration in the selection of candidates.

Positions are available to applicants in several applicant pools, including Iowa residents, participants in the Professional Program in Veterinary Medicine with the University of Nebraska-Lincoln, participants in the contract with the State of North Dakota, participants in other institution-specific contracts, and all other applicants including non-Iowan US citizens and international applicants. Consideration for admission is given equally without regard to race, color, national origin, gender, religion, disability, or age, political beliefs, or marital or familial status.

For further information, please visit the College of Veterinary Medicine at <https://vetmed.iastate.edu/future-dvm-students> (<https://vetmed.iastate.edu/future-dvm-students/>).

Curriculum in Veterinary Medicine

Graduation Requirements

To be awarded the degree Doctor of Veterinary Medicine, candidates must have passed all required courses in the curriculum in veterinary medicine, earned a minimum 2.0 grade-point average in the veterinary medicine curriculum, and earned at least 4 elective credits during the VM1-3 years. Candidates must also have given a grand rounds presentation (VCS 7495 Grand Rounds Presentations).

Required Courses in the Professional Program

BMS 7330	Biomedical Sciences I	6
BMS 7331	Principles of Morphology II	4
BMS 7333	Biomedical Sciences I	6
BMS 7334	Biomedical Sciences II	6
BMS 7335	Molecular and Cellular Basis of Disease	1
BMS 7336	Veterinary Nutrition	2
BMS 7337	Neuroanatomy	3
BMS 7339	Clinical Foundations I	1
BMS 7345	Case Study I	1
BMS 7346	Case Study II	1
BMS 7354	General Pharmacology	3
BMS 7443	Pharmacology and Therapeutics	3
VCS 7311	Careers in Veterinary Medicine	1
VCS 7313	Veterinary Medical Ethics	1
VCS 7314	Communication and Leadership in Veterinary Medicine	1
VCS 7315	Veterinary Law	1
VCS 7339	Clinical Foundations I	1
VCS 7391	Clinical Imaging	1
VCS 7393	Principles of Surgery I	3
VCS 7394	Principles of Surgery II	1
VCS 7395	Small Animal Surgery	2
VCS 7398	Anesthesiology	2
VCS 7399	Ophthalmology	1
VCS 7436	Small Animal Internal Medicine	3
VCS 7440	Introduction to Clinics	1
VCS 7444	Small Animal Medicine	4
VCS 7445	Equine Medicine	2
VCS 7448	Diagnostic Imaging and Radiobiology	3
VCS 7449	Surgery, Anesthesia, and Community Outreach	3
VDPAM 7312	Introduction to Animal Welfare	1
VDPAM 7426	Veterinary Toxicology	3
VDPAM 7445	Production Animal Clinical Medicine	3
VDPAM 7450	Disturbances of Reproduction	4

VMPM 7378	Case Study IV	2
VMPM 7380	Veterinary Immunology	2
VMPM 7386	Veterinary Microbiology	5
VMPM 7387	Veterinary Virology	3
VMPM 7388	Public Health and the Role of the Veterinary Profession	3
VMPM 7437	Infectious Diseases and Preventive Medicine	3
VPTH 7342	Anatomic Pathology I	3
VPTH 7372	Anatomic Pathology II	4
VPTH 7376	Veterinary Parasitology	4
VPTH 7377	Case Study III	2
VPTH 7425	Clinical Pathology	4

Fourth Year

The fourth year of the veterinary medical curriculum is designed to be flexible yet provide a broad-based clinical education involving all domestic species of animals. All students participate in rotations that are considered fundamental to any species orientation that the student might choose. In addition, students choose one of four options for additional study, including the Small Animal, Equine, Mixed Animal, or Food Animal Options. Students may obtain clinical elective credits by repeating on-campus rotations or participating in approved off-campus preceptorships at government, private or public agencies; other universities; or private veterinary practices.

The following rotations are required of all fourth-year students in addition to the requirements of the track they choose. A complete listing of track-specific requirements can be found at: <http://vetmed.iastate.edu/>:

VCS 7453	Small Animal Medicine I	2
VCS 7455	Small Animal Soft Tissue Surgery	2
or VCS 7456	Small Animal Orthopedic Surgery	
Must have one equine course as assigned by the schedule optimizer.		2
VCS 7457	Equine Medicine	
or VCS 7464	Equine Field Services	
or VCS 7458	Equine Surgery	
VCS 7460	Radiology	2
VCS 7463	Primary Care	2
VCS 7466	Anesthesiology	2
VCS 7468	Intensive Care	4
VCS 7495	Grand Rounds Presentations	R
VDPAM 7477	Food Animal and Camelid Medicine and Surgery	2
VPTH 7456	Necropsy Laboratory Practicum	2
& VPTH 7457	and Clinical Pathology Laboratory Practicum (Taken together as one 2-week block)	

Reinstatement

Any student who voluntarily withdraws from the College of Veterinary Medicine or who is dismissed from the College of Veterinary Medicine, after having successfully completed one or more semesters forfeits his/her standing and must make written application for reinstatement to this college a minimum of 60 days prior to the opening of the semester for which they seek to re-enter. Any student who voluntarily withdraws from the College of Veterinary Medicine prior to completion of one semester must re-apply for admission to the college in the general applicant pool.

Biomedical Sciences Professional Program of Study

For professional curriculum in veterinary medicine leading to the degree doctor of veterinary medicine, see Veterinary Medicine

Biomedical Sciences

The Department of Biomedical Sciences provides a hands on educational experience in human and animal health sciences. Our courses include cadaver-based human and veterinary anatomy, histology, physiology, pharmacology and cell biology, emphasizing a One Health approach that recognizes the interconnection between human and animal health.

A solid foundation in anatomy, physiology, and pharmacology is necessary to understand both the mechanisms of disease processes in humans and animals as well as their treatment. Specimen-based study of anatomy and physiology prepares students with a background in the structural and functional activities of cells, tissues, organs, and body systems relevant to human and veterinary medicine.

An understanding of drug action is essential for rational drug therapy. Our general pharmacology courses provide students with a background in basic pharmacology to include pharmacodynamics, toxicology, and the clinical application of drugs. Special emphasis is placed on chemical agents and therapeutic practices specific to both human and veterinary medicine.

Graduate Programs

The department offers Master of Science and Doctor of Philosophy degrees with a major in Biomedical Sciences and specializations in Anatomy, Physiology, Pharmacology, and Cell Biology. Up to 10 credits of dual-listed veterinary courses may be applied for major graduate credit.

The objective of the department is to prepare graduate students for successful careers in biomedical research and professional service. The department is part of interdepartmental programs in neuroscience, toxicology, and molecular, cellular, and developmental biology. The combined Ph.D./DVM program is an option offered by the department.

Departmental research facilities allow for training in experimental anatomy, pharmacology, and physiology. Graduate studies are supervised by faculty members recognized in their areas of expertise. Current areas of research include: Alzheimer’s disease, aquatic animal health, calcium and mineral homeostasis, diabetes mellitus, glia-neuron signaling, neurophysiology of pain, neurotoxicology, physiology and pharmacology of nematode ion-channels, Parkinson’s disease, pharmacology of schistosomiasis, pharmacology of salmonellosis, physiology and pharmacology of thalamic neurons, physiology of the retina, Spinal Muscular Atrophy, and study of neural stem cells.

Pharmacology and Toxicology Minor Pharmacology and Toxicology - Undergraduate Minor

The interdisciplinary pharmacology and toxicology minor is intended to significantly increase the number of ISU graduates who can:

- Understand, use and define key terms and concepts related to pharmacology and toxicology;
- Apply concepts and standard practices in pharmacology and toxicology to solving practical problems relevant to these fields;
- Analyze scientific data in pharmacology and toxicology;
- Synthesize detailed and accurate descriptions of current knowledge on key topics in pharmacology and toxicology;
- Make informed decisions about current controversies in pharmacology and toxicology, using appropriate scientific methods and ethical reasoning.

The minor in Pharmacology and Toxicology may be earned by completing the following courses. All minors require at least 15 credits; 3 credits of the courses listed in the minor must not be used to meet any other department, college, or university requirement except the credit requirement for graduation. There are three required courses for all Pharmacology and Toxicology undergraduate minors: TOX 4010, BMS 4390, and one physiology course selected from BMS 3290, BMS 4380 or BIOL 3350. The remaining credits are fulfilled by any of the electives listed below.

Required Core Courses:

TOX 4010	Principles of Toxicology	3
BMS 4390	Principles of Pharmacology	4
Select one of the following:		3-4
BMS 3290	Anatomy and Physiology of Domestic Animals	
BMS 4380	Principles of Physiology	
BIOL 3350	Principles of Human and Other Animal Physiology	
Total Credits		10-11

Electives:

ABE 4510	Food and Bioprocess Engineering	3
BBMB 3160	Principles of Biochemistry	3
BBMB 4040	Biochemistry I	3
BBMB 4050	Biochemistry II	3
BIOL 3190	Analysis of Environmental Systems	3
BIOL 4230	Developmental Biology	3
BIOL 4340	Endocrinology	3
BIOL 4360	Neurobiology	3
BME 4400	Biomedical Applications of Chemical Engineering	3
BMS 7443	Pharmacology and Therapeutics	3
BMS 4480	Principles of Human Gross Anatomy	4
CHEM 2110 & 2110L	Quantitative and Environmental Analysis and Quantitative and Environmental Analysis Laboratory	4
CHEM 2310	Elementary Organic Chemistry	3
CHEM 3310	Organic Chemistry I	3
ENSCI 4860	Aquatic Ecology	3
ENT 4500	Pesticides in the Environment	3
FSHN 4420	Food, Culture, and Sustainability	3
FSHN 4610	Medical Nutrition and Disease I	4
FSHN 4640	Medical Nutrition and Disease II	4
FSHN 4670	Molecular Basis of Nutrition in Disease Etiology and Health Promotion	3
TOX 7354	General Pharmacology	3
TOX 4190	Foodborne Hazards	3
TOX 4200	Food Microbiology	3
TOX 4900	Independent Study	1-2
TOX 4990	Undergraduate Research	1-3

Veterinary Clinical Sciences Professional Program of Study

For the professional curriculum in veterinary medicine leading to the degree doctor of veterinary medicine, see Veterinary Medicine, Curriculum.

The curriculum of veterinary clinical sciences explores the preventive health care, and diagnosis and treatment of diseases of companion and competitive athletic animals. Veterinary specialists lead didactic and laboratory based learning in the clinical sciences. Experiential based courses conducted through the Veterinary Medical Center during the fourth year provide the student an opportunity to participate in the application of clinical skills and knowledge.

Graduate Study

The department offers work for the degree master of science with major in veterinary clinical science, and minor work for students majoring in other departments. Within the veterinary clinical sciences major, the student may specialize in veterinary medicine, surgery, or theriogenology. The D.V.M. degree or equivalent is prerequisite to a major graduate work.

Both thesis and nonthesis options are available and require the completion of a minimum of 30 graduate credits and a final examination.

World languages and cultures requirements may be established by the student's program of study committee.

Courses primarily for graduate students, open to qualified undergraduates:

VCS 5900A: Special Topics: Medicine

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

VCS 5900B: Special Topics: Surgery

Credits: 1-3. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

VCS 5900C: Special Topics: Theriogenology

Credits: 1-3. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

VCS 5900D: Special Topics: Radiology

Credits: 1-3. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

VCS 5900E: Special Topics: Anesthesiology

Credits: 1-3. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

VCS 5900F: Special Topics - Ophthalmology

Credits: 1-3. Repeatable, maximum of 3 credits.

Prereq: Graduate Standing or Permission of Instructor

Special topics in Ophthalmology. (Typically Offered: Fall, Spring)

VCS 5960: International Preceptorship

Credits: 1-12. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

International Preceptorships and Study Abroad Group programs. Provides opportunities for students to be involved in applied clinical, production, and/or research experiences in international locations. The course consists of 40 hour per week experiential learning opportunities. (Typically Offered: Fall, Spring, Summer)

VCS 5990: Creative Component

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Courses for graduate students:

VCS 6040: Seminar

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

(Typically Offered: Fall, Spring)

VCS 6400: Advanced Radiology

Credits: 2. Contact Hours: Lecture 2.

Detailed principles of clinical radiology with particular reference to radiographic interpretation.

VCS 6760: Advanced Medicine

Credits: 2. Contact Hours: Lecture 2.

Principles of general medicine. A study in depth of factors that contribute to the development of clinical signs as related to the pathogenesis of disease.

VCS 6770: Advanced Medicine

Credits: 2. Contact Hours: Lecture 2.

An advanced study of metabolic diseases.

VCS 6990A: Research: Medicine

Credits: 1-30. Repeatable.

VCS 6990B: Research: Surgery

Credits: 1-30. Repeatable.

VCS 6990C: Research: Theriogenology

Credits: 1-30. Repeatable.

VCS 6990E: Research: Anesthesiology

Credits: 1-30. Repeatable.

VCS 6990F: Research: Ophthalmology

Credits: 1-30. Repeatable.

Graduate Level Research.

VCS 6990G: Research: Cardiology

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Graduate Level Research.

Courses primarily for professional curriculum students:

VCS 7305: Shelter Medicine

Credits: 1. Contact Hours: Lecture 1.

An elective course designed to educate the veterinary student about issues of relevance to companion animal population and shelter medicine and welfare. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

VCS 7311: Careers in Veterinary Medicine

Credits: 1. Contact Hours: Lecture 1.

Introduction to the veterinary profession and the various career opportunities available. (Typically Offered: Fall)

VCS 7313: Veterinary Medical Ethics

Credits: 1. Contact Hours: Lecture 1.

A continuation of the Veterinarian in Society series. The course covers selected topics on moral and ethical issues affecting the practice of veterinary medicine. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

VCS 7314: Communication and Leadership in Veterinary Medicine

Credits: 1. Contact Hours: Lecture 1.

A continuation of the Veterinarian in Society series. This course will focus on helping students develop their communication, leadership, team building and conflict resolution skills. (Typically Offered: Fall)

VCS 7315: Veterinary Law

Credits: 1. Contact Hours: Lecture 1.

A continuation of the Veterinarian in Society series. This course will emphasize veterinary law. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

VCS 7318: Advanced Small Animal Oncology

Credits: 1.

Provide advanced instruction in medical oncology, radiation oncology, and surgical oncology. General learning objectives include demonstrating the ability to utilize information from the physical exam and historical findings to direct appropriate diagnostics and staging based on a specific cancer diagnosis. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

VCS 7319X: Veterinary Military Practicum

Credits: 1-6. Repeatable, maximum of 6 credits.

Allows students to gain veterinary experience through military service. (Typically Offered: Fall, Spring, Summer)

VCS 7339: Clinical Foundations I

(Cross-listed with BMS 7339).

Credits: 1. Contact Hours: Lecture 1, Laboratory 2.

Canine physical examination; basic behavior, animal handling and restraint; medical record keeping. (Typically Offered: Fall)

VCS 7346X: Clinical Neurology

Credits: 2. Contact Hours: Lecture 2.

SEAT - Veterinary Medicine Students

This course is intended to provide students with foundational concepts of clinical evaluation and management of animals with suspected neurologic disease. Focused discussions include the neurologic examination process, problem identification, neuroanatomical localization, formation of an appropriate differential diagnosis, disease discussion and formation of an appropriate diagnostic plan. The emphasis in this course is increasing skills, knowledge, and confidence when diagnosing and treating dogs and cats with neurologic conditions using relevant case examples. (Typically Offered: Fall)

VCS 7385: Grand Rounds

Credits: Required. Contact Hours: Lecture 1.

Repeatable.

Seminars and case presentations on selected clinical subjects by fourth-year students of the College of Veterinary Medicine. Attendance is required for a passing grade. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

VCS 7391: Clinical Imaging

Credits: 1. Contact Hours: Lecture 1.

Evaluation of morphologic anatomy of the dog and cat utilizing clinical imaging methods - radiography, ultrasonography, computed tomography, magnetic resonance imaging and nuclear imaging. Emphasis will be placed on normal radiographic anatomy. (Typically Offered: Fall)

VCS 7393: Principles of Surgery I

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

General principles of surgery of companion animals. (Typically Offered: Fall)

VCS 7394: Principles of Surgery II

Credits: 1. Contact Hours: Lecture 1, Laboratory 2.

General principles of surgery of companion animals. (Typically Offered: Spring)

VCS 7395: Small Animal Surgery

Credits: 2. Contact Hours: Lecture 2.

Small animal surgery. (Typically Offered: Spring)

VCS 7396: Fundamentals in Equine Practice

Credits: 2. Contact Hours: Lecture 2.

This elective course is an introduction and overview of the clinical aspects of common conditions in horses and related conditions, including pathogenesis, clinical manifestations, diagnosis, treatment and prognosis. It is not designed to teach the student how to perform specific procedures, but rather to improve knowledge base of students interested in equine or mixed animal practice. Class will include lecture, photos, video presentations, and other formats. (Typically Offered: Spring)

VCS 7398: Anesthesiology

Credits: 2. Contact Hours: Lecture 2.

Anesthetic equipment, agents and procedures, including pain management for core species. (Typically Offered: Spring)

VCS 7399: Ophthalmology

Credits: 1. Contact Hours: Lecture 1.

Principles and techniques of medical and surgical ophthalmology. (Typically Offered: Spring)

VCS 7402: Clinical Cardiology I

Credits: 1. Contact Hours: Lecture 1.

Elective course in diagnosis and management of cardiac diseases. Emphasis on interpretation of electrocardiography. (Typically Offered: Fall)

VCS 7403: Clinical Cardiology II

Credits: 1. Contact Hours: Lecture 0.5, Discussion 0.5.

Elective course in clinical cardiology. Emphasis on common congenital and acquired cardiac diseases of companion animals. Builds on foundation of basic clinical cardiac knowledge obtained in VCS 7444; expands to cover additional diseases in greater depth (e.g. infective endocarditis, systemic and pulmonary hypertension, heartworm disease, feline arterial thromboembolism, bradyarrhythmias and cardiac pacing, congenital heart diseases and interventional correction). Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

VCS 7404: Topics in Emergency and Critical Care

Credits: 2. Contact Hours: Lecture 2.

Introduction of common topics in emergency and critical care in companion animals. General learning goals for students in this course include developing the ability to utilize physical exam skills and historical findings to triage patients and assess stability. (Typically Offered: Spring)

VCS 7405: Pet Bird and Exotic Species Medicine

Credits: 2. Contact Hours: Lecture 1, Laboratory 3.

Elective course in management and diseases of pet birds and exotic species. (Typically Offered: Spring)

VCS 7406: Introduction to Captive Wild Animal Medicine

Credits: 1. Contact Hours: Lecture 1.

Topics covering the health and welfare of non-domestic animals in captivity. Regulations specific to exotic animal ownership and exhibition will be covered. Students will discuss diseases which affect multiple taxon groups, and learn about interface diseases. Specific topics regarding the veterinary care of exotic canids, felids, ungulates, primates, Old-World Camelids, exotic equids and avian species will be discussed. Laboratories will introduce remote-delivery and restraint devices, dangerous animal handling techniques (including venomous snake handling techniques), contraception for non-domestic animals, and extra-label use of medications and vaccines in non-domestic species. (Typically Offered: Spring)

VCS 7407: Feline Internal Medicine

Credits: 1. Contact Hours: Lecture 1.

Elective course in feline internal medicine. (Typically Offered: Fall)

VCS 7409: Oncology

Credits: 2. Repeatable, maximum of 4 credits.

Elective clinical assignment in oncology.

VCS 7414: Companion Animal Nutrition

Credits: 1. Contact Hours: Lecture 1.

Elective course in small animal and equine nutrition. (Typically Offered: Spring)

VCS 7415: Advanced Small Animal Dermatology

Credits: 2. Contact Hours: Lecture 1, Laboratory 2.

Elective course in dermatology. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

VCS 7419: Preceptorship in Companion Animal/Equine Veterinary Medical Practice

Credits: 2-6. Contact Hours: Laboratory 12.

Repeatable, maximum of 6 credits.

Elective course in veterinary practice under the guidance of veterinarians in approved practice settings. Maximum of 6 credits in 2 credit increments. Instructor Permission needed if not a VM4 classification. (Typically Offered: Fall, Spring, Summer)

VCS 7420: Practicum

Credits: Required. Repeatable.

External practical experiences in the fourth year curriculum for additional professional development of the veterinary student. Instructor Permission needed if not a WM4 classification. Offered on a satisfactory-fail basis only.

VCS 7423: Zoo Preceptorship

Credits: 2-12. Repeatable, maximum of 12 credits.

Elective course in veterinary practice under the guidance of trained zoo veterinarians in approved practice settings. Maximum of 12 credits. (Typically Offered: Fall, Spring, Summer)

VCS 7425X: Rotation in Exotic Pet & Wildlife Medicine Clinical and Surgical Skills

Credits: 2.

Opportunity for 4th year veterinary students to learn appropriate restraint techniques, radiographic positioning and interpretation, emergency triage, physical examination, and surgical skills for exotic companion animals (birds, rodents, rabbits, ferrets and pet reptiles) and wildlife. The course will also include rabbit dentistry techniques. The purpose of this course is to give students the tools to be more comfortable in the handling, diagnostics, and treatment of exotic animals and native wildlife species. (Typically Offered: Summer)

VCS 7436: Small Animal Internal Medicine

Credits: 3. Contact Hours: Lecture 3.

Clinical diagnosis and treatment of diseases of small animals. (Typically Offered: Fall)

VCS 7437: Small Animal Shelter Medicine

Credits: 2. Contact Hours: Lecture 2.

Repeatable.

A 2-week elective rotation at an animal shelter/humane society that works with the public to place pets in homes. This rotation will encompass population medicine (medicine, surgery, intake, adoption, behavior and temperament, neglect and cruelty) that animal shelters deal with on a daily basis. The selected animal shelter/humane society must have a veterinarian(s) on staff and be approved by the course coordinator. More than one VCS 7437 may be taken upon approval of the course coordinator.

VCS 7440: Introduction to Clinics

Credits: Required. Contact Hours: Laboratory 4.

Rotating assignments through multiple sections within the Veterinary Medical Center. (Typically Offered: Spring)

VCS 7441: Canine Rehabilitation

Credits: 2.

Elective clinical assignment in rehabilitation.

VCS 7443: Equine Lameness

Credits: 2. Contact Hours: Lecture 1, Laboratory 2.

Orthopedic diseases of the equine. (Typically Offered: Spring)

VCS 7444: Small Animal Medicine

Credits: 4. Contact Hours: Lecture 4.

Clinical diagnosis and treatment of diseases of small animals. (Typically Offered: Fall, Spring)

VCS 7445: Equine Medicine

Credits: 2. Contact Hours: Lecture 2.

Clinical diagnosis and treatment of diseases of equine. (Typically Offered: Fall)

VCS 7446: Clinical Neurology

Credits: 2. Repeatable.

Clinical rotation in neurology with an emphasis on neurolocalization, disease processes, use of diagnostics in medical and surgical neurology and treatment options. Exposure to neurosurgical techniques.

VCS 7447: Equine Veterinary Diagnostic Skills

Credits: 2. Repeatable.

Hands on experience with equine veterinary diagnostic skills related to theriogenology, medicine, surgery, radiology, and ophthalmology. Preference to equine track student. (Typically Offered: Spring)

VCS 7448: Diagnostic Imaging and Radiobiology

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Essentials of diagnostic image interpretation. Essentials of radiobiology, radiation therapy and protection from radiation. (Typically Offered: Fall, Spring)

VCS 7449: Surgery, Anesthesia, and Community Outreach

Credits: 3. Contact Hours: Lecture 1, Laboratory 6.

Repeatable.

This laboratory introduces the student to anesthetic and surgical principles and techniques that can be applied to all animal species. Provides a broader range of surgical experiences throughout the laboratory. (Typically Offered: Fall, Spring)

VCS 7451B: Advanced Junior Surgery Laboratory: Traditional Curriculum

Credits: 2. Contact Hours: Lecture 1, Laboratory 6.

Repeatable.

8 weeks. Continuation of surgical laboratory experience. Techniques and advanced principles learned are applicable to all animal species. Exposure to more advanced surgical techniques with most surgical principles. (Typically Offered: Spring)

VCS 7451C: Advanced Junior Surgery Laboratory: Traditional Curriculum

Credits: 2. Contact Hours: Lecture 1, Laboratory 6.

Repeatable.

8 weeks. Continuation of surgical laboratory experience. Techniques and advanced principles learned are applicable to all animal species. A second repeat for students with a special interest in small animal surgery. (Typically Offered: Spring)

VCS 7452: Clinical Dermatology

Credits: 2. Repeatable.

Study of clinical dermatological problems via computer-aided instruction, case simulations, and/or lectures. Clinical management of cases presented to Veterinary Medical Center. Instructor Permission needed if not a VM4 classification.

VCS 7453: Small Animal Medicine I

Credits: 2. Contact Hours: Laboratory 6.

Repeatable, maximum of 6 credits.

Clinical assignment in small animal medicine.

VCS 7455: Small Animal Soft Tissue Surgery

Credits: 2. Contact Hours: Laboratory 6.

Repeatable.

Clinical assignment in soft tissue surgery.

VCS 7456: Small Animal Orthopedic Surgery

Credits: 2. Contact Hours: Laboratory 6.

Repeatable.

Clinical assignment in orthopedic surgery.

VCS 7457: Equine Medicine

Credits: 2. Contact Hours: Laboratory 4.

Repeatable.

Clinical assignment in equine medicine.

VCS 7458: Equine Surgery

Credits: 2. Contact Hours: Laboratory 4.

Repeatable.

Clinical assignment in equine surgery.

VCS 7459A: Small Animal Overpopulation Medicine and Surgery :Nebraska Humane Society, Omaha NE

Credits: 2. Contact Hours: Laboratory 4.

A 2-week surgical emphasis, elective rotation at a humane society that addresses the issues facing veterinarians and non-veterinary humane society personnel who deal with small animal overpopulation issues. Each section can be taken for credit once.

VCS 7459C: Small Animal Overpopulation Medicine and Surgery: WaySide Waifs, Kansas City MO

Credits: 2. Contact Hours: Laboratory 4.

A 2-week surgical emphasis, elective rotation at a humane society that addresses the issues facing veterinarians and non-veterinary humane society personnel who deal with small animal overpopulation issues. Each section can be taken for credit once.

VCS 7459D: Small Animal Overpopulation Medicine and Surgery: Boulder Humane Society, Boulder, CO

Credits: 2. Contact Hours: Laboratory 4.

A 2-week surgical emphasis, elective rotation at a humane society that addresses the issues facing veterinarians and non-veterinary humane society personnel who deal with small animal overpopulation issues.

Each section can be taken for credit once.

VCS 7459E: Small Animal Overpopulation Medicine and Surgery: ASPCA Spay/Neuter Alliance, Ashville, NC

Credits: 2. Contact Hours: Laboratory 4.

A 2-week surgical emphasis, elective rotation at a humane society that addresses the issues facing veterinarians and non-veterinary humane society personnel who deal with small animal overpopulation issues.

Each section can be taken for credit once.

VCS 7459F: Small Animal Overpopulation Medicine and Surgery: Capital City Humane Society, Lincoln, NE

Credits: 2. Contact Hours: Laboratory 4.

Small Animal Overpopulation Medicine and Surgery: Capital City Humane Society, Lincoln NE.

VCS 7460: Radiology

Credits: 2. Contact Hours: Laboratory 6.

Repeatable.

Clinical assignment in veterinary radiology.

VCS 7463: Primary Care

Credits: 2. Contact Hours: Laboratory 6.

Repeatable, maximum of 4 credits.

Clinical experience in hospital based general practice.

VCS 7464: Equine Field Services

Credits: 2. Contact Hours: Laboratory 4.

Repeatable.

Clinical assignment in equine ambulatory practice.

VCS 7465: Farrier

Credits: 2. Contact Hours: Laboratory 4.

Elective clinical assignment on the principles and practices of normal and therapeutic horseshoeing and equine foot care.

VCS 7466: Anesthesiology

Credits: 2. Contact Hours: Laboratory 6.

Repeatable.

Clinical assignment in small animal and large animal anesthesiology.

VCS 7468: Intensive Care

Credits: 4. Contact Hours: Laboratory 12.

Repeatable.

Clinical assignment to provide supervision of hospital cases requiring intensive care and including emergency cases.

VCS 7469: Ophthalmology

Credits: 2. Contact Hours: Laboratory 6.

Repeatable.

Clinical assignment in ophthalmology.

VCS 7475: Cardiology Rotation

Credits: 2. Contact Hours: Laboratory 4.

Repeatable.

Elective clinical assignment in cardiology.

VCS 7476E: Equine Anesthesiology

Credits: 2. Contact Hours: Laboratory 4.

Repeatable.

Assignments in equine, small animal, and large animal anesthesiology.

Experience includes case work-up, management and recovery.

Understanding of the unique physiology and potential complications of anesthetized patients. Pharmacology of commonly used drugs. Specific protocols and management for both field and general anesthesia.

VCS 7476S: Small Animal Anesthesiology

Credits: 2. Contact Hours: Laboratory 4.

Repeatable.

Assignments in equine, small animal, and large animal anesthesiology.

Experience includes case work-up, management and recovery.

Understanding of the unique physiology and potential complications of anesthetized patients. Pharmacology of commonly used drugs. Specific protocols and management for both field and general anesthesia.

VCS 7478: Intensive and Critical Care

Credits: 2. Contact Hours: Lecture 2.

Repeatable, maximum of 4 credits.

Elective clinical assignment in intensive care. (Typically Offered: Fall, Spring, Summer)

VCS 7480: Veterinary Dentistry

Credits: 1. Contact Hours: Lecture 1.

All aspects of veterinary dentistry, prophylaxis, endodontics, and orthodontics. This course is an on-line course. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

VCS 7481: Advanced Equine Dentistry

Credits: 2. Contact Hours: Laboratory 4.

Clinical rotation in equine dentistry with an emphasis on routine equine dental examinations, specialized equipment, and corrective procedures.

Offered only offered for one 2-week rotation. Enrollment is limited.

(Typically Offered: Spring)

VCS 7484X: Clinical Practice in Diverse Communities

Credits: 2.

Two week rotation for fourth year veterinary students working with equine patients both in the hospital and field settings. This rotation includes a community service component, which will include lecture time on relevant topics and a veterinary service trip to the Crow Creek Tribal Reservation in Fort Thompson, SD. Five-day trip, providing experience in preparing, setting up, and running an equine and small animal veterinary clinic to serve the tribal community.

VCS 7490: Independent Study

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Independent Study in veterinary medicine focusing on basic / translational research or learning issues. Enrollment in this course is not appropriate for clinical experiences in the Veterinary Medical Center or extramural experiences in clinical veterinary practice (i.e., preceptorships).

VCS 7492: Orientation for International Experience

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

8 weeks. Predeparture orientation for group study abroad. Cultural considerations for the study abroad experience and a conversational language introduction. Out of class work may be assigned. (Typically Offered: Spring)

VCS 7495: Grand Rounds Presentations

Credits: Required. Contact Hours: Lecture 1.

Seminars and case presentations on selected subjects by fourth year students of the College of Veterinary Medicine. Completion of a seminar presentation is required for graduation. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

VCS 7496: International Experience

Credits: 1-12. Repeatable, maximum of 12 credits.

International Preceptorships and Study Abroad Group programs.

Opportunities for students to be involved in applied clinical, production, and/or research experiences in international locations. The course consists of 40 hour per week experiential learning opportunities.

Veterinary Diagnostic and Production Animal Medicine

Professional Program of Study

For the professional curriculum in veterinary medicine leading to the degree doctor of veterinary medicine, see Veterinary Medicine, Curriculum.

Courses in veterinary diagnostic and production animal medicine provide students with basic and advanced skills in diagnostics, reproduction, medicine, surgery, production, welfare, and health management of the major livestock species. Students in the fourth year of the curriculum in veterinary medicine may elect to take advanced courses in beef, dairy, swine, poultry or small ruminant production medicine. Elective courses may include preceptorships in private practices, at other veterinary schools, in research and disease control laboratories, or in related agribusinesses.

Production animal medicine emphasizes the integration of veterinary medicine with nutrition, genetics, economics, food safety, and other disciplines, enabling graduates to acquire and use a broad knowledge base to support the health and improve the production and efficiency of the food supply chain.

Graduate Study in Veterinary Preventive Medicine

Veterinary Preventive Medicine is a multidisciplinary program focused on the study of health and disease in populations. The various disciplines represented in the program are unified by a common approach based on the application of epidemiological methods to problem solving in populations. Through their research and course work, students will learn to understand and apply a variety of disciplines, principles, and techniques to population health issues involving environmental, ecological, nutritional, genetic, infectious, or non-infectious diseases.

Graduate study in Veterinary Preventive Medicine will provide valuable skills and experience to persons interested in public health, food safety, emerging infectious diseases, zoo or wildlife health, and livestock health. A degree in Veterinary Preventive Medicine may be valuable for individuals considering a future in the biological or pharmaceutical industries, government regulatory agencies, public veterinary practice, international service agencies responsible for population health or progressive private practice.

Veterinary Preventive Medicine is an interdepartmental major administered by the Department of Veterinary Diagnostic and Production Animal Medicine (VDPAM) with participating faculty from colleges and departments across the University and collaborators from the National

Animal Disease Center (USDA:ARS) and the National Veterinary Services Laboratories (USDA:APHIS) located in Ames, Iowa.

Both thesis and non-thesis options are available and require the completion of a minimum of 30 graduate credits for thesis and 36 graduate credits for non-thesis and a final examination.

Program of Study: Master of Science in Veterinary Preventive Medicine (Thesis Option) 30 credits

STAT 5101	Statistical Methods for Data Analysis	4
VDPAM 5270	Applied Statistical Methods in Population Studies	3
VDPAM 5280	Principles of Epidemiology and Population Health	3
VDPAM 5290	Epidemiological Methods in Population Research	3
VDPAM 6990	Research	1-30
Research or Electives to total at least 17 additional credits		

Program of Study: Master of Science in Veterinary Preventive Medicine (Non-Thesis Option) 36 Credits

STAT 5101	Statistical Methods for Data Analysis	4
VDPAM 5270	Applied Statistical Methods in Population Studies	3
VDPAM 5280	Principles of Epidemiology and Population Health	3
VDPAM 5290	Epidemiological Methods in Population Research	3
VDPAM 5900	Special Topics	1-3
One Additional STAT course from the following		3
STAT 5212	Experimental Design and Data Analysis	3
STAT 5730	Introduction to Survey Sampling	
STAT 5750	Introduction to Multivariate Data Analysis	
VDPAM 5990	Creative Component	

Creative Component and Electives to total 18 additional credits

Graduate Certificate in Veterinary Preventive Medicine

Veterinary Diagnostic and Production Animal Medicine offers a graduate certificate for DVMs, concurrent DVM students and non-DVMs in allied animal industries in Veterinary Preventive Medicine.

Students in this program are able to select courses that focus in areas of animal welfare, diagnostics, food safety, evidence-based medicine, surgery, pathology, microbiology, epidemiology, public health, statistics and production medicine.

The purpose of the graduate certificate in Veterinary Preventive Medicine for industry professionals is to address the continued and advanced needs of animal health professionals. The certificate enables professionals to gain recognition for a skill set that includes epidemiology, risk assessment, production medicine and animal welfare. A graduate certificate may be used to increase knowledge in a new or emerging area of interest to the candidate. As such, it may be used to

formally gain recognition for retraining to meet the needs of today's food production systems.

The graduate certificate for concurrent DVM students is designed to give additional skills to students planning on working with populations of animals. Using a combination of on-line and dual listed graduate level courses, the program is designed to enable DVM students to complete the certificate while studying for their DVM degree. Students enrolled in any US-based DVM program are able to complete a graduate certificate at ISU using a combination of on-line and transfer graduate level courses.

The graduate certificate is an additional qualification awarded by Iowa State University after successful completion of 15 graduate level credits. A graduate certificate is different from continuing education as the certificate includes an academic transcript from Iowa State University. Students complete the same courses graduate students do with the the same expectations for all assignments and exams.

The program is available as a strictly on-line (off campus) delivery method or as a combination of classroom-based and on-line course offerings providing maximum flexibility in scheduling.

Program of Study: Graduate Certificate in Veterinary Preventive Medicine (15 credits)

Certificate required core courses		7
STAT 5101	Statistical Methods for Data Analysis	4
VDPAM 5280	Principles of Epidemiology and Population Health	
Remaining 3 core credits can be selected from		3
VDPAM 5270	Applied Statistical Methods in Population Studies	
VDPAM 5290	Epidemiological Methods in Population Research	
VDPAM 5700	Risk Assessment for Food, Agriculture and Veterinary Medicine	
5 elective credits from any approved ISU graduate course		5
Total Credits		19

Courses primarily for professional curriculum students:

VDPAM 4280: Principles of Epidemiology and Population Health (Dual-listed with VDPAM 5280/ VMPM 5280). (Cross-listed with MICRO 4280/ VMPM 4280).

Credits: 3. Contact Hours: Lecture 3.

Epidemiology of disease in populations. Disease causality, observational study design and approaches to epidemiologic investigations. This course is available on campus and by distance. (Typically Offered: Spring)

VDPAM 4870: Livestock Disease Prevention

Credits: 3. Contact Hours: Lecture 3.

The course is designed for both the pre-veterinary and animal science majors who have an interest in production animal health, disease prevention methods, epidemiology of economically important agents, and the ecology of currently important pathogens found in North American livestock industries. It will focus on disease prevention principles for individuals and large production population systems. (Typically Offered: Fall)

Courses primarily for graduate students, open to qualified undergraduates:

VDPAM 5070: Evidence Based Clinical Decision Making

(Dual-listed with VDPAM 7407).

Credits: 1. Contact Hours: Lecture 1.

Prereq: Graduate Standing or Permission of Instructor

Discussion, lectures and laboratories to assess the quality and significance of medical evidence in making informed decisions about the treatment of individual animals and animal populations. (Typically Offered: Spring)

VDPAM 5080: Poultry Diseases

(Dual-listed with VDPAM 7408).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Discussion, lectures and laboratories to assess the quality and significance of medical evidence in making informed decisions about the treatment of individual animals and animal populations. Offered even-numbered years. (Typically Offered: Spring)

VDPAM 5140: Veterinary Practice Entrepreneurship

(Dual-listed with VDPAM 7414).

Credits: 2-3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Formal exposure to the entrepreneurial and business skills necessary to own and operate a successful veterinary practice or other small business opportunity. Personal finance, marketing, human resource management, general accounting, site assessment, location demographics, practice valuation, and a host of other issues which must be considered when purchasing or starting a new business are covered. Class instruction will be delivered by successful practice and business owners with examples from real world experience. (Typically Offered: Spring)

VDPAM 5260: Veterinary Toxicology

(Dual-listed with Dual Listed Course: VDPAM 7426).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Study of toxicological diseases of animals emphasizing clinical recognition, circumstances of poisoning, differential diagnosis with clinical and laboratory data, therapeutic procedures, preventive management and public health implications. Supplemented with case-based materials. (Typically Offered: Spring)

VDPAM 5270: Applied Statistical Methods in Population Studies

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

ANOVA, Linear Regression, Model Selection, Mixed Models, ANCOVA, Repeated Measurement Analysis, MANOVA, Nonparametric Methods, Diagnostic Test Evaluation, ROC Curve Analysis, Generalized Linear Models, Logistic Regression, Survival Analysis, Cox Proportional Hazards Regression, Count Data Analyses. This course is available on campus and by distance. Offered odd-numbered years. (Typically Offered: Fall)

VDPAM 5280: Principles of Epidemiology and Population Health

(Dual-listed with VDPAM 4280/ VMPPM 4280/ MICRO 4280). (Cross-listed with VMPPM 5280).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Epidemiology of disease in populations. Disease causality, observational study design and approaches to epidemiologic investigations. This course is available on campus and by distance. (Typically Offered: Spring)

VDPAM 5290: Epidemiological Methods in Population Research

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Train students on selecting the proper statistical model to conduct statistical analysis in the context of epidemiological studies. Train students to report and interpret data collected from experimental (clinical trials), observational (cross-sectional, case-control, cohort) or field-based studies incorporating the information covered in previous epidemiology/biostatistics courses and this course, and how to communicate the findings with the end-users. Introduce other methods that can be used when analyzing epidemiological studies. This course is available on campus and by distance. Offered even-numbered years. (Typically Offered: Fall)

VDPAM 5420A: Introduction to Molecular Biology Techniques: DNA Techniques

(Cross-listed with BMS 5420A/ EEOB 5420A/ FSHN 5420A/ GDCB 5420A/ HORT 5420A/ NREM 5420A/ NUTRS 5420A/ BBMB 5420A/ VMPM 5420A).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes genetic engineering procedures, sequencing, PCR, and genotyping. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

VDPAM 5420B: Introduction to Molecular Biology Techniques: Protein

(Cross-listed with BMS 5420B/ EEOB 5420B/ FSHN 5420B/ GDCB 5420B/ HORT 5420B/ NREM 5420B/ NUTRS 5420B/ BBMB 5420B).

Credits: 1. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. Offered on a satisfactory-fail basis only. (Typically Offered: Spring, Summer)

VDPAM 5420C: Introduction to Molecular Biology Techniques: Cell Techniques

(Cross-listed with BMS 5420C/ EEOB 5420C/ FSHN 5420C/ GDCB 5420C/ HORT 5420C/ NREM 5420C/ NUTRS 5420C/ VMPM 5420C/ BBMB 5420C).

Credits: 1. Contact Hours: Laboratory 2. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. ular biology techniques and related procedures. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

VDPAM 5420D: Introduction to Molecular Biology Techniques: Plant Transformation

(Cross-listed with BMS 5420D/ EEOB 5420D/ FSHN 5420D/ GDCB 5420D/ HORT 5420D/ NREM 5420D/ NUTRS 5420D/ VMPM 5420D/ BBMB 5420D).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: Agrobacterium and particle gun-mediated transformation of tobacco, Arabidopsis, and maize, and analysis of transformants. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

VDPAM 5420E: Introduction to Molecular Biology Techniques: Proteomics

(Cross-listed with BMS 5420E/ EEOB 5420E/ FSHN 5420E/ GDCB 5420E/ HORT 5420E/ NREM 5420E/ NUTRS 5420E/ VMPM 5420E/ BBMB 5420E).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: two-dimensional electrophoresis, laser scanning, mass spectrometry, and database searching. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

VDPAM 5420F: Introduction to Molecular Biology Techniques: Metabolomics

(Cross-listed with BMS 5420F/ EEOB 5420F/ FSHN 5420F/ GDCB 5420F/ HORT 5420F/ NREM 5420F/ NUTRS 5420F/ VMPM 5420F/ BBMB 5420F).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: metabolomics and the techniques involved in metabolite profiling. For non-chemistry majoring students who are seeking analytical aspects into their biological research projects. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

VDPAM 5420G: Introduction to Molecular Biology Techniques: Genomic

(Cross-listed with BMS 5420G/ EEOB 5420G/ FSHN 5420G/ GDCB 5420G/ HORT 5420G/ NREM 5420G/ NUTRS 5420G/ VMPM 5420G/ BBMB 5420G).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

VDPAM 5460: Clinical and Diagnostic Toxicology

(Cross-listed with TOX 5460).

Credits: 1-3. Contact Hours: Laboratory 3. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Advanced study of current problems and issues in veterinary toxicology. Emphasis on problem solving and interpreting clinical cases while utilizing clinical, epidemiological, and laboratory resources. Course consists highly of clinical case based material. (Typically Offered: Fall, Spring, Summer)

VDPAM 5510: Advanced Veterinary Diagnostic Pathology

Credits: 1-3. Contact Hours: Laboratory 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Laboratory diagnosis of animal diseases with emphasis on gross and microscopic lesion description. Caseload is focused heavily on infectious diseases of food animals. (Typically Offered: Fall, Spring, Summer)

VDPAM 5600: Ecology of Infectious Diseases

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Topics of applied ecology of infectious diseases. Specific objectives include: a) understanding dynamics of pathogen transmission within and between population; b) how to reduce risk of pathogen introduction in populations; c) how to early detect pathogens and classify herds according to disease status; d) how to quantify pathogen transmission and impact in animal populations; e) applying and measure the effect of interventions to manipulate disease transmission dynamics within and between populations. Develop skills to prevent, detect and/or significantly control/eliminate animal health issues from animal populations. Learn how to quantify health issues and estimate the value of interventions to influence and mitigate health problems. Offered odd-numbered years. (Typically Offered: Spring)

VDPAM 5620X: Applied Diagnostic Technologies and Medicine for Infectious Disease

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Veterinary diagnostics and diagnostic medicine for infectious diseases in animal populations, mostly livestock, and clinical applications. Specific objectives include: understanding diagnostic process; mechanics of laboratory diagnostic methods; test development and validation; optimizing diagnostic outcomes; and applying diagnostic data to disease investigation and/or intervention. Additionally, students are expected to present a diagnostic relevant subject and participate in case review and discussion. On-line and can be asynchronous from time to time. Offered even-numbered years. (Typically Offered: Fall)

VDPAM 5640: Animal Welfare Science and Research

Credits: 3. Contact Hours: Lecture 2, Discussion 1.

Prereq: Graduate Standing or Permission of Instructor

Animal welfare is increasingly a key component of societal decisions about animal use, sustainable development and human-animal relationships. Understanding animal welfare as a scientific discipline, with primary focus on veterinary, biomedical and animal science disciplines. Explore fundamental and applied approaches to animal welfare science, including experimental design, data analysis and interpretation of results. Topics selected will reflect student interests, and may include animal welfare assessment and assurance, animal cognition, pain assessment and mitigation, and animal models used in biomedical research. Offered even-numbered years. (Typically Offered: Spring)

VDPAM 5670X: Design, Implementation and Analysis of Field Studies in Food Animals

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Design of field trials to test hypotheses related to biological outcomes in food animal production. Topics include field trial designs and how-to implement these trials under field/commercial conditions; and how to calculate sample size given different type of outcomes and covers the proper statistical analyses, interpretation, and communication of the results. Invited speakers will share how they use field trials in their daily practice. Case studies. (Typically Offered: Fall)

VDPAM 5700: Risk Assessment for Food, Agriculture and Veterinary Medicine

(Cross-listed with TOX 5700/ AGRON 5700).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Risk assessment principles as applied to biological systems. Exposure and effects characterization in human and animal health and ecological risk assessment. Risk analysis frameworks and regulatory decision-making. Introduction to quantitative methods for risk assessment using epidemiological and distributional analysis. Uncertainty analysis. Offered odd-numbered years. (Typically Offered: Fall)

VDPAM 5810: Advanced Cow/Calf Production Medicine

(Dual-listed with VDPAM 7481).

Credits: 2. Contact Hours: Lecture 1.5, Laboratory 1.5.

Prereq: Graduate Standing or Permission of Instructor

Two-week senior elective that will focus on the economics of animal disease in cow/calf operations. Evidence based medicine and epidemiological principles will be used in investigation of disease outbreaks. Extensive partial budgeting used. Students will complete at least two disease investigations involving outbreaks in commercial cow/calf operations and communicate their findings to the class, the herd owner, and local practitioner. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel. (Typically Offered: Spring)

VDPAM 5900: Special Topics

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Topics in medicine, surgery, theriogenology; beef, swine, dairy, or sheep production medicine. (Typically Offered: Fall, Spring, Summer)

VDPAM 5960: International Experience

(Dual-listed with VDPAM 7496).

Credits: 1-12. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

International Preceptorship. (Typically Offered: Fall, Spring, Summer)

VDPAM 5990: Creative Component

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

Courses for graduate students:**VDPAM 6500: Swine Diagnostic Medicine**

Credits: 4. Contact Hours: Lecture 4.

A detailed study of swine diseases emphasizing the pathogenesis and diagnosis of swine respiratory, enteric, reproduction, metabolic, and septicemic diseases. Course activities include interpretation of diagnostic case reports and development of diagnostic plans for specific disease objectives. (Typically Offered: Fall)

VDPAM 6540: Comparative Antimicrobial Clinical Pharmacology

Credits: 2. Contact Hours: Lecture 2.

Initial antimicrobial selection for infectious diseases of domestic animals. The antimicrobial drug groups will be examined, stressing pharmacokinetics, minimal inhibitory concentrations, and the use of these parameters to select appropriate compounds and dosages for maximum efficacy. Offered odd-numbered years. (Typically Offered: Fall)

VDPAM 6550: Advanced Swine Production Medicine

Credits: 4. Contact Hours: Lecture 4.

Detailed overview of applied techniques used in swine production medicine; production modeling and record analysis, facility design and management, analysis of competing intervention options, design and evaluation of therapeutic and vaccination strategies, quality control procedures and food safety. Course activities include interpretation of diagnostic case reports and development of diagnostic plans for specific disease objectives. Offered odd-numbered years. (Typically Offered: Spring)

VDPAM 6990: Research

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Courses primarily for professional curriculum students:**VDPAM 7308: Spanish for Veterinarians**

Credits: 2. Contact Hours: Lecture 2.

This course is designed to meet the needs of veterinary students who will practice in an environment in which the use of Spanish for accurate client communication is essential which includes much of our food animal industry in the state of Iowa. This is not a traditional Spanish language course. To be successful, students taking the course should have a basic knowledge of Spanish pronunciation, grammar and syntax. (Typically Offered: Spring)

VDPAM 7309: Introduction to Production Animal Informatics

Credits: 1. Contact Hours: Lecture 1.

The fundamentals of how clinical, diagnostic, production and financial information is obtained and used by production animal operations will be presented. Students will acquire skills to create and use spreadsheets for manipulating and summarizing data. They will also acquire knowledge of where to find inexpensive and readily available resources with information on how to use spreadsheets and other software. Students will also have the opportunity to work with record keeping programs used by food animal operations. (Typically Offered: Spring)

VDPAM 7310: Introduction to Production Medicine

Credits: 2. Contact Hours: Lecture 2.

The role of the veterinarian in the management of animal health and production in populations including evaluation tools in dairy and beef cattle herds, beef feedlots and swine herds will be described. Provides veterinary students with a starting point to understand the principles and techniques that are the basis of food-animal population health diagnosis management programs. Course available on-line, attendance is not required. (Typically Offered: Spring)

VDPAM 7312: Introduction to Animal Welfare

Credits: 1. Contact Hours: Lecture 1.

A continuation of the Veterinarian in Society series. The objective of this course is to develop knowledge of the fundamental principles of animal welfare, in terms of science, ethics and cultural components. (Typically Offered: Spring)

VDPAM 7340: Clinical Foundations

Credits: 1. Contact Hours: Laboratory 2.

One week, hands-on course at Iowa State University; introduction to food supply veterinary medicine covering overviews of major animal agriculture species (beef, dairy, swine, small ruminants, and camelid), production systems, behavior, welfare, handling and restraint, examination techniques, biosecurity, epidemiology and food safety. Students will visit farms owned by Iowa State University and private clients of Food Animal and Camelid Field Services to perform hands-on clinical skills. Attendance is mandatory. Biosecurity: All students must follow current college policies regarding animal contact following foreign travel. Additionally, no swine contact is allowed within 48 hours of the swine farm visit. Required equipment includes coveralls, rubber boots, thermometer and stethoscope. (Typically Offered: Spring)

VDPAM 7351: Bovine Embryo Transfer and Related Technology

Credits: 2. Contact Hours: Lecture 2.

This course will meet for two hours once each week of the Spring Semester. The first hour will be traditional lecture and the second hour will be a combination of student projects, labs and demonstrations of applied clinical procedures. Bovine embryo transfer and closely related topics such as: female reproductive physiology, estrus synchronization, semen sexing and reproductive disease will be emphasized. In addition, several class periods will be devoted to the use of ultrasound for diagnosis of reproductive and non-reproductive conditions. (Typically Offered: Spring)

VDPAM 7365: Animal Welfare Judging and Assessment

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Preparation for competition in the Intercollegiate Animal Welfare Judging Contest. Development of critical appraisal and oral communication skills in regard to animal welfare. Animal behavior, physiology, health and performance parameters, basic husbandry, housing and preventive care will be explored for select farmed, companion and exotic species. Optional field trips. Course is open to Vet Med, Undergraduate and Graduate students. (Typically Offered: Fall)

VDPAM 7402A: Advanced Dairy Production Informatics: Lecture Series

Credits: 2. Contact Hours: Lecture 2.

Advanced coverage of concepts related to collection, manipulation, analysis and reporting of information used by dairy farms and their consultants. Hands on experience with Dairy Comp 3050 and PC Dart as well as other dairy management and information software. (Typically Offered: Spring)

VDPAM 7402B: Advanced Dairy Production Informatics: Experience I

Credits: 2. Contact Hours: Lecture 2.

Independent records analysis and reporting of information used by dairy farms and their consultants. Hands on experience with Dairy Comp 3050 and PC Dart. (Typically Offered: Fall, Spring)

VDPAM 7402C: Advanced Dairy Production Informatics: Experience II

Credits: 2. Contact Hours: Lecture 2.

Independent records analysis and reporting of information used by dairy farms and their consultants. Hands on experience with Dairy Comp 3050 and PC Dart. (Typically Offered: Fall, Spring)

VDPAM 7402D: Advanced Dairy Production Informatics: Experience III

Credits: 2. Contact Hours: Lecture 2.

Independent records analysis and reporting of information used by dairy farms and their consultants. Hands on experience with Dairy Comp 3050 and PC Dart. (Typically Offered: Fall, Spring)

VDPAM 7407: Evidence Based Clinical Decision Making

(Dual-listed with VDPAM 5070).

Credits: 1. Contact Hours: Lecture 1.

Discussion, lectures and laboratories to assess the quality and significance of medical evidence in making informed decisions about the treatment of individual animals and animal populations. (Typically Offered: Spring)

VDPAM 7408: Poultry Diseases

(Dual-listed with VDPAM 5080).

Credits: 2. Contact Hours: Lecture 2.

Bacterial, viral, parasitic, and nutritional diseases of domestic poultry and gamebirds; biosecurity, immunization, and management procedures to prevent poultry diseases. This course includes wet labs. Additional assignments required for graduate level credit. (Typically Offered: Spring)

VDPAM 7409: Veterinary Practice Management and Organization

Credits: 2. Contact Hours: Lecture 2.

An A to Z introduction to proven veterinary practice management methods and strategies. The student will follow a detailed hands-on workbook describing most of the processes and procedures of day to day veterinary practice. Class content will be delivered via online modules. (Typically Offered: Fall)

VDPAM 7414: Veterinary Practice Entrepreneurship

(Dual-listed with VDPAM 5140).

Credits: 2-3. Contact Hours: Lecture 3.

Formal exposure to the entrepreneurial and business skills necessary to own and operate a successful veterinary practice or other small business opportunity. Personal finance, marketing, human resource management, general accounting, site assessment, location demographics, practice valuation, and a host of other issues which must be considered when purchasing or starting a new business are covered. Class instruction will be delivered by successful practice and business owners with examples from real world experience. (Typically Offered: Spring)

VDPAM 7416: Bovine Reproduction Evaluation Laboratory

Credits: 1. Contact Hours: Laboratory 4.

Repeatable.

Bovine rectal palpation techniques will be repetitively taught in 7 four-hour sessions. Students will also learn techniques of epidural anesthesia, artificial insemination, pregnancy staging and ultrasonic imaging. University-owned cattle will be used. Spring semester only offered one section. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel. (Typically Offered: Fall, Spring)

VDPAM 7419: Advanced Swine Production Informatics

Credits: 1. Contact Hours: Lecture 1.

Advanced coverage of concepts related to the collection, manipulation, analysis, and reporting of information used by swine production companies. A quick review of modern swine production and measures of productivity ensures students have a firm base for applying the informatics. This course introduces students to one of the most commonly used swine record-keeping systems in the industry and gives them access to actual production data with which to work. Students then learn how to generate and interpret regularly used reports and will use pivot tables and budgeting models in Excel. The importance of data entry and validation and how to transform data into useful knowledge are then addressed. Fundamentals of financial information, cost-benefit analysis and using budgeting models to assess the economics of animal health interventions are then applied. (Typically Offered: Fall)

VDPAM 7420A: Applied Production Animal Medicine Preceptorship: Food Animal Emphasis

Credits: 1-6. Repeatable.

Advanced course in mixed animal production medicine with a food animal emphasis in veterinary practice settings. Requires 40 hours of clinical experience per week. Assignments will be preceptorships with a practicing veterinarian, governmental agency and/or production unit. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel. (Typically Offered: Fall, Spring, Summer)

VDPAM 7420B: Applied Production Animal Medicine Preceptorship: General Mixed Animal Practice

Credits: 1-6. Repeatable.

Advanced course in production animal medicine in general mixed animal veterinary practice settings. Requires forty hours clinical experience per week. Assignments will be preceptorships with a practicing veterinarian, governmental agency and/or production unit. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel. (Typically Offered: Fall, Spring, Summer)

VDPAM 7420C: Applied Production Animal Medicine Preceptorship: Government Agency or Food Processing Company

Credits: 1-6. Repeatable.

Advanced course in production animal medicine with emphasis on government agency or food processing company in veterinary practice settings. Forty hours clinical experience per week. Assignments will be preceptorships with a governmental agency and/or production unit. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel. (Typically Offered: Fall, Spring, Summer)

VDPAM 7420P: Applied Poultry Production Medicine Preceptorship

Credits: 1-6. Repeatable, maximum of 6 credits.

Unique, highly relevant, hands-on veterinary experience for participating students. Development of poultry-specific practice skill sets. Documented experience that is highly valued by future poultry employers. Enhanced cultural and professional awareness for participating students through interaction with active poultry practitioners. Exposure to diverse poultry practice and production environments. (Typically Offered: Fall, Spring, Summer)

VDPAM 7421A: Great Plains Veterinary Educational Center: Calving

Credits: 1.

The Calving Elective provides an opportunity to expand knowledge and experience in all phases of calving management. The program is structured around normal calving operations at USMARC including emergency duties. Activities that take place during the Calving Elective including the diagnosis, treatment, and management of many commonly encountered conditions in the dam and calf, necropsies, and daily discussions. Participation in a caesarian section is not guaranteed. Student must be able to provide own transportation to each site. (Typically Offered: Spring)

VDPAM 7421B: Great Plains Veterinary Educational Center: Bull Breeding Soundness

Credits: 1.

The Bull Breeding Soundness Examination Elective involves training in all phases of the bull fertility examination as recommended by the Society for Theriogenology. Chuteside, hand-on experience is the primary training technique for this elective with informal discussions held during the performance of breeding soundness examinations on 350 or more bulls. Student must be able to provide own transportation to each site. (Typically Offered: Spring)

VDPAM 7421D: Great Plains Veterinary Educational Center: Feedlot Management

Credits: 1.

Evaluation of production techniques and production efficiency including ration and feeding management, health management program development and evaluation, environmental management, quality assurance and field necropsy techniques. Exposure to marketing and economic considerations in feed yard decision making. A strong emphasis on population medicine, trouble shooting and problem-solving skills in the beef industry, with exposure to harvest/food safety considerations. Discussions on pharmaceutical and feed additive usage and legal implications in food supply veterinary medicine. Student must be able to provide own transportation to each site. (Typically Offered: Fall, Summer)

VDPAM 7421E: Great Plains Veterinary Educational Center: Calf Weaning Management

Credits: 1.

This is a hands-on elective in which students participate in the weaning management at the USMARC. Students will be involved with processing, feeding, finding, and treating sick calves. Additionally, students will be introduced to developing weaning rations and managing feed delivery. Students will also learn how to develop vaccination and treatment protocols and each student will have as an objective the development of their own vaccination and treatment protocol template. As time allows, students will visit commercial feed yards and cover production management topics. Student must be able to provide own transportation to each site. (Typically Offered: Fall)

VDPAM 7421F: Great Plains Veterinary Educational Center: Pregnancy Examination

Credits: 1.

The Pregnancy Examination Elective involves rectal examinations for pregnancy, chuteside data collection and data entry into a computer software program to evaluate the reproductive performance of the herd. This elective is designed for students who have some palpation experience and are interested in honing their skills. Pregnancy Examination occurs during yearly fall herd work at the USMARC, therefore, speed and accuracy will be stressed, rather than basic technique. Student must be able to provide own transportation to each site. (Typically Offered: Fall)

VDPAM 7421J: Great Plains Veterinary Educational Center: Lambing

Credits: 1.

The Lambing Elective involves students working with the USMARC lambing crew and GPVEC faculty in observations, assistance with delivery when necessary, and routine lambing duties. Students will work with veterinary personnel in sheep necropsy and health surveillance. Self-study material will be provided covering topics such as pre-breeding and breeding, pregnancy diagnosis, pregnant ewe management, pre-lambing ewe/lambing management, feeder lamb health and nutrition management, and replacement ewe and ram management. Student must be able to provide own transportation to each site. (Typically Offered: Spring)

VDPAM 7421K: Great Plains Veterinary Educational Center: Equine Dentistry

Credits: 1.

The Equine Dentistry Elective provides the opportunity for students to expand their knowledge and experience related to equine dentistry. The rotation consists of lectures on topics relevant to equine dental care and hands-on laboratories during which students practice routine dental care procedures on USMARC horses. Equine Dentistry will involve both lecture and lab time at about equal shares. Student must be able to provide own transportation to each site. (Typically Offered: Spring)

VDPAM 7421P: Great Plains Veterinary Educational Center: Bovine Surgery

Credits: 1.

The Bovine Surgery Elective is designed to give students interested in food animal surgery an opportunity to practice their surgical skills by performing penile translocations and epididymectomies on USMARC teaser bull candidates. Lectures specific to gomer bull surgery as well as other topics related to food animal surgery will be presented during this elective. Student must be able to provide own transportation to each site. (Typically Offered: Fall)

VDPAM 7421Q: Great Plains Veterinary Educational Center: Swine Husbandry

Credits: 1.

This elective provides students the opportunity to gain hands-on experience related to the daily activities of an intensively managed confinement swine unit. Rotation participants will work closely with USMARC Swine Unit personnel as they complete their daily routines in the farrowing and breeding areas of the USMARC Swine Unit and will participate in piglet delivery, neonatal pig processing, artificial and natural breeding, necropsies, and other activities as they arise. Student must be able to provide own transportation to each site. (Typically Offered: Fall, Spring)

VDPAM 7421R: Great Plains Veterinary Educational Center: Lamb Weaning Management

Credits: 1.

This elective provides the opportunity for students to develop their skills in the area of health and nutritional management of sheep immediately before and after weaning. The rotation consists of lectures on pre- and post-weaning nutrition, clinical parasitology, and prevention and control of common ovine infectious diseases. Hands-on experience during the week will take place at the USMARC Sheep Unit and will consist of walk-through and hand-on examinations of recently weaned lambs, treatment of sick lambs, inspection of weaning pen environment, investigation of herd outbreaks, and post mortem examination of all sheep mortalities. Student must be able to provide own transportation to each site. (Typically Offered: Summer)

VDPAM 7421S: Great Plains Veterinary Educational Center: Ultrasound Pregnancy Examination

Credits: 1.

The Ultrasound Pregnancy Examination Elective involves transrectal ultrasonographic examinations for pregnancy, chuteside data collection and data entry into a computer software program to evaluate the reproductive performance of the herd. This elective is designed for students who have some ultrasound experience and are interested in honing their skills. This elective occurs during yearly fall herd work at the USMARC, therefore, speed and accuracy will be stressed, rather than basic technique. Didactic instruction may include several topics in cow herd health, nutrition, management and reproductive decision making. Student must be able to provide own transportation to each site. (Typically Offered: Summer)

VDPAM 7421T: Great Plains Veterinary Educational Center: Food Animal Clinical Care and Treatment (FACCT)

Credits: 1.

This course is designed to achieve hands-on and critical thinking skills necessary to provide clinical care to cattle and sheep. Student needs will be met through structured discussions and accompanying the veterinarians in daily care of the animals at USMARC. Student must be able to provide own transportation to each site. (Typically Offered: Fall, Spring)

VDPAM 7421U: Great Plains Veterinary Educational Center: Necropsy and Diagnostic Investigations

Credits: 1.

This course is designed to develop diagnostic and critical thinking skills necessary to investigate disease outbreaks in a herd health setting. Student needs will be met through daily necropsy procedures, in depth discussions of case examples, and thorough exposure to diagnostic tests and sampling procedures. Student must be able to provide own transportation to each site. (Typically Offered: Fall, Spring)

VDPAM 7422: Beef Cattle Calving

Credits: 2. Repeatable.

This elective provides students opportunity to assist cow-calf operations with calving in Nebraska, South Dakota or other locations. These operations typically calve 300-1,000 head each spring. Calving experience is not required, but a good understanding of working around cattle is necessary. Students will be actively participating in the day to day, normal calving routine including detecting and sorting off 'springers', calf 'watch', detecting when intervention is needed and assisting delivery, caring for and monitoring newborns and dams for good health and early disease detection, tagging/processing new calves, treating calves needing intervention and performing other routine calving chores. Students need to provide their own transportation to the site and overnight stays at or near the production sites are required. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel. (Typically Offered: Fall, Spring, Summer)

VDPAM 7424: Preceptorship in Diagnostic Pathology.

Credits: 1-6. Repeatable.

Advanced course in production animal medicine with emphasis on gross and diagnostic pathology. Forty hours clinical experience per week. Assignments will be preceptorships with a diagnostic laboratory, veterinary pathologist, governmental agency and/or production unit. Biosecurity policies require documentation of student's presence in the USA 5 days immediately prior to the start of class. (Typically Offered: Fall, Spring)

VDPAM 7426: Veterinary Toxicology

Credits: 3. Contact Hours: Lecture 3.

Study of toxicological diseases of animals emphasizing clinical recognition, circumstances of poisoning, differential diagnosis with clinical and laboratory data, therapeutic procedures, preventive management and public health implications. Supplemented with case-based materials. (Typically Offered: Spring)

VDPAM 7436A: Beef Records Analysis: Introduction

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Lectures will emphasize current production and evaluation techniques for beef cow/calf operations and students will learn to conduct and critically assess production and financial data using a standardized approach. Lab activities will allow students an opportunity to become Beef Quality Assurance (BQA) certified through the Iowa Beef Center. (Typically Offered: Fall)

VDPAM 7436B: Beef Records Analysis: Herd Management

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Lectures will emphasize current production and evaluation techniques for beef cow/calf operations and students will learn to conduct and critically assess production and financial data using a standardized approach. Lab activities will allow students an opportunity to work with individual beef cattle producers to identify areas for improving profitability, health, and sustainability. (Typically Offered: Spring)

VDPAM 7436C: Beef Records Analysis: Cow/Calf Preventive Medicine

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Lectures will emphasize current production and evaluation techniques for beef cow/calf operations and students will learn to conduct and critically assess production and financial data using a standardized approach. Emphasis will be on obtaining a better understanding of nutritional and reproductive management of cow herds. Lab activities will allow students an opportunity to work with individual beef cattle producers to identify areas for improving profitability, health, and sustainability. (Typically Offered: Fall)

VDPAM 7436D: Beef Records Analysis: Feedlot Production Medicine

Credits: 1. Contact Hours: Laboratory 2.

Repeatable.

Lectures will emphasize current production and evaluation techniques for feedlot production and students will develop a standard treatment protocol book. Topics include respiratory disease, receiving programs, nutrition, cattle handling and environmental issues. (Typically Offered: Spring)

VDPAM 7445: Production Animal Clinical Medicine

Credits: 3. Contact Hours: Lecture 3.

Clinical diagnosis and treatment of diseases of swine, beef and dairy cattle, and small ruminants. (Typically Offered: Spring)

VDPAM 7450: Disturbances of Reproduction

Credits: 4. Contact Hours: Lecture 4.

Repeatable.

General principles of normal reproductive functions in addition to environment, management and diseases causing disturbances in reproduction. Cattle, Swine, Equine, Small Ruminant, and Small Animal species will be covered. (Typically Offered: Fall)

VDPAM 7451: Clinical Embryo Transfer

Credits: 2. Contact Hours: Laboratory 4.

Repeatable.

Elective clinical assignment in techniques of embryo transfer. Primary species studied will be bovine but equine and small ruminant embryo transfer will be covered during discussions. Enrollment is limited to four students per two week session. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel. (Typically Offered: Fall, Spring, Summer)

VDPAM 7455: Diagnostic Laboratory Practicum

Credits: 1. Contact Hours: Laboratory 2.

Repeatable.

Prereq: VDPAM 7310

Practical experience and training in necropsy, recognition of gross lesions, diagnostic sample collection and test selection for the diagnosis of infectious, toxic, nutritional and metabolic diseases through exposure to diagnostic cases submitted to the ISU Veterinary Diagnostic Laboratory. The VDL accepts cases from all species; however, this course predominantly consists of porcine and bovine cases. (Typically Offered: Fall, Spring)

VDPAM 7456: Veterinary Diagnostic Lab Methods & Applications

Credits: 1. Contact Hours: Lecture 1.

An introduction to diagnostic medicine including strengths and weaknesses of various testing technologies, how to choose appropriate tests and technologies, sampling strategies in diseased and non-diseased populations and interpretation and integration of results of tests to achieve an accurate diagnosis are discussed. (Typically Offered: Fall)

VDPAM 7463: Feedlot Production Medicine

Credits: 1.

One-week VM4 elective focusing on Midwestern feedlot production. Addresses feedlot production practices common to Iowa and surrounding states, including feeding cattle on concrete or under roofs. Activities include participation and visitation to representative feedlots in Iowa. (Typically Offered: Spring)

VDPAM 7465: Animal Welfare Clinical Rotation

Credits: 2.

Two-week course for senior veterinary students to gain skills for collecting and interpreting animal welfare data, aid clients with identifying and achieving welfare goals, and assisting law enforcement with animal cruelty response. Field trips to food animal and companion animal facilities are mandatory. (Typically Offered: Fall, Summer)

VDPAM 7466X: Preceptorship in Animal Welfare

Credits: 1-6. Repeatable.

Preceptorship in animal behavior and welfare with emphasis on animal behavior and/or welfare assessment, problem solving, interventions to treat and prevent animal behavior and/or welfare cases. Mentors include practicing veterinarians, professionals consulting on animal behavior and welfare, and/or animal welfare organizations. Biosecurity: all students must follow current College of Veterinary Medicine policies regarding animal contact following foreign travel. (Typically Offered: Fall, Spring, Summer)

VDPAM 7471C: Animal Reproduction: Comparative

Credits: 2. Repeatable, maximum of 4 credits.

Elective comparative clinical assignment in Theriogenology with caseload management in Food Animal, Equine, Small Animal and Small Ruminants sections. Rotation through these different sections will depend on the caseload (by species) and include routine breeding management, semen collection and cryopreservation in different species, advanced laparoscopic and non-surgical procedures for insemination and embryo flushing/transfer, pregnancy diagnosis as well as management of reproductive emergencies. (Typically Offered: Fall, Summer)

VDPAM 7471E: Animal Reproduction: Equine Reproduction

Credits: 2. Repeatable, maximum of 4 credits.

Elective clinical assignment in Equine Theriogenology involving both mare and stallion breeding management, cool-shipped semen preparation and semen cryopreservation, embryo transfer, foaling of high-risk pregnant mares as well as normal mares, breeding soundness exams of the mare and stallion, treatment of retained fetal membranes and neonatal care. (Typically Offered: Spring, Summer)

VDPAM 7471F: Animal Reproduction: Food Animal Reproduction

Credits: 2. Repeatable, maximum of 4 credits.

Elective clinical assignment in Food Animal Theriogenology involving male and female breeding soundness exams, dystocia management, advanced diagnostic and surgical procedures, surgical and non-surgical insemination programs in small ruminants, and semen cryopreservation. Medical and surgical correction of reproductive disorders in cattle, swine and small ruminants. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel. (Typically Offered: Spring, Summer)

VDPAM 7471S: Animal Reproduction: Small Animal Reproduction

Credits: 2. Repeatable, maximum of 4 credits.

Primary reproductive management in the canine and feline involving breeding management of the bitch and stud dog, advanced surgical and non-surgical insemination using fresh, cooled or frozen semen, and infertility case management for the male and female. High risk pregnancy management, parturition and neonatal care of both canine and felines, as required. (Typically Offered: Fall, Spring, Summer)

VDPAM 7476: Food Animal and Camelid Field Service

Credits: 1-2. Contact Hours: Laboratory 4.

Repeatable.

Prereq: VDPAM 7310

Students will assist university veterinarians in delivering individual animal health care and herd-based production management services to the ISU livestock farms and other livestock farms in the local area. Focus on the establishment of best practices for herd management of production systems at the university and in the region. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel. (Typically Offered: Fall, Spring, Summer)

VDPAM 7477: Food Animal and Camelid Medicine and Surgery

Credits: 2. Contact Hours: Laboratory 4.

Repeatable.

Clinical assignment focused on the management of food animal and camelid medicine and surgery cases. Specific instruction in clinical evaluation of cases coupled with appropriate diagnostic testing and therapeutic intervention will be emphasized. Additional instruction will be provided in disease prevention, intensive care and management of food animal and camelid species. Particular emphasis will be placed on appropriate on-label and extra-label drug usage in food animal species. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel. (Typically Offered: Fall, Spring, Summer)

VDPAM 7478A: Swine Medicine Education Center: Swine Production Management and Consultation

Credits: 2. Repeatable.

Swine production management and consulting skills within a progressive swine production and management system. Time will be split approximately with half in-class discussion topics of finance and business of the swine industry and half on-farm learning opportunities where students will visit a breeding farm, nursery facility, finishing facility, wean-to-finish facility, gilt developer unit, and a truck wash facility. (Typically Offered: Fall, Spring)

VDPAM 7478B: Drug, Vaccination, and Treatment Management for Swine

Credits: 2. Repeatable.

Basic and applied information on swine treatment options, strategies to maximize efficacy, and skills to pursue judicious use of antimicrobials, reproductive interventions, and the entire spectrum of drug therapies. The course emphasizes case based application and decisions and is approximately 30% web-based and 70% on-site including farms of a variety of structures and functions. During the course, students prepare a thorough evaluation of the pharmacologic interventions that may occur on farms and then implement this evaluation in active production facilities to maximize efficacy, compliance and animal welfare as part of a comprehensive judicious use objective. (Typically Offered: Spring, Summer)

VDPAM 7478C: Swine Medicine Education Center: Swine Emerging Diseases and Emergency Response Management

Credits: 2. Repeatable.

Diagnostic tests, methods, approaches, analysis, and evaluation of emerging swine diseases and provide general knowledge of disease elimination and methods to manage herd losses and economic losses due to disease. Two-week, on-site module that combines structured site visits and classroom activities. (Typically Offered: Fall, Spring)

VDPAM 7479: Applied Swine Production Medicine Preceptorship

Credits: 1-6. Contact Hours: Laboratory 12.
Repeatable.

Preceptorship course in swine production medicine with emphasis on herd management, production analysis, and problem solving. Forty hours clinical experience per week. Assignments will be preceptorships with a practicing veterinarian and/or a production unit. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel. (Typically Offered: Fall, Spring, Summer)

VDPAM 7480: Swine Medicine

Credits: 2. Contact Hours: Lecture 1, Laboratory 2.
Repeatable.

Two week clinical rotation in swine production medicine. Students will be assigned to take the lead in investigating field based client cases with supervision of the instructors. Development of critical thinking skills that will allow students to apply concepts of herd management, production analysis, economic analysis, and disease prevention in addressing client cases. Variable amounts of travel to farm sites will be required with the potential for rare overnight stays. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel. (Typically Offered: Fall, Spring, Summer)

VDPAM 7481: Advanced Cow/Calf Production Medicine

(Dual-listed with VDPAM 5810).

Credits: 2. Contact Hours: Lecture 1.5, Laboratory 1.5.

Two-week senior elective that will focus on the economics of animal disease in cow/calf operations. Evidence based medicine and epidemiological principles will be used in investigation of disease outbreaks. Extensive partial budgeting used. Students will complete at least two disease investigations involving outbreaks in commercial cow/calf operations and communicate their findings to the class, the herd owner, and local practitioner. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel. (Typically Offered: Spring)

VDPAM 7482: Applied Beef Production Medicine Preceptorship

Credits: 1-6. Repeatable.

Advanced course in beef production medicine with emphasis on herd management, production analysis, and problem solving. Forty hours clinical experience per week. Assignments will include preceptorships with a practicing veterinarian and/or a production unit. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel. (Typically Offered: Fall, Spring, Summer)

VDPAM 7483: Beef Production Medicine

Credits: 2. Contact Hours: Lecture 1, Laboratory 2.

Two week advanced clinical rotation in beef production medicine. Fifteen hours recitation/discussion and 20 hours clinical experience per week. This course is designed to expose students to cow-calf and feedlot production concepts. The activities scheduled for the rotation depend greatly on the time of year. Whenever possible, the class incorporates field trips to better understand how commercial cow/calf and feedlots operate and the veterinarian's role in their management. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel. (Typically Offered: Fall)

VDPAM 7484: Dairy Production Medicine

Credits: 2. Contact Hours: Lecture 1, Laboratory 2.

Two week course in dairy production medicine combining class time with multiple on-farm visits to learn various management aspects (DHIA, DC305 & PC Dart record analysis, calf rearing through lactating cows, reproduction programs, udder health and milk quality, biosecurity, welfare, nutrition and cow comfort) for a wide variety of dairy operations. Students will learn the latest in dairy management by reviewing current topic articles and gain experience in farm evaluation through a group project. Fifteen hours recitation/discussion and 20 hours clinical experience per week. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel. (Typically Offered: Fall, Summer)

VDPAM 7485: Applied Dairy Production Medicine Preceptorship

Credits: 1-6. Contact Hours: Laboratory 12.

Repeatable.

Advanced course in dairy production medicine with emphasis on herd management, production analysis, and problem solving. Forty hours clinical experience per week. Assignments will include preceptorships with a practicing veterinarian and/or a production unit. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel. (Typically Offered: Fall, Spring, Summer)

VDPAM 7486: Introduction to Small Ruminant Production Medicine

Credits: 1. Contact Hours: Lecture 1.

Survey of small ruminant production systems, common management practices, and disease processes of small ruminants and camelids. This course is intended to give the student a background in small ruminant medicine. Herd health, disease monitoring and prevention, nutrition, and typical management systems will be emphasized in lecture. (Typically Offered: Spring)

VDPAM 7488: Laboratory in Clinical Microbiology

Credits: 1. Contact Hours: Laboratory 3.

Repeatable.

Prereq: VDPAM 7310

Application of microbiological procedures to the diagnosis of infectious diseases. (Typically Offered: Fall, Spring)

VDPAM 7490: Independent Study

Credits: 1-5. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

VDPAM 7491: Advanced Ruminant Nutrition

Credits: 2. Contact Hours: Lecture 2.6, Laboratory 0.8.

Focus on dairy nutrition and balancing rations from the calf to the adult, lactating cow. Introduction to different feedstuffs and forage varieties to determine those that are best suited to bovine diets. This course starts the week immediately prior to the start of the fall semester and continues throughout the fall semester. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel. (Typically Offered: Fall)

VDPAM 7494: Advanced Dairy Production Medicine

Credits: 2. Contact Hours: Lecture 1.3, Laboratory 1.3.

Advanced course in investigating dairy herd problems relating to milk quality or nutrition. Milk quality and nutrition troubleshooting will be taught through the combination of lecture and on-farm investigations. Students will combine lecture knowledge, data acquired from on-farm investigations and record analysis to generate management plans. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel. (Typically Offered: Spring)

VDPAM 7495: Advanced Small Ruminant Production Medicine

Credits: 2. Contact Hours: Laboratory 4.

Two week clinical rotation in small ruminant production medicine. Field trips (including overnight stays) will be incorporated when possible. Topics to be covered include small ruminant industries (milk, meat, and fiber), milk quality, nutrition, reproduction, and disease management of small ruminants. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel. (Typically Offered: Fall, Spring)

VDPAM 7496: International Experience

(Dual-listed with VDPAM 5960).

Credits: 1-12. Repeatable.

International Preceptorships and Study Abroad Group programs. Opportunities for students to be involved in applied clinical, production, and/or research experiences in international locations. The course consists of 40 hour per week experiential learning opportunities. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

VDPAM 7498: Poultry Medicine

Credits: 2.

Two-week senior elective to introduce students into poultry production medicine in the Midwest. Students will participate in routine flock monitoring, biosecurity reviews, disease investigations involving outbreaks in commercial and backyard poultry operations, and have a basic understanding of the poultry industry and poultry diseases. Involves didactic lectures in the classroom, field trips to poultry farms, and necropsies. (Typically Offered: Summer)

Veterinary Microbiology and Preventive Medicine

Professional Program of Study

For the professional curriculum in veterinary medicine leading to the degree doctor of veterinary medicine, see Veterinary Medicine, Curriculum.

The Department of Veterinary Microbiology and Preventive Medicine provides instruction on pathogenic bacteria, fungi, and viruses and their interaction with host animal species. Principles and applications of infectious diseases, immunity to disease, diagnostic methods for infectious diseases, and vaccinology are covered. Principles and applications of epidemiology, public health, preventive veterinary medicine, regulatory veterinary medicine and food safety are also emphasized.

Graduate Study

The department offers opportunities for the degree doctor of philosophy with a major in veterinary microbiology. A specialization in preventive medicine is an option for this degree. Graduates in the Veterinary Microbiology and Preventive Medicine programs have a broad understanding of the fundamental processes involved in infectious diseases, pathogenesis and immunology. They are able to effectively establish research programs, which involve complex biological systems and disease syndromes. They are also prepared to address microbial-based social, ethical and environmental problems. Graduates acquire effective written and oral communication skills which lead to successful research and teaching careers in the medical and veterinary sciences. The department also offers work towards the master of science with majors in veterinary microbiology or veterinary preventive medicine. A non-thesis master's option is available for majors in preventive medicine. Courses are open for students majoring in other graduate programs.

Prerequisite to graduate study is completion of coursework in general microbiology, biology, biochemistry, mathematical sciences, and physics. Candidates for the majors in veterinary microbiology should possess an undergraduate degree in biomedical science with emphasis in medical microbiology or the D.V.M. degree. Candidates for the major in preventive medicine should possess the D.V.M. degree.

The department also participates in the interdepartmental majors and programs in genetics, immunobiology, and MCDB (molecular, cellular, and developmental biology; see Index).

Each graduate student must demonstrate proficiency in English composition within two semesters in residence.

Courses primarily for undergraduates:

VMPM 3300: Global Health Disparities

(Cross-listed with GLOBE 3300).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior classification

Historical and contemporary factors contributing to disparities in health outcomes for persons disadvantaged by income, location, ethnicity, sexual orientation, and abilities. Analysis and evaluation of health promotional materials, such as campaigns, and community-based interventions focused on reducing global health disparities. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Spring)

VMPM 3600: Global Health

(Cross-listed with GLOBE 3600/ MICRO 3600).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2110

Explores human health across the world with particular emphasis on low- and lower-middle-income countries. Attention is given to the interconnectedness of health determinants, problems, and solutions found in global health, including the role of animals and the environment. Broad in scope, highlighting different cultures and the historical foundations of global health. Topics include colonialism, poverty, emerging diseases, climate change, biodiversity, one health, maternal and child health, HIV, malaria, urbanization, noncommunicable diseases and more. Current events will be a feature of all class meetings. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

VMPM 4280: Principles of Epidemiology and Population Health

(Dual-listed with VDPAM 5280/ VMPM 5280). (Cross-listed with MICRO 4280/ VDPAM 4280).

Credits: 3. Contact Hours: Lecture 3.

Epidemiology of disease in populations. Disease causality, observational study design and approaches to epidemiologic investigations. This course is available on campus and by distance. (Typically Offered: Spring)

VMPM 4500X: Introduction to a Research Career in Industry

(Cross-listed with BMS 4500X).

Credits: 1. Contact Hours: Lecture 2.

Explores research career paths in industry. Course will discuss ways students can prepare competitive applications and skill sets necessary for success. Concepts of regulatory constraints, quality management systems and intellectual property will also be introduced. Material will be presented by industry associates and leaders. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

Courses primarily for graduate students, open to qualified undergraduates:

VMPM 5010: Basic Principles of Microbiology

Credits: 3. Contact Hours: Lecture 3.

Prereq: Biomedical Science Graduate Student or Permission of Instructor

The general principles of bacteriology, immunology and virology will be discussed. The structure and function of bacteria and viruses, the mechanisms of pathogenesis, and the host response to infectious agents will be reviewed. Vaccines, their failures, and new developments in vaccine development will be explored. (Typically Offered: Fall)

VMPM 5020: Microbial Genetics and Genomics

(Dual-listed with MICRO 4020/ GEN 4020). (Cross-listed with MICRO 5020).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (BIOL 3130 and MICRO 3020) or Graduate Classification

The fundamental concepts of bacterial and bacteriophage genetics including mutagenesis, mechanisms of vertical and horizontal genetic information transfer and gene regulation are covered, along with genetic and genomic-based approaches to study these and other cellular processes of microorganisms. Review and discussion of research literature to examine experimental design, methodology, and interpretation of both historical and contemporary relevance to microbial genetics and genomics. Offered even-numbered years. (Typically Offered: Fall)

VMPM 5170: Gut Microbiome: Implications for Health and Diseases

(Cross-listed with ANS 5170/ MICRO 5170/ FSHN 5170).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 2-3 credits in microbiology and/or immunology.

Explore current research on gut microbiome including modern tools used to study the gut microbiome. Examine the linkages between gut microbiome and health status, diseases, and manipulation of gut microbiome to improve health. (Typically Offered: Fall)

VMPM 5200: Principles of Immunology

Credits: 3. Contact Hours: Lecture 3.

Prereq: MICRO 3100 or Permission of Instructor

Nature of the immune system and its role in health and disease.

Graduation Restriction: Credit for either VMPM 5200 or 5750, but not both may be applied toward graduation. (Typically Offered: Fall)

VMPM 5250: Intestinal Microbiology

(Cross-listed with MICRO 5250).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Overview of commensal microbiota in the health and well-being of vertebrates. Topics include diversity of intestinal structure, microbial diversity/function, innate immune development, community interactions and metabolic diseases associated with alterations of the intestinal microbiome. Offered even-numbered years. (Typically Offered: Spring)

VMPM 5280: Principles of Epidemiology and Population Health

(Dual-listed with VDPAM 4280/ VMPM 4280/ MICRO 4280). (Cross-listed with VDPAM 5280).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Epidemiology of disease in populations. Disease causality, observational study design and approaches to epidemiologic investigations. This course is available on campus and by distance. (Typically Offered: Spring)

VMPM 5360: Zoonoses and Environmental Health

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Pathogenesis and control of zoonotic diseases. Factors influencing transmission and survival of pathogenic microorganisms in the environment. Offered odd-numbered years. (Typically Offered: Spring)

VMPM 5400: Livestock Immunogenetics

(Cross-listed with MICRO 5400/ ANS 5400).

Credits: 2. Contact Hours: Lecture 2.

Prereq: ANS 5610 or MICRO 5750 or VMPM 5200 or Graduate Classification

Basic concepts and contemporary topics in genetic regulation of livestock immune response and disease resistance. Offered odd-numbered years. (Typically Offered: Spring)

VMPM 5420A: Introduction to Molecular Biology Techniques: DNA Techniques

(Cross-listed with BMS 5420A/ EEOB 5420A/ FSHN 5420A/ GDCB 5420A/ HORT 5420A/ NREM 5420A/ NUTRS 5420A/ VDPAM 5420A/ BBMB 5420A).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes genetic engineering procedures, sequencing, PCR, and genotyping. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

VMPM 5420C: Introduction to Molecular Biology Techniques: Cell Techniques

(Cross-listed with BMS 5420C/ EEOB 5420C/ FSHN 5420C/ GDCB 5420C/ HORT 5420C/ NREM 5420C/ NUTRS 5420C/ BBMB 5420C/ VDPAM 5420C).

Credits: 1. Contact Hours: Laboratory 2.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. ular biology techniques and related procedures. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

VMPM 5420D: Introduction to Molecular Biology Techniques: Plant Transformation

(Cross-listed with BMS 5420D/ EEOB 5420D/ FSHN 5420D/ GDCB 5420D/ HORT 5420D/ NREM 5420D/ NUTRS 5420D/ BBMB 5420D/ VDPAM 5420D).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.
Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: Agrobacterium and particle gun-mediated transformation of tobacco, Arabidopsis, and maize, and analysis of transformants. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

VMPM 5420E: Introduction to Molecular Biology Techniques: Proteomics

(Cross-listed with BMS 5420E/ EEOB 5420E/ FSHN 5420E/ GDCB 5420E/ HORT 5420E/ NREM 5420E/ NUTRS 5420E/ BBMB 5420E/ VDPAM 5420E).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.
Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: two-dimensional electrophoresis, laser scanning, mass spectrometry, and database searching. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

VMPM 5420F: Introduction to Molecular Biology Techniques: Metabolomics

(Cross-listed with BMS 5420F/ EEOB 5420F/ FSHN 5420F/ GDCB 5420F/ HORT 5420F/ NREM 5420F/ NUTRS 5420F/ BBMB 5420F/ VDPAM 5420F).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.
Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: metabolomics and the techniques involved in metabolite profiling. For non-chemistry majoring students who are seeking analytical aspects into their biological research projects. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

VMPM 5420G: Introduction to Molecular Biology Techniques: Genomic

(Cross-listed with BMS 5420G/ EEOB 5420G/ FSHN 5420G/ GDCB 5420G/ HORT 5420G/ NREM 5420G/ NUTRS 5420G/ BBMB 5420G/ VDPAM 5420G).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.
Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

VMPM 5500X: Introduction to a Research Career in Industry

(Dual-listed with BMS 4500/ VMPM 4500). (Cross-listed with BMS 5500X).

Credits: 1. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Explores research career paths in industry. Course will discuss ways students can prepare competitive applications and skill sets necessary for success. Concepts of regulatory constraints, quality management systems and intellectual property will also be introduced. Material will be presented by industry associates and leaders. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

VMPM 5750: Immunology

(Dual-listed with MICRO 4750). (Cross-listed with MICRO 5750).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MICRO 3100 or Graduate Classification

An examination of humoral and cellular immune function as well as the interaction of the cells and factors of the immune system that result in health and disease. MICRO 4750L optional. Graduation Restriction: Credit for either MICRO 4750 or VMPM 5200, but not both, may be applied to graduation. (Typically Offered: Spring)

VMPM 5860: Medical Bacteriology

(Cross-listed with MICRO 5860).

Credits: 4. Contact Hours: Lecture 4.

Prereq: MICRO 3100 or Graduate Classification

Bacteria associated with diseases of vertebrates, including virulence factors and interaction of host responses. Concurrent students need to register for 5860L. (Typically Offered: Fall)

VMPM 5860L: Medical Bacteriology Laboratory

Credits: 2. Contact Hours: Laboratory 6.

Prereq: Graduate Standing or Permission of Instructor

Laboratory in clinical bacteriology and mycology. Credit or enrollment in VMPM 5860 or VMPM 6250. (Typically Offered: Fall)

VMPM 5870: Animal Virology

Credits: 4. Contact Hours: Lecture 4.

Prereq: Instructor Permission for Course

Principles of animal virology. Biology of viruses associated with diseases of veterinary importance, including mechanisms of pathogenesis. (Typically Offered: Spring)

VMPM 5900: Special Topics

Credits: 1-5. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

VMPM 5990: Creative Component

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

A written report based on laboratory research, library reading, or topics related to the student's area of specialization and approved by the student's advisory committee. (Typically Offered: Fall, Spring, Summer)

Courses for graduate students:

VMPM 6040: Seminar

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

VMPM 6080: Molecular Virology

(Cross-listed with MICRO 6080/ PLP 6080).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BBMB 4050 or GDCB 5110

Advanced study of virus host-cell interactions. Molecular mechanisms of viral replication and pathogenesis. Offered even-numbered years. (Typically Offered: Fall)

VMPM 6150: Molecular Immunology

(Cross-listed with MICRO 6150/ BBMB 6150).

Credits: 3. Contact Hours: Lecture 3.

Current topics in molecular aspects of immunology: T and B cell receptors; major histocompatibility complex; antibody structure; immunosuppressive drugs and viruses; and intracellular signaling pathways leading to expression of genes that control and activate immune function. Offered odd-numbered years. (Typically Offered: Fall)

VMPM 6250: Mechanisms of Bacterial Pathogenesis

(Cross-listed with MICRO 6250).

Credits: 3. Contact Hours: Lecture 3.

Review of current concepts in specific areas of microbial pathogenesis including the genetic basis for bacterial disease, genetic regulation and control of virulence factors and their mechanisms of action, and host-pathogen interactions at the cellular and molecular levels. The application of microbial genetics to understanding pathogenesis will be included. Offered odd-numbered years. (Typically Offered: Spring)

VMPM 6290: Advanced Topics in Cellular Immunology

Credits: 2. Contact Hours: Lecture 2.

Prereq: VMPM 5200 or VMPM 5750

Current topics and literature in cellular immunology. Topics include thymocyte development and selection, T cell interactions with antigen presenting cells, and lymphocyte effector functions. Offered even-numbered years. (Typically Offered: Spring)

VMPM 6600: Pathogenesis of Persistent Infections

(Cross-listed with VPTH 6600).

Credits: 2. Contact Hours: Lecture 2.

Study of current knowledge related to host pathogen interactions during persistent and chronic infections by bacteria, viruses and parasites. Offered odd-numbered years. (Typically Offered: Spring)

VMPM 6900A: Current Topics: Immunology

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Instructor Permission for Course

Colloquia or advanced study of specific topics in a specialized field. (Typically Offered: Fall, Spring, Summer)

VMPM 6900B: Current Topics: Infectious Diseases

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Instructor Permission for Course

Colloquia or advanced study of specific topics in a specialized field. (Typically Offered: Fall, Spring, Summer)

VMPM 6980: Seminar in Molecular, Cellular, and Developmental Biology

(Cross-listed with BBMB 6980/ GDCB 6980/ MICRO 6980/ MCDB 6980).

Credits: 1-2. Contact Hours: Lecture 2.

Repeatable.

Student and faculty presentations. (Typically Offered: Spring)

VMPM 6990: Research

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

Courses primarily for professional curriculum students:

VMPM 7378: Case Study IV

Credits: 2. Contact Hours: Lecture 2.

Case-based applied learning that relates to the basic science courses. Emphasis on early integration of basic and clinical science concepts. (Typically Offered: Spring)

VMPM 7380: Veterinary Immunology

Credits: 2. Contact Hours: Lecture 2.

Structure and function of the immune system in animals. (Typically Offered: Spring)

VMPM 7386: Veterinary Microbiology

Credits: 5. Contact Hours: Lecture 3, Laboratory 5.

Bacteria and fungi of veterinary importance with emphasis on mechanisms of disease production and laboratory diagnostic procedures. (Typically Offered: Fall)

VMPM 7387: Veterinary Virology

Credits: 3. Contact Hours: Lecture 3.

Basic principles of animal virology. Pathogenesis of viral infections. The nature and ecology of viruses of veterinary and zoonotic importance. (Typically Offered: Spring)

VMPM 7388: Public Health and the Role of the Veterinary Profession

Credits: 3. Contact Hours: Lecture 3.

Fundamental epidemiology, zoonotic diseases, occupational health, food safety, other public health topics. (Typically Offered: Spring)

VMPM 7390: Topics in Veterinary History

Credits: 1. Contact Hours: Lecture 1.

An overview of the history of veterinary medicine focused primarily on disease-specific events. A review of the historical aspects of the veterinary profession's accomplishments in the discovery of the etiological origins of disease and their subsequent control will provide students with insights that are applicable to understanding and solving today's animal and human health challenges. (Typically Offered: Fall, Spring)

VMPM 7437: Infectious Diseases and Preventive Medicine

Credits: 3. Contact Hours: Lecture 3.

Etiology, epidemiology, laboratory diagnosis, regulatory control and preventive medicine aspects of the infectious diseases of swine, sheep, goats, cattle, horses, poultry, and honeybees. (Typically Offered: Spring)

VMPM 7486: Laboratory in Public Health

Credits: 2. Contact Hours: Laboratory 5.

Repeatable.

Discussions, lectures, exercises and field trips related to veterinary public health. (Typically Offered: Fall, Spring, Summer)

VMPM 7490: Independent Study

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

VMPM 7491: CDC Epidemiology Elective Preceptorship

Credits: 6.

Introduction to preventive medicine, public health and the principles of applied epidemiology within the working atmosphere of the Centers for Disease Control and Prevention. (Typically Offered: Fall, Spring, Summer)

VMPM 7496: International Experience

Credits: 1-12. Repeatable.

International Preceptorships and Study Abroad group programs.

Opportunities for students to be involved in applied clinical, production, and/or research experiences in international locations. The course consists of 40 hour per week experiential learning opportunities.

(Typically Offered: Fall, Spring, Summer)

Veterinary Pathology

Professional Program of Study

For the professional curriculum in veterinary medicine leading to the degree doctor of veterinary medicine, see Veterinary Medicine, Curriculum.

The Department of Veterinary Pathology offers a systematic study of basic disease mechanisms with emphasis on the changes in gene expression, cells, tissues, organs, and body fluids associated with disease. The theory and practice of veterinary pathology, veterinary clinical pathology, veterinary parasitology, veterinary toxicology, and related disciplines provide the basis for accurate diagnosis and a rational approach to the treatment and prevention of animal diseases.

Graduate Study

The department offers work for the degree master of science and doctor of philosophy with a major in veterinary pathology. The majority of students choose an area of specialization in veterinary anatomic pathology, veterinary clinical pathology, or veterinary parasitology (<http://vetmed.iastate.edu/vpath/academics/graduate-program> (<http://vetmed.iastate.edu/vpath/academics/graduate-program/>)). The master of science degree is available on a thesis or nonthesis basis in the veterinary pathology major with or without an area of specialization.

For the ACVP training track (residency) of the anatomic or clinical pathology graduate program designed to train veterinary pathologists, the student must have a funded position within the Department of Veterinary Pathology. If the student does not have a funded position or is not enrolled in the departmental degree program, enrollment in courses pertaining to the residency program and activities that support the residency program must have the approval of the Department Chair of Veterinary Pathology and the head of the departmental residency training program.

Graduates have a broad understanding of the mechanistic basis of disease pathogenesis. They are able to communicate with clinicians, other scientists, and other colleagues on scientific matters, and with the general public on related science policy matters. Graduates are able to address complex problems facing the agricultural and biomedical sciences, and comparative medicine, and are able to make appropriate diagnoses and investigations of animal diseases. They consider ethical, social, legal and environmental issues, and are skilled at carrying out research, communicating research results, and writing concise and competitive grant proposals.

Collaborative work is recommended in other departments in the College of Veterinary Medicine or departments or programs in other colleges. The department participates in the interdepartmental programs in Immunobiology (www.immunobiology.iastate.edu/)

(<http://www.immunobiology.iastate.edu/>), Toxicology (<http://www.toxicology.iastate.edu/>), Genetics (<http://www.genetics.iastate.edu/>), and Molecular, Cellular, and Developmental Biology (<http://www.mcdb.iastate.edu/>).

A veterinary degree (doctor of veterinary medicine or equivalent) is required for training in Veterinary Anatomic Pathology and Veterinary Clinical Pathology. Other specializations do not require the veterinary degree. A minimum score of 550 paper-based (213 computer-based; 79 internet based) is required on the TOEFL examination for students whose native language is not English. A foreign language requirement will be determined by the student's program of study committee with the approval of the departmental chair. The Graduate English Examination is a graduate college requirement for native English speakers.

The M.S. thesis degree in veterinary pathology, with or without an area of specialization, requires a minimum of 30 graduate credits. Following completion of all other requirements, a comprehensive final examination is administered covering all graduate work including the thesis. The examination is typically oral, but a written component may be specified by the program of study committee. The degree candidate must submit a thesis, including at least one manuscript suitable for publication, to the committee members and departmental chair at least two weeks prior to the final examination. The departmental requirement for graduate courses includes:

3 credits of basic biological sciences (biochemistry, genetics, cell biology)	3
VPTH 5510 Postmortem Pathology Laboratory	1-3
VPTH 5700 Systemic Pathology I	4
STAT 5101 Statistical Methods for Data Analysis	4
VPTH 6050 Current Topics Seminar	1
VPTH 6990A Research: Veterinary Pathology or VPTH 6990B Research: Veterinary Parasitology or VPTH 6990C Research: Veterinary Toxicology or VPTH 6990D Research: Veterinary Clinical Pathology	1-30

The M.S. nonthesis degree in veterinary pathology, with or without an area of specialization, requires a minimum of 40 graduate credits including at least 10 graduate credits earned outside the department. Every nonthesis master's degree program requires evidence of individual accomplishment demonstrated by completion of a creative component, special report, or scientific study. A minimum of 3 credits of such independent work (VPTH 5990) and a practical diagnostic examination (VPTH 6060) corresponding to the area of specialization are required on every program of study. The final examination is comprehensive and consists of written and oral questions. The departmental requirement for graduate courses includes those for the M.S. thesis degree plus

additional courses corresponding to the area of degree emphasis of specialization. Contact the department for a more complete list of requirements and information on areas of specialization.

The Ph.D. degree in veterinary pathology, with or without an area of specialization, requires a minimum of 72 graduate credits including at least 12 graduate credits earned outside the department. The preliminary examination, consisting of written and oral components, is comprehensive and not restricted to the content of graduate courses. The degree candidate must submit a dissertation, including at least two manuscripts suitable for publication, to the committee members and departmental chair at least two weeks prior to the final examination. The final examination is primarily a defense of the dissertation, but it may include questions on other areas of specialized knowledge. The department also offers a combined DVM/Ph.D. program designed for completion of courses for the Ph.D. degree in Veterinary Pathology simultaneously with study in the professional curriculum in the College of Veterinary Medicine. Contact the department for a more complete list of requirements for the Ph.D. degree and information on areas of specialization.

Courses primarily for undergraduates:

VPTH 3530: Introductory Parasitology

(Cross-listed with BIOL 3530/ MICRO 3530).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2120

Biology and host-parasite relationships of major groups of animal parasites, and techniques of diagnosing and studying parasites. (Typically Offered: Spring)

VPTH 4010: Basics of Medical Terminology

Credits: 1. Contact Hours: Lecture 1.

Discussion of prefixes, suffixes, and roots (mostly from Latin and Greek) that comprise medical terms. (Typically Offered: Fall)

VPTH 4020: Introduction to Pathology

(Cross-listed with BIOL 4020).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2110, BIOL 2110L, BIOL 2120, and BIOL 2120L

Introductory exploration of pathology as a medical discipline. This includes study of disease mechanisms via an introduction to general pathology topics (cell degeneration, necrosis, disturbances of growth, disturbances of blood flow, inflammation, neoplasia) and organ system-specific response to injury. (Typically Offered: Fall)

VPTH 4030: Introduction to Pathology II

(Cross-listed with BIOL 4030).

Credits: 3. Contact Hours: Lecture 3.

Prereq: VPTH 4020 and BIOL 4020

Continuation of pathology topics begun in VPTH/BIOL 4020. How specific organ systems respond to injury using principles and information covered in VPTH 4020/ BIOL 4020. Study of a set of prototypical diseases that affect humans and animals. (Typically Offered: Spring)

Courses primarily for graduate students, open to qualified undergraduates:

VPTH 5030: Principles of Pathology

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introductory exploration of pathology as a medical discipline. This includes study of disease mechanisms via an introduction to general pathology topics (cell degeneration, necrosis, disturbances of growth, disturbances of blood flow, inflammation, neoplasia) and organ system-specific response to injury. (Typically Offered: Spring)

VPTH 5300: Teaching and Learning in Veterinary Medical Education

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Study of principles of teaching and learning as they relate to veterinary medical education. These include: theories of learning, analyzing content/learners/context, identifying goals, identifying appropriate instructional strategies (specific to medical education), matching assessment processes to goals and strategies, common curricular approaches and decision-making processes in medical education, and the scholarship of teaching and learning for veterinary medical educators. Offered even-numbered years. (Typically Offered: Fall)

VPTH 5420: Anatomic Pathology I

(Dual-listed with VPTH 7342).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Basic pathology with emphasis on disease in animals and introduction to disease by system. (Typically Offered: Spring)

VPTH 5480: Diagnostic Parasitology Laboratory

Credits: 1-3. Contact Hours: Laboratory 9.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Contact hours are (0-3 to 0-9). A laboratory experience in the technical and applied aspects of veterinary parasitology. (Typically Offered: Fall, Spring, Summer)

VPTH 5490: Clinical Pathology Laboratory

Credits: 1. Contact Hours: Laboratory 3.

Repeatable, maximum of 1 credits.

Prereq: Graduate Standing or Permission of Instructor

Laboratory procedures and clinical interpretations with emphasis on hematology, cytology, and clinical chemistry. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

VPTH 5500: Surgical Pathology Laboratory

Credits: 1-3. Contact Hours: Laboratory 9.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Contact hours are (0-3 to 0-9). Diagnosis of lesions in biopsy specimens; classification of neoplasms. Course includes rotation through departmental biopsy service and review of selected cases from departmental archives. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

VPTH 5510: Postmortem Pathology Laboratory

Credits: 1-3. Contact Hours: Laboratory 9.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Contact hours are (0-3 to 0-9). Necropsy techniques of animals with emphasis on gross and microscopic lesions and diagnosis. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

VPTH 5540: Ethics in Scientific Research and Writing

Credits: 1. Contact Hours: Lecture 1.

Prereq: Graduate Standing or Permission of Instructor

Ethical conduct in biomedical research, criticism, writing, and adherence to regulations. Offered even-numbered years. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

VPTH 5700: Systemic Pathology I

Credits: 4. Contact Hours: Lecture 4.

Prereq: [Graduate Classification and (VPTH 3420 or VPTH 5420)] OR Instructor Permission

Pathology of the respiratory, reproductive, endocrine, musculoskeletal, and cardiovascular systems. Emphasis on pathogenesis and histopathology correlated with interpretive clinical pathology where appropriate. DVM degree required. Offered even-numbered years. (Typically Offered: Fall)

VPTH 5710: Systemic Pathology II

Credits: 4. Contact Hours: Lecture 4.

Prereq: Graduate Standing or Permission of Instructor

Pathology of the integumentary, urinary, digestive, lymphoid, and nervous systems and special senses. Emphasis on pathogenesis and histopathology correlated with interpretive clinical pathology where appropriate. DVM degree required. Offered odd-numbered years. (Typically Offered: Fall)

VPTH 5720: Anatomic Pathology II

(Dual-listed with VPTH 7372).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Response to injury by each body system. (Typically Offered: Fall)

VPTH 5760: Veterinary Parasitology

(Dual-listed with VPTH 7376).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Parasitic diseases of domestic animals and their control. (Typically Offered: Fall)

VPTH 5900A: Special Topics: Veterinary Pathology

Credits: 1-4. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

VPTH 5900B: Special Topics: Veterinary Parasitology

Credits: 1-4. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

VPTH 5900C: Special Topics: Veterinary Toxicology

Credits: 1-4. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

(Typically Offered: Fall, Spring, Summer)

VPTH 5900D: Special Topics: Veterinary Clinical Pathology

Credits: 1-4. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

VPTH 5900E: Special Topics: Other

Credits: 1-4. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

VPTH 5960: International Preceptorship

Credits: 1-12. Repeatable, maximum of 12 credits.

Prereq: Graduate Standing or Permission of Instructor

International Preceptorships and Study Abroad Group programs.

This course will provide opportunities for students to be involved in applied clinical, production, and/or research experiences in international locations. The course consists of 40 hour per week experiential learning opportunities. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

VPTH 5990A: Creative Component Research: Veterinary Pathology

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Course for departmental graduate research. (Typically Offered: Fall, Spring, Summer)

VPTH 5990B: Creative Component Research: Veterinary Parasitology

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Course for departmental graduate research. (Typically Offered: Fall, Spring, Summer)

VPTH 5990C: Creative Component Research: Veterinary Toxicology

Credits: 1-30. Repeatable.

Course for departmental graduate research. (Typically Offered: Fall, Spring, Summer)

VPTH 5990D: Creative Component Research: Veterinary Clinical Pathology

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Course for departmental graduate research. (Typically Offered: Fall, Spring, Summer)

Courses for graduate students:

VPTH 6040: Pathology Case Seminar

Credits: 1-2. Contact Hours: Lecture 2.

Repeatable.

Description and interpretation of microscopic lesions and clinical pathology data collected from cases of natural and experimental disease. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

VPTH 6050: Current Topics Seminar

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Prereq: Instructor Permission for Course

A seminar of graduate research at the time of thesis or dissertation defense. (Typically Offered: Fall, Spring, Summer)

VPTH 6060A: Diagnostic Interpretation: Veterinary Pathology

Credits: Required. Contact Hours: Lecture 1.

Prereq: VPTH majors only

A comprehensive examination in the diagnostic description and interpretation of case materials relevant to veterinary pathology and areas of specialization for the graduate degree preliminary examination. (Typically Offered: Fall, Spring, Summer)

VPTH 6060B: Diagnostic Interpretation: Veterinary Parasitology

Credits: Required. Contact Hours: Lecture 1.

Prereq: VPTH majors only

A comprehensive examination in the diagnostic description and interpretation of case materials relevant to veterinary pathology and areas of specialization for the graduate degree preliminary examination. (Typically Offered: Fall, Spring, Summer)

VPTH 6060C: Diagnostic Interpretation: Veterinary Toxicology

Credits: Required. Contact Hours: Lecture 1.

Prereq: VPTH majors only

A comprehensive examination in the diagnostic description and interpretation of case materials relevant to veterinary pathology and areas of specialization for the graduate degree preliminary examination. (Typically Offered: Fall, Spring, Summer)

VPTH 6060D: Diagnostic Interpretation: Veterinary Clinical Pathology

Credits: Required. Contact Hours: Lecture 1.

Prereq: VPTH majors only

A comprehensive examination in the diagnostic description and interpretation of case materials relevant to veterinary pathology and areas of specialization for the graduate degree preliminary examination. (Typically Offered: Fall, Spring, Summer)

VPTH 6550: Cellular and Molecular Pathology I

Credits: 3. Contact Hours: Lecture 3.

Cellular and molecular mechanisms of cell injury, cellular responses to injury, and inflammation. Graduate course in biochemistry, genetics, or cell biology recommended. Offered odd-numbered years. (Typically Offered: Spring)

VPTH 6560: Cellular and Molecular Pathology II

(Cross-listed with TOX 6560).

Credits: 3. Contact Hours: Lecture 3.

Cellular and molecular mechanisms of carcinogenesis. Offered even-numbered years. (Typically Offered: Spring)

VPTH 6600: Pathogenesis of Persistent Infections

(Cross-listed with VMPP 6600).

Credits: 2. Contact Hours: Lecture 2.

Study of current knowledge related to host pathogen interactions during persistent and chronic infections by bacteria, viruses and parasites. Offered odd-numbered years. (Typically Offered: Spring)

VPTH 6610: Comparative Immunology and Infectious Disease

(Cross-listed with IMBIO 6610).

Credits: 2. Contact Hours: Lecture 2.

Discuss and define similarities and differences of varied host responses to infectious challenge. Learning will focus on comparative aspects of the host response and the unique aspects of immunity from different organisms, while highlighting molecular and mechanistic similarities of pathogen recognition, response and resolution. Offered odd-numbered years. (Typically Offered: Spring)

VPTH 6790: Histopathology of Laboratory Animals

Credits: 2.

Prereq: VPTH 5700 or VPTH 5710; Permission of Instructor

Study of microscopic lesions in laboratory animals with emphasis on description, etiology, pathogenesis, and diagnosis.

VPTH 6990A: Research: Veterinary Pathology

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Course restricted to graduate program within the department. (Typically Offered: Fall, Spring, Summer)

VPTH 6990B: Research: Veterinary Parasitology

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Course restricted to graduate program within the department. (Typically Offered: Fall, Spring, Summer)

VPTH 6990C: Research: Veterinary Toxicology

Credits: 1-30. Repeatable.

Course restricted to graduate program within the department. (Typically Offered: Fall, Spring, Summer)

VPTH 6990D: Research: Veterinary Clinical Pathology

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Course restricted to graduate program within the department. (Typically Offered: Fall, Spring, Summer)

Courses primarily for professional curriculum students:

VPTH 7342: Anatomic Pathology I

(Dual-listed with VPTH 5420).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Basic pathology with emphasis on disease in animals and introduction to disease by system. (Typically Offered: Spring)

VPTH 7372: Anatomic Pathology II

(Dual-listed with VPTH 5720).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Response to injury by each body system. (Typically Offered: Fall)

VPTH 7376: Veterinary Parasitology

(Dual-listed with VPTH 5760).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Parasitic diseases of domestic animals and their control. (Typically Offered: Fall)

VPTH 7377: Case Study III

Credits: 2. Contact Hours: Lecture 1, Laboratory 2.

Clinical applications of the basic sciences taught concurrently in the fall semester of the second year curriculum in veterinary medicine. (Typically Offered: Fall)

VPTH 7409: Introduction to Veterinary Cytology and Laboratory Techniques

Credits: 1. Contact Hours: Laboratory 2.

Description, interpretation, and techniques for cellular preparations from tissues and body fluids. (Typically Offered: Spring)

VPTH 7425: Clinical Pathology

Credits: 4. Contact Hours: Lecture 2, Laboratory 4.

Principles of clinical hematology, clinical chemistry, and urinalysis in domestic animals. (Typically Offered: Spring)

VPTH 7456: Necropsy Laboratory Practicum

Credits: 1. Contact Hours: Laboratory 2.5.

Repeatable.

Practicum in postmortem examination and diagnosis.

VPTH 7457: Clinical Pathology Laboratory Practicum

Credits: 1. Contact Hours: Laboratory 1.

Repeatable.

Methodology in clinical chemistry, hematology and cytology; practice in interpretation of laboratory data.

VPTH 7476X: Clinical Veterinary Parasitology

Credits: 1-2. Repeatable.

Two week clinical rotation in clinical veterinary parasitology. Students will investigate parasitic disease with supervision of the instructors. Variable amount of travel to farm or sites will be required. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel.

VPTH 7490: Independent Study

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

VPTH 7492: Orientation for International Experience

Credits: 1. Contact Hours: Lecture 1.

Repeatable, maximum of 1 credits.

8 weeks. Predeparture orientation for group study abroad. Cultural considerations for the study abroad experience and a conversational language introduction. Out of class work will be assigned. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

VPTH 7495: Clinical Competency Skills Checklist/Remediation

Credits: Required. Contact Hours: Lecture 1.

In order to graduate, all 4th year veterinary students are required to complete a checklist of clinical procedures and complete any assigned remediation (based on evaluation in core clinical rotations). These requirements are tied to the college's AVMA COE accreditation, and this course is used to document completion of those requirements. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

VPTH 7496: International Experience

Credits: 1-12. Repeatable.

International Preceptorships and Study Abroad Group programs.

Opportunities for students to be involved in applied clinical, production, and/or research experience in international locations. The course consists of 40 hour per week experiential learning opportunities. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

A-Z COURSES

A

- Accounting (ACCT)
- Actuarial Science (ACSCI)
- Advertising (ADVRT)
- Aerospace Engineering (AERE)
- African and African American Studies (AFAM)
- Agricultural and Biosystems Engineering (ABE)
- Agricultural Education and Studies (AGEDS)
- Agronomy (AGRON)
- Air Force Aerospace Studies (AFAS)
- American Indian Studies (AMIN)
- American Sign Language (ASL)
- Animal Ecology (AECL)
- Animal Science (ANS)
- Anthropology (ANTHR)
- Apparel, Events, and Hospitality Management (AESHM)
- Apparel, Merchandising and Design (AMD)
- Arabic (ARABC)
- Architecture (ARCH)
- Art and Design (ART) (<http://catalog.iastate.edu/azcourses/art/>)
- Art Education (ARTED)
- Art History (ARTH)
- Artificial Intelligence (AI) (<http://catalog.iastate.edu/azcourses/ai/>)
- Astronomy and Astrophysics (ASTRO)
- Athletics (ATH)
- Athletic Training (ATR)
- A-Z Courses

B

- Biochemistry, Biophysics, and Molecular Biology (BBMB)
- Bioinformatics and Computational Biology (BCB)
- Bioinformatics and Computational Biology (BCBIO)
- Biology (BIOL)
- Biomedical Engineering (BME)
- Biomedical Sciences (BMS)
- Business Administration (BUSAD)

C

- Chemical Engineering (CHE)
- Chemistry (CHEM)
- Chinese (CHIN)

- Civil Engineering (CE)
- Classical Studies (CLST)
- Climate Science (CLSCI) (<http://catalog.iastate.edu/azcourses/clsci/>)
- Communication Studies (COMST)
- Community and Regional Planning (CRP)
- Community Development (COMDV)
- Community Development GPIDEA (CDEV)
- Computer Engineering (CPRE)
- Computer Science (COMS)
- Construction Engineering (CONE)
- Criminal Justice (CJ)
- Cyber Security (CYBSC)
- Cyber Security Engineering (CYBE)

D

- Dance (DANCE)
- Data Science (DS)
- Design (DES)
- Design Studies (DSNS)
- Dietetics (DIET)
- Digital Health (DH) (<http://catalog.iastate.edu/azcourses/dh/>)

E

- Early Childcare Education and Programming (ECP)
- Early Childhood and Family Policy (ECFP)
- Ecology and Evolutionary Biology (EEB)
- Ecology, Evolution, and Organismal Biology (EEOB)
- Economics (ECON)
- Educational Administration (EDADM)
- Educational Leadership and Policy Studies (ELPS)
- Education (EDUC)
- Electrical Engineering (EE)
- Engineering (ENGR)
- Engineering Mechanics (EM)
- English (ENGL)
- Entomology (ENT)
- Entrepreneurship (ENTSP)
- Environmental Engineering (ENVE)
- Environmental Science (ENSCI)
- Environmental Studies (ENVS)
- Event Management (EVENT)

F

- Family and Consumer Sciences Education and Studies (FCEDS)
- Family Financial Planning (FFP)
- Fashion Design and Merchandising (FDM) (<http://catalog.iastate.edu/azcourses/fdm/>)
- Finance (FIN)
- Food Science and Human Nutrition (FSHN)
- Forestry (FOR)
- French (FRNCH)

G

- Game Design (GAME) (<http://catalog.iastate.edu/azcourses/game/>)
- Genetics, Development and Cell Biology (GDCB)
- Genetics (GEN)
- Genetics (GENET)
- Geology (GEOL)
- German (GER)
- Gerontology (GERON)
- Global Resource Systems (GLOBE)
- Graduate Studies (GRST)
- Graphic Design (ARTGR)

H

- Health and Human Sciences (HHSCI) (<http://catalog.iastate.edu/azcourses/hhsci/>)
- Healthcare Management (HCM)
- Health Studies (HS)
- Higher Education (HGED)
- History (HIST)
- Honors (HON)
- Horticulture (HORT)
- Hospitality Management (HSPM)
- Human Computer Interaction (HCI)
- Human Development and Family Studies (HDFS)

I

- Immunobiology (IMBIO)
- Industrial Design (INDD)
- Industrial Engineering (IE)
- Interdisciplinary Graduate Studies (IGS)
- Interior Design (ARTID)
- International Studies (INTST)

- Iowa Lakeside Laboratory (IALL)
- Italian (ITAL)

J

- Journalism and Mass Communication (JLMC)

K

- Kinesiology (KIN)

L

- Landscape Architecture (LA)
- Latin (LATIN)
- Leadership Studies (LDST)
- Learning and Leadership Sciences (LLS)
- Liberal Arts and Sciences Cross-Disciplinary Studies (LAS)
- Library (LIB)
- Linguistics (LING)

M

- Management Information Systems (MIS)
- Management (MGMT)
- Marketing (MKT)
- Materials Engineering (MATE)
- Materials Science and Engineering (MSE)
- Mathematics (MATH)
- Mechanical Engineering (ME)
- Meteorology (MTEOR)
- Microbiology (MICRO)
- Military Science (MS)
- Molecular, Cellular and Developmental Biology (MCDB)
- Music (MUSIC)

N

- Natural Resource Ecology and Management (NREM)
- Naval Science (NS)
- Neuroscience (NEURO)
- Nursing (NRS)
- Nutritional Sciences (NUTRS)

O

- Organization for Tropical Studies (OTS)

P

- Performing Arts (PERF)
- Philosophy (PHIL)

- Physics (PHYS)
- Plant Biology (PLBIO)
- Plant Pathology (PLP)
- Political Science (POLS)
- Portuguese (PORT)
- Psychology (PSYCH)
- Public Relations (PR)

R

- Religious Studies (RELIG)
- Research and Evaluation (RESEV)
- Russian (RUS)

S

- Scientific Illustration and Visualization (SCIVZ)
- Seed Technology and Business (STB)
- Sociology (SOC)
- Software Engineering (SE)
- Spanish (SPAN)
- Special Education (SPED)
- Speech Communication (SPCM)
- Statistics (STAT)
- Supply Chain Management (SCM)
- Sustainable Agriculture (SUSAG)
- Sustainable Environments (SUSE)

T

- Technology Systems Management (TSM)
- Theatre (THTRE)
- Toxicology (TOX)
- Transportation (TRANS)

U

- University Studies (UST)
- Urban Design (URBD)
- U.S. Latino/a Studies Program (USLS)

V

- Veterinary Clinical Sciences (VCS)
- Veterinary Diagnostic and Production Animal Medicine (VDPAM)
- Veterinary Microbiology and Preventive Medicine (VMPPM)
- Veterinary Pathology (VPTH)

W

- Wind Energy Science, Engineering and Policy (WESEP)
- Women in Science and Engineering (WISE)
- Women's and Gender Studies (WGS)
- World Film Studies (WFS)
- World Languages and Cultures (WLC)

Y

- Youth (YTH)

Accounting (ACCT)

Courses primarily for undergraduates:

ACCT 2150: Legal Environment of Business

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

General history, structure, and principles of the US legal system. The legal system, as an agency of social control and tool for resolving disputes. The court systems, Constitution, torts, crimes, intellectual property, contracts, property rights, employment law, basic business entity law, bankruptcy, administrative agencies, environmental law and agency law. (Typically Offered: Fall, Spring, Summer)

ACCT 2840: Financial Accounting

Credits: 3. Contact Hours: Lecture 3.

Introduction to the basic concepts and procedures of financial accounting from a user perspective. The course examines the accounting cycle, business terminology, basic control procedures, and the preparation and evaluation of financial reports, with an emphasis on financial statement analysis. (Typically Offered: Fall, Spring, Summer)

ACCT 2850: Managerial Accounting

Credits: 3. Contact Hours: Lecture 3.

Prereq: ACCT 2840

Understanding of fixed and variable costs and their role in planning, control and performance evaluation. Examination of alternative costing methods. Making decisions by identifying and developing relevant information. Development of spreadsheet skills. (Typically Offered: Fall, Spring, Summer)

ACCT 3010: The Accounting Cycle

Credits: 1. Contact Hours: Lecture 1.

Prereq: ACCT 2840

Interactive computer-based analysis of the accounting cycle including transactions and financial statements. Preparation of journal entries and adjusting entries and completion of the closing process. (Typically Offered: Fall, Spring, Summer)

ACCT 3150: Business Data Streams and Issues

(Cross-listed with MIS 3150).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ACCT 2840 and MIS 3010

Identification of open data sources and other private data sources. Develop methods of data access, collection, and sharing; develop methods to validate and standardize data sources; develop methods to assess data worthiness (risk). Typically Offered: Fall (even-numbered years), Spring (odd-numbered years), Summer (annually).

ACCT 3830: Intermediate Managerial Accounting

Credits: 3. Contact Hours: Lecture 3.

Prereq: ACCT 2850 and credit or enrollment in ACCT 3010

Generation, communication and use of information to assist management with planning, control, and decision making in manufacturing and service organizations. Includes cost concepts and relevance to decision situations, operational and capital budgeting, and performance evaluation. Emphasis on developing effective teamwork skills as well as spreadsheet capabilities. (Typically Offered: Fall, Spring)

ACCT 3840: Accounting Information Systems and Analytics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or enrollment in ACCT 3010 and MIS 3010

Concepts and procedures underlying creating, sharing, reporting, storing, and analyzing accounting data. Information technology internal controls and audit techniques. Trends in accounting information systems.

ACCT 3860: Intermediate Financial Accounting I

Credits: 3. Contact Hours: Lecture 3.

Prereq: (ACCT 2840 or ACCT 2840H) and ACCT 3010

The conceptual framework of financial accounting. Communication of financial information on the income and retained earnings statements, statement of cash flows, and the balance sheet. Accounting concepts relating to current and operational assets of the firm. (Typically Offered: Fall, Spring)

ACCT 3870: Intermediate Financial Accounting II

Credits: 3. Contact Hours: Lecture 3.

Prereq: Minimum of C- in ACCT 3860

Financial accounting and reporting practices for business entities. Generally accepted accounting principles (GAAP) relative to firm liabilities, equity, income, taxes, employee benefits, leases, accounting changes and cash flows. Discussion of current issues in financial accounting. (Typically Offered: Fall, Spring)

ACCT 4010: Financial Management for Healthcare Organizations

(Cross-listed with HCM 4010).

Credits: 3. Contact Hours: Lecture 3.

Prereq: FIN 3010 and credit or enrollment in HCM 3010

Examination of the current accounting system for, and the financing of, health care and the factors affecting the industry. Exploration and analysis of budgetary concepts, financial management, cost accounting, and management under rate control and competition, as well as the differences between the goods and service industries. Additional areas of discussion include the practical application of health care finance theory as it applies to the current healthcare environment. The revenue and expense applications will be explored in-depth, particularly in relation to the delivery of health care services. Specific emphasis will be placed on understanding the components of the income statement and balance sheet, developing a budget, and using these financial statements for analyzing operational changes. (Typically Offered: Fall, Spring)

ACCT 4160: Business Law

(Dual-listed with ACCT 5160).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ACCT 2150

Continuation of 2150. The Uniform Commercial Code as applied to sales contracts and negotiable instruments. Property law, wills and estates, insurance, secured transactions, corporation law, partnership law and antitrust law. (Typically Offered: Fall, Spring)

ACCT 4420X: Generative AI in Business Decision-Making

(Dual-listed with ACCT 5420X/ MIS 5420X). (Cross-listed with MIS 4420X).

Credits: 3. Contact Hours: Lecture 3.

This intensive course is designed to equip students with the knowledge and skills to leverage generative AI in business decision-making. Through learning modules, interactive case studies, and practical assignments, students will learn to create effective prompts and use Generative AI to transform business processes and decision-making. (Typically Offered: Spring, Summer)

ACCT 4610: Entrepreneurship and Accounting Information

(Dual-listed with ACCT 5610). (Cross-listed with ENTSP 4610).

Credits: 3. Contact Hours: Lecture 3.

Accounting information recording, dissemination, and use by entrepreneurs. Introduces pro forma financials, venture capital, private equity, and state and federal regulations for business creation and formation. Other topics include intrapreneurship, intellectual property, information privacy, cybersecurity, and internal controls, including managing the risk of embezzlement.

ACCT 4830: Application and Communication in Managerial Accounting

(Dual-listed with ACCT 5830).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ACCT 3830 or ACCT 5810

Business simulation focusing on generation and communication of information to assist management with financial decision-making. Emphasis on developing teamwork, written communication, data visualization, and oral presentation skills.

ACCT 4840: Advanced Accounting Information Systems

(Dual-listed with ACCT 5840).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ACCT 3840

Advanced accounting information systems concepts; database design and information retrieval, internal controls within computerized accounting information systems, financial reporting in an electronic environment.

ACCT 4850: Principles of Federal Income Tax

Credits: 3. Contact Hours: Lecture 3.

Prereq: Minimum of C- in ACCT 3860

Introduction to the fundamentals of federal income taxation and concepts applicable to all tax entities. Addresses issues related to the measurement and recognition of income, deductions, gains, and losses, taxation of property transactions, and basis / cost recovery concepts. Includes coverage of tax law policy objectives, tax implications of business and investment decisions, tax versus financial reporting treatment of common business transactions, and ethical issues related to tax compliance and planning. (Typically Offered: Fall, Spring)

ACCT 4870: Volunteer Income Tax Assistance

(Dual-listed with ACCT 5870).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Repeatable, maximum of 6 credits.

Prereq: (ACCT 2850 or ACCT 5010) OR department permission

Introduction to and field work in the preparation of individual income tax returns (state and federal). Basic coverage of filing and residency status, taxable income, exemptions, deductions, and credits. Tax software usage and online filing. (Typically Offered: Spring)

ACCT 4880: Governmental and Non-profit Institution Accounting

(Dual-listed with ACCT 5880).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ACCT 3860

Accounting and financial reporting principles of local and state governments, including universities, schools, and hospitals. In addition, accounting and financial reporting of non-profit organizations will be addressed. Financial statements of local governmental units and the university are explored.

ACCT 4890: Corporate Social Responsibility Reporting

(Dual-listed with ACCT 5890).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior, Senior, or Graduate Standing

Theory and practice of social and environmental reporting, the role of the corporation in society, and the mechanisms by which society might hold corporations accountable for their actions. (Typically Offered: Spring)

ACCT 4900: Independent Study

Credits: 1-3. Repeatable.

Prereq: Department Permission for Course

(Typically Offered: Fall, Spring, Summer)

ACCT 4930: Corporate Taxation

(Dual-listed with ACCT 5930).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ACCT 3860

Introduction to the fundamentals of corporate taxation issues.

Discussion of concepts related to the formation and capital structure of corporations. Identification and effect of tax codes and regulations related to corporations. Discussion of operating rules, earnings and profits, distributions, as well as redemptions and liquidations of corporations. (Typically Offered: Fall, Spring)

ACCT 4950: Advanced Financial Accounting Problems

(Dual-listed with ACCT 5950).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ACCT 3870

Accounting for business combinations and affiliated companies, intercompany transactions, and consolidated financial statements; Partnership accounting; Segment and Interim Reporting; Multinational accounting.

ACCT 4960: Accounting in the Global Economy

(Dual-listed with ACCT 5960).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ACCT 3860 or ACCT 5010

Financial reporting issues in a global environment, including introduction to International Financial Reporting Standards (IFRS) and the potential for the use of IFRS in the U.S. Accounting and managerial issues faced by multinational corporations. Technical issues such as transfer pricing, inflation accounting and taxation will be discussed.

ACCT 4970: Introduction to Auditing

Credits: 3. Contact Hours: Lecture 3.

Prereq: ACCT 3840 and ACCT 3870 and STAT 3260

The conceptual framework of auditing. Professional ethics. External reporting concepts. Audit methodology including risk analysis, internal control, procedures for gathering evidence and the role of statistical sampling in auditing. (Typically Offered: Fall, Spring)

ACCT 4980: Accounting Communication and Analysis

Credits: 3. Contact Hours: Lecture 3.

Prereq: ACCT 3870

Integrative studies in accounting. Development of critical thinking, ethical reasoning, professional research and teamwork skills. Written, visual, and oral communication with corporate stakeholders. (Typically Offered: Fall)

Courses primarily for graduate students, open to qualified undergraduates:

ACCT 5010: Financial Accounting

Credits: 3. Contact Hours: Lecture 3.

Prereq: Ivy College of Business Graduate Student or instructor permission

A general introduction to financial accounting information. Topics covered include the use and analysis of financial information, the regulatory environment, the role of International Financial Reporting Standards (IFRS), and the use of the internet and electronic spreadsheets as a means of accessing and analyzing financial data.

ACCT 5150: Accounting Analytics

Credits: 3. Contact Hours: Lecture 3.

Prereq: ACCT 3840 or Permission of Department

Applications and skills for performing data analytics in accounting contexts. Explores conceptual framework for providing data-driven insights and recommendations. Includes hands-on experiences working with different types of data and the latest analysis tools. (Typically Offered: Fall)

ACCT 5160: Business Law

(Dual-listed with ACCT 4160).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ACCT 2150

Continuation of 2150. The Uniform Commercial Code as applied to sales contracts and negotiable instruments. Property law, wills and estates, insurance, secured transactions, corporation law, partnership law and antitrust law. (Typically Offered: Fall, Spring)

ACCT 5420X: Generative AI in Business Decision-Making

(Dual-listed with ACCT 4420X/ MIS 4420X). (Cross-listed with MIS 5420X).

Credits: 3. Contact Hours: Lecture 3.

This intensive course is designed to equip students with the knowledge and skills to leverage generative AI in business decision-making. Through learning modules, interactive case studies, and practical assignments, students will learn to create effective prompts and use Generative AI to transform business processes and decision-making. (Typically Offered: Fall, Spring, Summer)

ACCT 5610: Entrepreneurship and Accounting Information

(Dual-listed with ACCT 4610/ ENTSP 4610).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ACCT 2840 or Graduate Classification

Accounting information recording, dissemination, and use by entrepreneurs. Introduces pro forma financials, venture capital, private equity, and state and federal regulations for business creation and formation. Other topics include intrapreneurship, intellectual property, information privacy, cybersecurity, and internal controls, including managing the risk of embezzlement.

ACCT 5710: Real Estate Law

Credits: 3. Contact Hours: Lecture 3.

Prereq: Ivy College of Business Graduate Student or instructor permission

Fundamentals of real estate finance and development from a legal perspective and in a transactional setting. Topics include land acquisition and finance, choice of entity, tax aspects, management, disposition of real property, and recent legal developments. Legal responsibilities of owners, designers, and contractors are also examined by highlighting typical contractual relationships in place throughout the design and construction process.

ACCT 5800A: CPA Exam Preparation - AUD

Credits: 3.

Prereq: Graduate Standing or Permission of Instructor

Preparation for the Auditing and Attestation (AUD) section of the Certified Public Accountant (CPA) examination. Graduation Restriction: Only two of ACCT 5800A, 5800B, 5800C, 5800D, 5800E, and 5800F may count toward graduation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

ACCT 5800B: CPA Exam Preparation - BEC

Credits: 3.

Prereq: Graduate Standing or Permission of Instructor

Preparation for the Business Environment and Concepts (BEC) section of the Certified Public Accountant (CPA) examination. Graduation Restriction: Only two of ACCT 5800A, 5800B, 5800C, 5800D, 5800E, and 5800F may count toward graduation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

ACCT 5800C: CPA Exam Preparation - FAR

Credits: 3.

Prereq: Graduate Standing or Permission of Instructor

Preparation for the Financial Accounting and Reporting (FAR) section of the Certified Public Accountant (CPA) examination. Graduation Restriction: Only two of ACCT 5800A, 5800B, 5800C, 5800D, 5800E, and 5800F may count toward graduation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

ACCT 5800D: CPA Exam Preparation - REG

Credits: 3.

Prereq: Graduate Standing or Permission of Instructor

Preparation for the Regulation (REG) section of the Certified Public Accountant (CPA) examination. Graduation Restriction: Only two of ACCT 5800A, 5800B, 5800C, 5800D, 5800E, and 5800F may count toward graduation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

ACCT 5800E: CMA Exam Preparation - Part 1

Credits: 3.

Prereq: Graduate Standing or Permission of Instructor

Preparation for Part 1 (Financial Planning, Performance, and Analytics) of the Certified Management Accountant (CMA) examination. Graduation Restriction: Only two of ACCT 5800A, 5800B, 5800C, 5800D, 5800E, and 5800F may count toward graduation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

ACCT 5800F: CMA Exam Preparation - Part 2

Credits: 3.

Prereq: Graduate Standing or Permission of Instructor

Preparation for Part 2 (Strategic Financial Management) of the Certified Management Accountant (CMA) examination. Graduation Restriction: Only two of ACCT 5800A, 5800B, 5800C, 5800D, 5800E, and 5800F may count toward graduation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

ACCT 5810: Accounting for Decision Making

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate classification

Decision analysis applied to managerial accounting issues. Generation of information for management decision making and control. Responsibility accounting and non-recurring decisions.

ACCT 5820: Corporate Governance and Top Management

(Cross-listed with MGMT 5820).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MGMT 5030 or permission

Duties, structure, and functioning of top management teams and corporate boards of directors. CEO/board tenure and succession planning, top management compensation, board committee composition, assessment of CEO and board performance, theories of corporate governance, management of the corporate strategic agenda, governance codes, international governance, and chairman/CEO duality. Case studies and contemporary issues discussed.

ACCT 5830: Application and Communication in Managerial Accounting

(Dual-listed with ACCT 4830).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ACCT 3830 or ACCT 5810

Business simulation focusing on generation and communication of information to assist management with financial decision-making. Emphasis on developing teamwork, written communication, data visualization, and oral presentation skills.

ACCT 5840: Advanced Accounting Information Systems

(Dual-listed with ACCT 4840).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ACCT 3840 or Graduate Classification

Advanced accounting information systems concepts; database design and information retrieval, internal controls within computerized accounting information systems, financial reporting in an electronic environment.

ACCT 5850: Taxes and Business Strategy

Credits: 3. Contact Hours: Lecture 3.

Prereq: ACCT 4850 or Graduate Classification

Integration of concepts from accounting, finance, and economics to determine how taxes affect business decisions. Provides students with a conceptual framework for thinking about business tax planning and applies it to various common business decisions.

ACCT 5860: Advanced Federal Taxation

Credits: 3. Contact Hours: Lecture 3.

Prereq: ACCT 4850 or Graduate Classification

Advanced coverage of federal taxation including issues related to the taxation of corporations, partnerships, estates and trusts, and their owners. Includes coverage of rules, concepts, background, and planning opportunities related to a number of common transactions involving these entities.

ACCT 5870: Volunteer Income Tax Assistance

(Dual-listed with ACCT 4870).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Repeatable, maximum of 6 credits.

Prereq: (ACCT 2850 or ACCT 5010) OR department permission

Introduction to and field work in the preparation of individual income tax returns (state and federal). Basic coverage of filing and residency status, taxable income, exemptions, deductions, and credits. Tax software usage and online filing. (Typically Offered: Spring)

ACCT 5880: Governmental and Non-profit Institution Accounting

(Dual-listed with ACCT 4880).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ACCT 3860

Accounting and financial reporting principles of local and state governments, including universities, schools, and hospitals. In addition, accounting and financial reporting of non-profit organizations will be addressed. Financial statements of local governmental units and the university are explored.

ACCT 5890: Corporate Social Responsibility Reporting

(Dual-listed with ACCT 4890).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ACCT 3860 or ACCT 5010

Theory and practice of social and environmental reporting, the role of the corporation in society, and the mechanisms by which society might hold corporations accountable for their actions. (Typically Offered: Spring)

ACCT 5900: Special Topics

Credits: 1-3. Repeatable.

Prereq: Department Permission for Course

For students wishing to do individual research in a particular area of accounting. (Typically Offered: Fall, Spring, Summer)

ACCT 5910: Fraud Examination and Prevention

Credits: 3. Contact Hours: Lecture 3.

Prereq: ACCT 4970 or ACCT 5010

Principles and methodology of fraud detection and deterrence. Addresses the causes and elements of fraud, asset theft, corruption, financial statement mis-representation, internal controls for fraud prevention, investigative evidence gathering, and legal aspects of fraud.

ACCT 5920: Financial Statement Analysis

Credits: 3. Contact Hours: Lecture 3.

Prereq: ACCT 3860 or ACCT 5010

Presentation and analysis of financial statement information from the point of view of the primary users of such data: owners and creditors. Topics include the financial reporting system, the primary financial statements, effects of accounting method choice on reported financial data, and firm valuation.

ACCT 5930: Corporate Taxation

(Dual-listed with ACCT 4930).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to the fundamentals of corporate taxation issues. Discussion of concepts related to the formation and capital structure of corporations. Identification and effect of tax codes and regulations related to corporations. Discussion of operating rules, earnings and profits, distributions, as well as redemptions and liquidations of corporations. (Typically Offered: Fall, Spring)

ACCT 5950: Advanced Financial Accounting Problems

(Dual-listed with ACCT 4950).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ACCT 3870

Accounting for business combinations and affiliated companies, intercompany transactions, and consolidated financial statements; Partnership accounting; Segment and Interim Reporting; Multinational accounting.

ACCT 5960: Accounting in the Global Economy

(Dual-listed with ACCT 4960).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ACCT 3860 or ACCT 5010

Financial reporting issues in a global environment, including introduction to International Financial Reporting Standards (IFRS) and the potential for the use of IFRS in the U.S. Accounting and managerial issues faced by multinational corporations. Technical issues such as transfer pricing, inflation accounting and taxation will be discussed.

ACCT 5970: Advanced Auditing and Assurance Services

Credits: 3. Contact Hours: Lecture 3.

Prereq: ACCT 4970

A study of advanced auditing and assurance issues. Topics include auditor independence, audit risk analysis, internal control evaluation and reporting, fraud detection, data analytic applications in auditing, audit reporting, auditors' legal liability, and non-financial information assurance.

ACCT 5980: Financial Accounting: Theory and Contemporary Issues

Credits: 3. Contact Hours: Lecture 3.

Prereq: ACCT 3860 or ACCT 5010

Theoretical discussion of the financial accounting and reporting environment. The usefulness of financial accounting information for decision making. Current financial accounting issues, the financial accounting standard setting process, FASB Standards Codification, and the role of the SEC in financial reporting. (Typically Offered: Fall)

ACCT 5990: Creative Component

Credits: 2. Contact Hours: Lecture 2.

Prereq: Admission to the Master of Accounting Program

This course prepares students to complete their creative component project option in the Master of Accounting degree.

Actuarial Science (ACSCI)

Courses primarily for undergraduates:

ACSCI 3910: Actuarial Exam P Lab

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Prereq: Credit or enrollment in STAT 3260 or STAT 3410

Material review for actuarial exam P. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

ACSCI 3920: Actuarial Exam FM Lab

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Prereq: Credit or enrollment in MATH 2400

Material review for actuarial exam FM. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

ACSCI 4010: Loss Models I

Credits: 3. Contact Hours: Lecture 3.

Prereq: STAT 3410

Probability distributions used to model uncertain events in actuarial practice. Aggregate models, evaluating the effect of various coverage modifications such as deductibles and limits. Construction of empirical models, calculations of common risk measures, and calculations of commonly used severity and frequency models. Various methods for estimating distributional parameters and their properties. (Typically Offered: Fall)

ACSCI 4020: Credibility Theory

Credits: 3. Contact Hours: Lecture 3.

Prereq: ACSCI 4010

Method of moments and percentile matching. The method of maximum likelihood estimation for complete individual data, grouped data, censored and truncated data, and variance estimation. Bayesian estimation, including conjugate priors, posterior distributions, and the Poisson-gamma model. Credibility theory, including limited fluctuation credibility, applying Bayesian analysis for both discrete and continuous models, Buhlmann and Buhlmann-Straub models, and their relationship to Bayesian models. Simulating discrete and continuous random variables and the bootstrap method for estimating mean squared error. (Typically Offered: Spring)

Advertising (ADVRT)

Courses primarily for undergraduates:

ADVRT 2300: Advertising Principles

Credits: 3. Contact Hours: Lecture 3.

Historical, social, economic and legal aspects of advertising. Evaluations of advertising research, media, strategy and appeals. Study of the creation of advertising.

ADVRT 3010: Research and Strategic Planning for Advertising and Public Relations

(Cross-listed with PR 3010).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ADVRT 2300 or PR 2200

Use of primary and secondary research methods utilizing conventional and online tools for development of successful strategic communications and campaign development for advertising and public relations.

ADVRT 3340: Advertising Creativity

Credits: 3.

Prereq: JLMC 1100; Minimum of C+ in JLMC 2010; Credit in ADVRT/PR 3010

Development and execution of creative advertising materials.

Copywriting, art direction and computer applications. Creative strategy development, execution and evaluation.

ADVRT 3350: Advertising Media Planning

Credits: 3. Contact Hours: Lecture 3.

Prereq: ADVRT 3010 and PR 3010

Concepts of media planning and selection in the development, execution and evaluation of advertising campaigns. Characteristics and capabilities of the advertising media. Utilization of online digital tools for market segmentation, uncovering consumer buying behaviors and attitudes, and media audience analysis.

ADVRT 3360: Advertising Account Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: JLMC 1100; Minimum of C+ in JLMC 2010; Credit or concurrent enrollment in ADVRT 3010/PR 3010

Fundamentals of account management with emphasis on leadership, sales techniques, relationship building, presentation skills, and strategic thinking. Includes aspects of agency communications, team building, client management, evaluating creative concepts and media plans, and developing strategic proposals and campaign recommendations.

ADVRT 3900: Professional Skills Development

(Cross-listed with JLMC 3900/ PR 3900/ SMC 3900).

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: (Minimum of C+ in JLMC 2010; JLMC major or ADVRT major or PR major or SMC major)

Check with Greenlee School for course availability. No More Than 3 Credits In JLMC/ADVRT/PR 3900 May Be Applied Toward Major Requirements For Graduation. (Typically Offered: Fall, Spring)

ADVRT 3910: Short Course Intensive

(Cross-listed with JLMC 3910/ PR 3910/ SMC 3910).

Credits: 1. Contact Hours: Lecture 1.

Repeatable, maximum of 6 credits.

Focused short courses on timely concepts. Check with Greenlee School for course availability. Offered on a satisfactory-fail basis only.

ADVRT 4340: Advertising Campaigns

Credits: 3. Contact Hours: Lecture 3.

Prereq: Minimum of C+ in ADVRT 3340 or ADVRT 3360; ADVRT major
Development of advertising campaigns including primary and secondary research, target audience analysis, campaign strategy, media planning, budgeting and creative execution. (Typically Offered: Fall, Spring)

ADVRT 4350: Advertising Competition

Credits: 1-3. Repeatable, maximum of 3 credits.

Prereq: Instructor Permission for Course

Concepts of media planning and selection in the development, execution and evaluation of advertising campaigns. Characteristics and capabilities of the advertising media. Utilization of market segmentation, consumer buying and media audience databases. Offered irregularly. (Typically Offered: Spring)

ADVRT 4360: Advertising Creative Portfolio

Credits: 3. Contact Hours: Lecture 3.

Prereq: Minimum of C+ in ADVRT 3340, non-majors with instructor permission

Advanced advertising writing and design. May include campaign development for competitions. Other projects include creative development in a variety of media for an online digital portfolio. (Typically Offered: Spring)

ADVRT 4730: Social Media Strategy

(Cross-listed with JLMC 4730/ PR 4730).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

The strategic use of social media, from both an advertising and public relationship standpoint, to the advantage of a client or organization. Examination and analysis of the social media space from a business perspective. Best practices in the areas of strategic planning, tactical execution, and measurement of social media platforms via online digital tools. (Typically Offered: Fall, Spring)

ADVRT 4900: Independent Study in Media and Communication

(Cross-listed with JLMC 4900/ PR 4900/ SMC 4900).

Credits: 1-30. Repeatable.

Prereq: Junior or Senior classification; Instructor Permission

Projects during which students may study problems associated with a medium, a professional specialization, a philosophical or practical concern, a reportorial method or writing technique, or a special topic in their field. Credit is not given for working on student or professional media without an accompanying research component. Graduation Restriction: No more than 3 credits of ADVRT/JLMC/PR/SMC 4900 may be used toward a degree in the Greenlee School.

ADVRT 4970: Special Topics in Communication

(Cross-listed with JLMC 4970/ PR 4970/ SMC 4970).

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: Junior classification

Seminars or one-time classes on topics of relevance to students in communication. See Schedule of Classes for topics.

ADVRT 4990A: Professional Media Internship: Required

(Cross-listed with JLMC 4990A/ PR 4990A/ SMC 4990A).

Credits: 3.

Prereq: ([JLMC major; JLMC 1100; minimum of C+ in JLMC 3020 or JLMC 3030] or [ADVRT major; JLMC 1100; ADVRT 3010 or PR 3010; minimum of C+ in JLMC 2010] or [PR major; JLMC 1100; ADVRT 3010 or PR 3010; minimum of C+ in PR 3210] or [SMC major; minimum of C+ in JLMC 2010; SMC 3040 or SMC 3510]); Advisor Approval

Initial, required internship. A 400-hour (for 3 credits) internship in the student's specialization. Assessment based on employer evaluations, student reports and faculty reviews. Available only to Greenlee School majors. Offered on a satisfactory-fail basis only.

ADVRT 4990B: Professional Media Internship: Optional

(Cross-listed with JLMC 4990B/ PR 4990B/ SMC 4990B).

Credits: 1-3. Repeatable.

Prereq: ([JLMC major; JLMC 1100; minimum of C+ in JLMC 3020 or JLMC 3030] or [ADVRT major; JLMC 1100; ADVRT 3010 or PR 3010; minimum of C+ in JLMC 2010] or [PR major; JLMC 1100; ADVRT 3010 or PR 3010; minimum of C+ in PR 3210] or [SMC major; minimum of C+ in JLMC 2010; SMC 3040 or SMC 3510]); *Advisor Approval*

Optional internship in the student's specialization. Assessment based on employer evaluations, student reports and faculty reviews. Available only to Greenlee School majors. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

Aerospace Engineering (AERE)

Courses primarily for undergraduates:

AERE 1600: Aerospace Engineering Problems With Computer Applications Laboratory

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Credit or enrollment in MATH 1650 or satisfactory (76+) score on mathematics placement exam

Introduction to aerospace engineering and systems thinking through engineering design team projects such as flight control of Lighter Than Air (LTA) vehicles. Introduction to programming using python. Solving aerospace engineering problems while learning about significant figures, estimation, units of measure, graphing, curve fitting, and presenting solutions through technical reports. Brief history of aerospace engineering. Satisfactory placement scores can be found at: <https://math.iastate.edu/academics/undergraduate/aleks/placement/>. Graduation Restriction: Only one of ENGR 1600, ABE 1600, AERE 1600, BME 1600, CE 1600, CHE 1600, CPRE 1850, EE 1850, IE 1480, ME 1600, and SE 1850 may count towards graduation. (Typically Offered: Fall, Spring)

AERE 1600H: Aerospace Engineering Problems With Computer Applications Laboratory: Honors

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Credit or enrollment in MATH 1650 or satisfactory (76+) score on mathematics placement exam; Membership in the University Honors Program

Solving aerospace engineering problems and presenting solutions through technical reports. Significant figures and estimation. SI units. Graphing and curve fitting. Introduction to aerospace engineering and engineering design. Spreadsheet programs. History of aerospace. Systems thinking. Team projects. Satisfactory placement scores can be found at: <https://math.iastate.edu/academics/undergraduate/aleks/placement/>. Graduation Restriction: Only one of ENGR 1600, ABE 1600, AERE 1600, CE 1600, CHE 1600, CPRE 1850, EE 1850, IE 1480, ME 1600, and SE 1850 may count towards graduation. (Typically Offered: Fall, Spring)

AERE 1610: Numerical, Graphical and Laboratory Techniques for Aerospace Engineering

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: (Credit in ABE 1600, AERE 1600, BME 1600, CE 1600, CHE 1600, CPRE 1850, EE 1850, ENGR 1600, IE 1480, ME 1600, or SE 1850) OR [(Enrollment in ABE 1600, AERE 1600, BME 1600, CE 1600, CHE 1600, CPRE 1850, EE 1850, ENGR 1600, IE 1480, ME 1600, or SE 1850) AND Instructor Permission]

Computer-based problem solving using Matlab(R), with emphasis on numerical methods. Introduction to solid modeling and aerospace design using SolidWorks. (Typically Offered: Fall, Spring)

AERE 1610H: Numerical, Graphical and Laboratory Techniques for Aerospace Engineering: Honors

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: (Credit in ABE 1600, AERE 1600, BME 1600, CE 1600, CHE 1600, CPRE 1850, EE 1850, ENGR 1600, IE 1480, ME 1600, or SE 1850) OR [(Enrollment in ABE 1600, AERE 1600, BME 1600, CE 1600, CHE 1600, CPRE 1850, EE 1850, ENGR 1600, IE 1480, ME 1600, or SE 1850) AND Instructor Permission]; Membership in University Honors Program

Computer-based problem solving using Matlab(R), with emphasis on numerical methods. Introduction to solid modeling and aerospace design using SolidWorks. (Typically Offered: Fall, Spring)

AERE 1920: Aerospace Seminar

Credits: Required. Contact Hours: Lecture 1.

Vectors, differentiation, integration, matrices, and systems of linear equations. (Typically Offered: Spring)

AERE 1920H: Aerospace Seminar: Honors

Credits: Required. Contact Hours: Lecture 1.

Prereq: Membership in the University Honors Program

Vectors, differentiation, integration, matrices, and systems of linear equations. (Typically Offered: Spring)

AERE 2610: Introduction to Performance and Design

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 1660 or MATH 1660H; PHYS 2210 or PHYS 2310 or PHYS 2310H; PHYS 2310L; Credit or enrollment in AERE 1610

Aerodynamics of the airplane, lift and drag, drag polar, propulsion characteristics of turbojets and piston props, level flight, range, endurance, climbing flight, turning flight, take-off and landing, design examples. (Typically Offered: Fall, Spring)

AERE 2650: Scientific Balloon Engineering and Operations

Credits: 1. Contact Hours: Laboratory 2.

Repeatable.

Engineering aspects of scientific balloon flights. Integration of science mission objectives with engineering requirements. Operations team certification. FAA and FCC regulations, communications, and command systems. Flight path prediction and control. (Typically Offered: Fall)

AERE 2900A: Aerospace Engineering Independent Study: Flight Ground Instruction

Credits: 1-2. Repeatable.

Prereq: Sophomore classification, approval of the department

AERE 2900B: Aerospace Engineering Independent Study: In-flight Training

Credits: 1-2. Repeatable.

Prereq: Instructor Permission for Course

AERE 2900C: Aerospace Engineering Independent Study: Other

Credits: 1-2. Repeatable.

Prereq: Instructor Permission for Course

AERE 2940: Make to Innovate I

Credits: 1. Repeatable.

Prereq: ENGR 1010 AND Freshman or Sophomore Classification

Multidisciplinary projects to engage students in the fundamentals of engineering, project management, systems engineering, teamwork, and oral and visual communication. Students will define and attain their team objectives and milestones that are approved by the instructor. Graduation Restriction: Can only be used toward graduation in these cases. To make credit deficiencies in 1000 or 2000 level courses. No more than 2 credits of AERE 2940 can be used to make-up credit deficiencies in 1000 or 2000 level courses. Cannot be used in any category or technical electives in the AERE curriculum. (Typically Offered: Fall, Spring)

AERE 3010: Flight Experience

Credits: Required.

Prereq: Credit or enrollment in AERE 3550

Two hours of in-flight training and necessary ground instruction. Course content prescribed by the Aerospace Engineering Department. Ten hours of flight training certified in a pilot log book can be considered by the course instructor as evidence of satisfactory performance in the course. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

AERE 3100: Aerodynamics I: Incompressible Flow

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 2650; Grade of C- or better in AERE 2610

Introduction to fluid mechanics and aerodynamics. Fluid properties and kinematics. Conservation equations in differential and integral form. Bernoulli's equation. Basic potential flow concepts and solutions. Boundary layer concept. Incompressible flow over airfoils and wings. Examples of numerical methods. Applications of multi-variable calculus to fluid mechanics and aerodynamics. (Typically Offered: Fall, Spring)

AERE 3110: Aerodynamics II: Compressible Flow

Credits: 3. Contact Hours: Lecture 3.

Prereq: AERE 3100 and ME 2310

Review of thermodynamics, energy equation, compressible flow, and isentropic flow. Normal and oblique shocks. Mach waves and expansion fans. Applications to ducts and nozzles. Compressible airfoil and wing theory. Introduction to advanced compressible flow topics. (Typically Offered: Fall, Spring)

AERE 3210: Flight Structures Analysis

Credits: 3. Contact Hours: Lecture 3.

Prereq: EM 3240 and Credit or concurrent enrollment in MATH 2660 or MATH 2670

Introduction to elasticity, airworthiness, and flight loads. Introduction to fatigue. Materials selection for flight applications. Thin walled cross-sections under bending, torsion, and shear loads using classical methods. Shear center. Column buckling. Matrix methods of structural analysis. (Typically Offered: Fall, Spring)

AERE 3220: Aerospace Structures Laboratory

Credits: 2. Contact Hours: Lecture 1, Laboratory 2.

Prereq: Credit or enrollment in AERE 3210

Design of experiments. Data analysis. Strain gage installation. Measurement of stiffness/strength of aluminum. Analysis/fabrication/testing of riveted joints. Shear/bending measurements in beam sections. Analysis/measurement of strains in frames. Buckling of columns. Stress concentration. Vibration testing of beams and plates. Fabrication/testing of composites. (Typically Offered: Fall, Spring)

AERE 3310: Flight Control Systems I

Credits: 3. Contact Hours: Lecture 3.

Prereq: AERE 3550

Linear system analysis. Control system designs using root-locus and frequency response methods. Applications in flight control systems. (Typically Offered: Fall, Spring)

AERE 3440: Aerodynamics and Propulsion Laboratory

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: AERE 3100 AND concurrent enrollment in AERE 3110

Similitude and dimensional analysis. Measurement uncertainty analysis. Pressure and velocity measurement methods and instruments. Pressure distribution around a circular cylinder. Aerodynamic performance of low-speed airfoils. Airfoil wake flow; Boundary layer flow. Flow visualization techniques for supersonic flows and de Laval nozzles. (Typically Offered: Fall, Spring)

AERE 3510: Astrodynamics I

Credits: 3. Contact Hours: Lecture 3.

Prereq: ME 3450

Introduction to astrodynamics. Two-body Keplerian satellite and planetary motion. Geocentric and extraterrestrial trajectories and applications. Ballistic missiles. (Typically Offered: Fall, Spring)

AERE 3550: Aircraft Flight Dynamics and Control

Credits: 3. Contact Hours: Lecture 3.

Prereq: AERE 2610, MATH 2670, and ME 3450

Aircraft rigid body equations of motion, linearization, and modal analysis. Longitudinal and lateral-directional static and dynamic stability analysis. Flight handling characteristics analysis. Longitudinal and lateral-directional open loop response to aircraft control inputs. Aircraft flight handling qualities. (Typically Offered: Fall, Spring)

AERE 3610: Computational Techniques for Aerospace Design

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: AERE 3100; EM 3240; (ENGL 3090 or ENGL 3140); ME 3450; MATH 2670

Advanced programming, workstation environment, and development of computational tools for aerospace analysis and design. Technical report writing. (Typically Offered: Fall, Spring)

AERE 3620: Aerospace Systems Integration

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500, Junior classification in Aerospace Engineering or permission of instructor for AERE 3620

Emphasis on impact of component interfaces in aerospace systems. Understand how changes in variables associated with individual components impact the performance of the aerospace system. Solving aerospace engineering problems and presenting solutions through reports. Specific integration challenges include: capturing implicit disciplinary interactions (e.g. structures/aerodynamics, propulsion/aerodynamics, etc.), propagating tolerances through the system (i.e. uncertainty modeling), balancing component attributes in the system objective. (Typically Offered: Fall, Spring)

AERE 3640: Cyber-Physical Systems Application

(Cross-listed with CPS 3640).

Credits: 3. Contact Hours: Laboratory 2, Lecture 2.

Repeatable.

Prereq: ENGR 1600 or equivalent; credit or enrollment in MATH 2670

Fundamental principles of cyber-physical systems and their system-level applications at an introductory level; introduction to radio control systems and control of actuators; computer programming of physical systems; data processing and communication; control loops; X-by-wire control systems; simulation; testing of control loops. (Typically Offered: Spring)

AERE 3810: Introduction to Wind Energy

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 1660 or MATH 1660H; PHYS 2310 or PHYS 2310H; PHYS 2310L

Basic introduction to the fundamentals of Wind Energy and Wind Energy conversion systems. Topics include but not limited to various types of wind energy conversion systems and the aerodynamics, blade and tower structural loads, kinematics of the blades and meteorology. (Typically Offered: Spring)

AERE 4070: Applied Formal Methods

(Dual-listed with AERE 5070/ COMS 5070). (Cross-listed with COMS 4070).

Credits: 3. Contact Hours: Lecture 3.

Prereq: AERE 3610 for AERE majors. COMS 3110 for COMS majors.

AERE 3610 or COMS 3110, or an equivalent course, plus instructor permission for other majors.

Introduction to the fundamentals of formal methods, a set of mathematically rigorous techniques for the formal specification, validation, and verification of safety- and security-critical systems. Tools, techniques, and applications of formal methods with an emphasis on real-world use-cases such as enabling autonomous operation. Build experience in writing mathematically analyzable specifications from English operational concepts for real cyberphysical systems, such as aircraft and spacecraft. Review capabilities and limitations of formal methods in the design, verification, and system health management of today's complex systems. (Typically Offered: Spring)

AERE 4110: Aerospace Vehicle Propulsion

Credits: 3. Contact Hours: Lecture 3.

Prereq: AERE 3110 and AERE 3440

Atmospheric propulsion system performance and cycle analysis. Momentum theorem, thrust and propulsive efficiency. Thermodynamics of compressible flow with heat and work addition. Components and principles of turbojet, ramjet, and turbofan aircraft engines. Introduction to rocket engines. (Typically Offered: Fall, Spring)

AERE 4120: Spacecraft Electric Propulsion

Credits: 3. Contact Hours: Lecture 3.

Prereq: AERE 3110

Electricity and magnetism. Plasma physics. Ion engine performance. Introduction to advanced electromagnetic propulsion systems. Energy sources and nuclear propulsion. Space mission requirements. (Typically Offered: Spring)

AERE 4130X: Hypersonic Aerothermodynamics

Credits: 3. Contact Hours: Lecture 3.

The course covers the aerodynamics, heat transfer, flight mechanics and propulsion for high speed flight, with a focus on high temperature gas dynamics. (Typically Offered: Fall, Spring)

AERE 4150: Rocket Propulsion

Credits: 3. Contact Hours: Lecture 3.

Prereq: AERE 3110 and AERE 3440

Components and principles of liquid rocket engines, solid rocket motors, and hybrid rocket motors. Rocket flight performance and rocket staging. Combustion and thermochemistry. Rocket cooling and nozzle heat transfer. Introduction to nuclear thermal propulsion and electric propulsion systems. Applications to spacecraft. (Typically Offered: Fall, Spring)

AERE 4170: Experimental Mechanics

(Dual-listed with EM 5170/ AERE 5170). (Cross-listed with EM 4170).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: EM 3240, and MATE 2730

Introduction to fundamental concepts for force, displacement, stress and strain measurements for structures and materials applications. Strain gage theory and application. Full field deformation measurements with laser interferometry and digital image processing. Advanced experimental concepts at the micro- and nano-scale regimes. Selected laboratory experiments. Offered even-numbered years. (Typically Offered: Fall)

AERE 4210: Advanced Flight Structures

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: AERE 3210, MATH 2660 or MATH 2670

Analysis of indeterminate flight structures including finite element laboratory. Static analysis of complex structural components subject to thermal and aerodynamic loads. Analytical and finite element solutions for stresses and displacements of membrane, plane stress, plate structures. Buckling of beams, frames, and plate structures. Introduction to vibration of flight structures. Steady state and transient structural response using normal modal analysis. (Typically Offered: Fall, Spring)

AERE 4220: Vibrations and Aeroelasticity

Credits: 3. Contact Hours: Lecture 3.

Prereq: EM 3240 or AERE 3210

Vibration theory. Steady and unsteady flows. Mathematical foundations of aeroelasticity, static and dynamic aeroelasticity. Linear unsteady aerodynamics, non-steady aerodynamics of lifting surfaces. Stall flutter. Aeroelastic problems in civil engineering structures. Aeroelastic problems of rotorcraft. Experimental aeroelasticity. Selected wind tunnel laboratory experiments. Offered even-numbered years. (Typically Offered: Spring)

AERE 4230: Composite Flight Structures

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: EM 3240, and MATE 2730

Fabrication, testing and analysis of composite materials used in flight structures. Basic laminate theory of beams, plates and shells. Manufacturing and machining considerations of various types of composites. Testing of composites for material properties, strength and defects. Student projects required. (Typically Offered: Spring)

AERE 4260: Design of Aerospace Structures

(Dual-listed with AERE 5260).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: EM 3240

Detailed design and analysis of aerospace vehicle structures. Material selection, strength, durability and damage tolerance, and validation analysis. Design for manufacturability. (Typically Offered: Fall)

AERE 4320: Flight Control Systems II

Credits: 3. Contact Hours: Lecture 3.

Prereq: AERE 3310

Aircraft lateral directional stability augmentation. Launch vehicle pitch control system design. Control of flexible vehicles. Satellite attitude control. Flight control designs based on state-space methods. Introduction to sample-data systems. (Typically Offered: Fall)

AERE 4330: Spacecraft Dynamics and Control

Credits: 3. Contact Hours: Lecture 3.

Prereq: ME 3450

Three-dimensional rotational kinematics and attitude dynamics of a rigid body in space. Classical stability analysis of spinning spacecraft with or without energy dissipation. Attitude dynamics, stability, and control of spacecraft in a circular orbit in the presence of gravity-gradient torques. Introduction to spacecraft attitude determination and control systems (ADCS) with emphasis on modern attitude determination algorithms. Simulation of spacecraft attitude dynamics and control problems of practical interest using programming and analysis software. (Typically Offered: Fall)

AERE 4420: V/STOL Aerodynamics and Performance

Credits: 3. Contact Hours: Lecture 3.

Prereq: AERE 2610

Introduction to the aerodynamics, performance, stability, control and critical maneuvering characteristics of V/STOL vehicles. Topics include hovercrafts, jet flaps, ducted fans and thrust vectored engines. (Typically Offered: Fall)

AERE 4450: Experimental Flow Mechanics and Heat Transfer

(Dual-listed with AERE 5450).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ABE 3780 or AERE 3100 or ME 3350

Similitude and dimensional analysis. Measurement uncertainty analysis; Fluid mechanical apparatus: wind tunnel and water tunnels. Various experimental techniques widely used for fluid mechanics, aerodynamics, heat transfer, and combustion studies: Pressure gauge and transducers; Pitot tube; hot wire anemometry; Shadowgraph and Schlieren Photography; laser Doppler velocimetry; particle image velocimetry (PIV); advanced PIV techniques (stereo PIV, 3-D PIV, Tomographic PIV, Holograph PIV and microscopic PIV); laser induced fluorescence; pressure sensitive painting, temperature sensitive painting; molecular tagging velocimetry; molecular tagging thermometry. Extensive applications and laboratory experiments will be included. (Typically Offered: Fall)

AERE 4460: Computational Fluid Dynamics

Credits: 3. Contact Hours: Lecture 3.

Prereq: AERE 3110 and AERE 3610

Introduction to computational fluid dynamics. Discretization, consistency, and stability. Explicit and implicit methods for ordinary and partial differential equations. Linearization techniques. Iterative and direct solution algorithms. Numerical methods for parabolic, elliptic and hyperbolic equations. Curvilinear coordinates and numerical grid generation. Applications to Euler, boundary-layer and Navier-Stokes equations. Proficiency in at least one programming language recommended. (Typically Offered: Fall)

AERE 4480: Fluid Dynamics of Turbomachinery

(Cross-listed with ME 4480).

Credits: 3. Contact Hours: Lecture 3.

Prereq: AERE 3110 or ME 3350

Applications of principles of fluid mechanics and thermodynamics in performance analysis and design of turbomachines. Conceptual and preliminary design of axial and radial flow compressors and turbines using velocity triangles and through-flow approaches. (Typically Offered: Spring)

AERE 4510: Orbital Mechanics

(Dual-listed with AERE 5510).

Credits: 3. Contact Hours: Lecture 3.

Prereq: AERE 3510

Review of solutions for Kepler's and Lambert's problems. Universal variables. Advanced orbit maneuvers. Restricted three-body problem and the stability of the Lagrange points. Spacecraft motion under continuous thrust. Relative orbital mechanics and Clohessy-Wiltshire equations. Orbit determination. (Typically Offered: Fall, Spring)

AERE 4520: Introduction To Systems Engineering And Analysis

(Cross-listed with IE 4520).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior classification in an Engineering major OR graduate standing

Principles of systems engineering to include problem statement formulation, stakeholder analysis, requirements definition, system architecture and concept generation, system integration and interface management, verification and validation, and system commissioning and decommissioning operations. Introduction to discrete event simulation processes. Students will work in groups to propose, research, and present findings for a systems engineering topic of current relevance. (Typically Offered: Summer)

AERE 4600X: Modern Design Methodology with Aeronautics Applications

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: AERE 3610, AERE 3110, AERE 3210, AERE 3220, AERE 3440, and AERE 3550

Introduction to modern engineering design methodology. Computational constrained optimal design approach including selection of objective function, characterization of constraint system, materials and strength considerations, and sensitivity analyses. This course assigns design projects in Aeronautics. (Typically Offered: Fall, Spring)

AERE 4610: Modern Design Methodology with Astronautics Applications

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: AERE 3610, AERE 3110, AERE 3210, AERE 3220, AERE 3440, AERE 3510, and AERE 3550

Introduction to modern engineering design methodology. Computational constrained optimal design approach including selection of objective function, characterization of constraint system, materials and strength considerations, and sensitivity analyses. This course assigns design projects in Astronautics. (Typically Offered: Fall, Spring)

AERE 4620: Design of Space Systems

Credits: 3. Contact Hours: Lecture 1, Laboratory 4.

Prereq: AERE 4610

Fundamental principles used in engineering design of space systems. Preliminary design of space vehicles. Engineering Ethics. This course assigns design projects in Astronautics. (Typically Offered: Fall, Spring)

AERE 4630: Introduction to Multidisciplinary Design Optimization

(Dual-listed with AERE 5630).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Senior classification in an Engineering major or Permission of Instructor

Introduction to the theory and methods of Multidisciplinary Design Optimization (MDO), including system coupling, system sensitivity methods, decomposition methods, MDO formulations (such as multiple-discipline feasible (MDF), individual discipline feasible (IDF) and all-at-once (AAO) approaches, and MDO search methods. (Typically Offered: Fall)

AERE 4640: Spacecraft Systems

Credits: 3. Contact Hours: Lecture 3.

Prereq: AERE 3510

An examination of spacecraft systems including attitude determination and control, power, thermal control, communications, propulsion, guidance, navigation, command and data handling, and mechanisms. Explanation of space and operational environments as they impact spacecraft design. Includes discussion of safety, reliability, quality, maintainability, testing, cost, legal, and logistics issues. (Typically Offered: Spring)

AERE 4680: Large-Scale Complex Engineered Systems (LSCES)

(Dual-listed with AERE 5680/ IE 5680). (Cross-listed with IE 4680).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Senior classification in an Engineering major or Permission of Instructor

Introduction to the theoretical foundation and methods associated with the design for large-scale complex engineered systems, including objective function formation, design reliability, value-driven design, product robustness, utility theory, economic factors for the formation of a value function and complexity science as a means of detecting unintended consequences in the product behavior. (Typically Offered: Spring)

AERE 4700X: Design of Aeronautical Systems

Credits: 3. Contact Hours: Lecture 1, Laboratory 4.

Prereq: AERE 4600X

Fundamental principles used in engineering design of aeronautical systems. Preliminary design of aeronautical vehicles. Engineering Ethics. This course assigns design projects in Aeronautics. (Typically Offered: Fall, Spring)

AERE 4730X: Random Variables

Credits: 3. Contact Hours: Lecture 3.

Prereq: AERE 3550

Introduction to the concept of a random variable and random processes in relation to various problems in probability and statistics. Emphasis on applications to aerospace engineering. (Typically Offered: Fall)

AERE 4800: Ultrasonic Nondestructive Evaluation

(Cross-listed with EM 4800/ MATE 4800).

Credits: 3. Contact Hours: Lecture 3.

Prereq: EM 3240 or MATE 3190; MATH 2660 or MATH 2670; PHYS 2320

Introduction to stress/strain, Hooke's law, and elastic wave propagation in two dimensions in isotropic media. Ultrasonic plane-wave reflection and transmission; and simple straight-crested guided waves. Transducer construction, behavior, and performance. Simple signal analysis and discrete signal processing. The last few weeks of the course are devoted to case studies. (Typically Offered: Spring)

AERE 4830: Aeroacoustics

(Dual-listed with AERE 5830).

Credits: 3. Contact Hours: Lecture 3.

Prereq: AERE 3110 or ME 3350 and MATH 2660 or MATH 2670

Noise metrics, Linear wave equation and its solution in 1-, 2-, and 3-D using Green's functions. Propagation of sound in free and confined spaces. Aerodynamic noise sources in engineering machines: aircraft engine noise, airfram noise, wind turbine noise, etc.

AERE 4900A: Aerospace Engineering Independent Study: Aero and/or Gas Dynamics

Credits: 1-6. Repeatable.

*Prereq: Junior or Senior classification; Instructor Permission***AERE 4900B: Aerospace Engineering Independent Study: Propulsion**

Credits: 1-6. Repeatable.

*Prereq: Junior or Senior classification; Instructor Permission***AERE 4900C: Aerospace Engineering Independent Study: Aerospace Structures**

Credits: 1-6. Repeatable.

*Prereq: Junior or Senior classification; Instructor Permission***AERE 4900D: Aerospace Engineering Independent Study: Flight Dynamics**

Credits: 1-6. Repeatable.

*Prereq: Junior or Senior classification; Instructor Permission***AERE 4900E: Aerospace Engineering Independent Study: Spacecraft Systems**

Credits: 1-6. Repeatable.

*Prereq: Junior or Senior classification; Instructor Permission***AERE 4900F: Aerospace Engineering Independent Study: Flight Control Systems**

Credits: 1-6. Repeatable.

*Prereq: Junior or Senior classification; Instructor Permission***AERE 4900G: Aerospace Engineering Independent Study: Aeroelasticity**

Credits: 1-6. Repeatable.

*Prereq: Junior or Senior classification; Instructor Permission***AERE 4900H: Aerospace Engineering Independent Study: Independent Study, Honors**

Credits: 1-6. Repeatable.

*Prereq: Junior or Senior classification; Instructor Permission; Membership in the University Honors Program***AERE 4900I: Aerospace Engineering Independent Study: Design**

Credits: 1-6. Repeatable.

*Prereq: Junior or Senior classification; Instructor Permission***AERE 4900J: Aerospace Engineering Independent Study: Non-destructive Evaluation**

Credits: 1-6. Repeatable.

*Prereq: Junior or Senior classification; Instructor Permission***AERE 4900K: Aerospace Engineering Independent Study: Wind Engineering**

Credits: 1-6. Repeatable.

*Prereq: Junior or Senior classification; Instructor Permission***AERE 4900L: Aerospace Engineering Independent Study: Multi-functional Ultra-light Structures**

Credits: 1-6. Repeatable.

*Prereq: Junior or Senior classification; Instructor Permission***AERE 4900M: Aerospace Engineering Independent Study: Intelligent Systems and Autonomy**

Credits: 1-6. Repeatable.

Prereq: Junior or Senior classification; Instructor Permission

(Typically Offered: Fall, Spring, Summer)

AERE 4900O: Aerospace Engineering Independent Study: Other

Credits: 1-6. Repeatable.

*Prereq: Junior or Senior classification; Instructor Permission***AERE 4940: Make to Innovate II**

Credits: 2-3. Repeatable.

Prereq: Junior or Senior Classification

Multidisciplinary projects to engage students in the fundamentals of engineering, project management, systems engineering, teamwork, and oral and visual communication. Students will define and attain their team objectives and milestones that are approved by their instructors.

Graduation Restriction: Maximum of 6 credits may count toward graduation as Technical Elective. (Typically Offered: Fall, Spring)

AERE 4990: Senior Project

Credits: 1-2. Repeatable.

Prereq: Senior classification, credit or enrollment in AERE 4910

Development of aerospace principles and concepts through individual research and projects. Written report. (Typically Offered: Fall, Spring)

Courses primarily for graduate students, open to qualified undergraduates:**AERE 5010: Advanced Engineering Analysis**

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Linear ordinary differential equations with variable coefficients; hyperbolic, parabolic, and elliptic equations; tensors. (Typically Offered: Fall)

AERE 5070: Applied Formal Methods

(Dual-listed with AERE 4070/ COMS 4070). (Cross-listed with COMS 5070).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to the fundamentals of formal methods, a set of mathematically rigorous techniques for the formal specification, validation, and verification of safety- and security-critical systems. Tools, techniques, and applications of formal methods with an emphasis on real-world use-cases such as enabling autonomous operation. Build experience in writing mathematically analyzable specifications from English operational concepts for real cyberphysical systems, such as aircraft and spacecraft. Review capabilities and limitations of formal methods in the design, verification, and system health management of today's complex systems. (Typically Offered: Spring)

AERE 5110: Wind Energy System Design

(Cross-listed with WESEP 5110).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Advanced design, control, and operation of wind plants. Topics include electromechanical energy conversion systems, aerodynamic and aeroelastic loads, optimal control of wind farms, life cycle management strategies, tall tower design, and prediction of component residual life.

AERE 5130X: Hypersonic Aerothermodynamics

Credits: 3. Contact Hours: Lecture 3.

The course covers the aerodynamics, heat transfer, flight mechanics and propulsion for high speed flight, with a focus on high temperature gas dynamics.

AERE 5140: Advanced Mechanics of Materials

(Cross-listed with EM 5140).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Theory of stress and strain, stress-strain relationships. Unsymmetrical bending, curved beams, shear center. Torsion of thin-walled noncircular sections. Equilibrium, compatibility equations. Airy stress functions. Membrane stresses in shells, thick-walled cylinders. (Typically Offered: Fall)

AERE 5150: Atomistic and Multiscale Mechanics of Materials

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to atomistic and multiscale computational methodology for the graduate-level study of mechanics of materials. At the end of this course, students will have an awareness and understanding of the application of atomistic and multiscale materials modeling techniques to fracture, plasticity, phase transformation, corrosion, thermal and mass transport in a variety of engineering materials. Offered odd-numbered years. (Typically Offered: Fall)

AERE 5170: Experimental Mechanics

(Dual-listed with EM 4170/ AERE 4170). (Cross-listed with EM 5170).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Introduction to fundamental concepts for force, displacement, stress and strain measurements for structures and materials applications. Strain gage theory and application. Full field deformation measurements with laser interferometry and digital image processing. Advanced experimental concepts at the micro- and nano-scale regimes. Selected laboratory experiments. Offered even-numbered years. (Typically Offered: Fall)

AERE 5210: Airframe Analysis

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Analysis of static stresses and deformation in continuous aircraft structures. Various analytical and approximate methods of analysis of isotropic and anisotropic plates and shells. (Typically Offered: Fall)

AERE 5220: Design and Analysis of Composite Materials

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Composite constituent materials, micro-mechanics, laminate analysis, hygro-thermal analysis, composite failure, joining of composites, design of composite beams and plates, honeycomb core, manufacturing of composites, short fiber composites, and demonstration laboratory. (Typically Offered: Fall)

AERE 5240: Numerical Mesh Generation

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to modern mesh generation techniques. Structured and unstructured mesh methods, algebraic and PDE methods, elliptic and hyperbolic methods, variational methods, error analysis, Delaunay triangulation, data structures, geometric modeling with B-spline and NURBS surfaces, surface meshing. (Typically Offered: Fall)

AERE 5250: Finite Element Analysis

(Cross-listed with EM 5250).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Variational and weighted residual approach to finite element equations. Emphasis on two- and three-dimensional problems in solid mechanics. Isoparametric element formulation, higher order elements, numerical integration, imposition of constraints and penalty, convergence, and other more advanced topics. Use of two- and three-dimensional computer programs. Dynamic and vibrational problems, eigenvalues, and time integration. Introduction to geometric and material nonlinearities.

(Typically Offered: Spring)

AERE 5260: Design of Aerospace Structures

(Dual-listed with AERE 4260).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Detailed design and analysis of aerospace vehicle structures. Material selection, strength, durability and damage tolerance, and validation analysis. Design for manufacturability. (Typically Offered: Fall)

AERE 5310: Automatic Control of Flight Vehicles

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Applications of classical and modern linear control theory to automatic control of flight vehicles. Spacecraft attitude control. Control of flexible vehicles. Linear-quadratic regulator design applications. (Typically Offered: Spring)

AERE 5320: Compressible Fluid Flow

(Cross-listed with ME 5320).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Thermodynamics of compressible flow. Viscous and inviscid compressible flow equations. One dimensional steady flow; isentropic flow, shocks, expansions. Multidimensional compressible flow aspects. Linear and nonlinear wave analysis and method of characteristics. Subsonic, transonic, supersonic and hypersonic flows. (Typically Offered: Spring)

AERE 5380: Foundations of Engineering Education

(Cross-listed with ENGR 5380/ HGED 5380).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to the field of engineering education, with an emphasis on engineering education history, existing challenges, teaching and learning pedagogies and theories, research opportunities, and research methodologies. The course goal is to develop students as scholars and to have students think critically about engineering and education. Students will apply the knowledge gained from this course to propose a research project related to their own discipline. The proposal is intended to help students learn and apply the key elements of engineering education research. This course is intended for students with a variety of interests and career goals, including those interested in learning to conduct engineering education research, exploring research discoveries about teaching and learning, and engaging with the engineering education community. (Typically Offered: Fall)

AERE 5410: Incompressible Flow Aerodynamics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Kinematics and dynamics of fluid flow. Derivation of the Navier-Stokes, Euler and potential flow equations. Introduction to generalized curvilinear coordinates. Ideal fluids. Two-dimensional and three-dimensional potential flow. Complex variable methods. (Typically Offered: Fall)

AERE 5440: Viscous Flow

Credits: 3. Contact Hours: Lecture 3.

Prereq: AERE 3110 or ME 3350

Kinematics and dynamics of compressible viscous fluid flow in aerodynamics. Derivation of the Navier-Stokes and compressible Prandtl boundary layer equations. Asymptotic analysis and solution methods for low/high Reynolds number compressible boundary layer flows. (Typically Offered: Spring)

AERE 5450: Experimental Flow Mechanics and Heat Transfer

(Dual-listed with AERE 4450).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Similitude and dimensional analysis. Measurement uncertainty analysis; Fluid mechanical apparatus: wind tunnel and water tunnels. Various experimental techniques widely used for fluid mechanics, aerodynamics, heat transfer, and combustion studies: Pressure gauge and transducers; Pitot tube; hot wire anemometry; Shadowgraph and Schlieren Photography; laser Doppler velocimetry; particle image velocimetry (PIV); advanced PIV techniques (stereo PIV, 3-D PIV, Tomographic PIV, Holograph PIV and microscopic PIV); laser induced fluorescence; pressure sensitive painting, temperature sensitive painting; molecular tagging velocimetry; molecular tagging thermometry. Extensive applications and laboratory experiments will be included. (Typically Offered: Fall)

AERE 5460: Computational Fluid Mechanics and Heat Transfer I

(Cross-listed with ME 5460).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Basic concepts of discretization, consistency, and stability. Explicit and implicit methods for ordinary differential equations. Methods for each type of partial differential equation. Iterative solution methods; curvilinear grids. Students will program basic algorithms. (Typically Offered: Fall)

AERE 5470: Computational Fluid Mechanics and Heat Transfer II

(Cross-listed with ME 5470).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Application of computational methods to current problems in fluid mechanics and heat transfer. Methods for solving the Navier-Stokes and reduced equation sets such as the Euler, boundary layer, and parabolized forms of the conservation equations. Introduction to relevant aspects of grid generation and turbulence modeling. (Typically Offered: Spring)

AERE 5510: Orbital Mechanics

(Dual-listed with AERE 4510).

Credits: 3. Contact Hours: Lecture 3.

Review of 2-body problem. Orbital maneuvers. Relative motion in orbit. Orbit perturbation analysis. Gravity field expansions and effects on orbiters. 3-body problem with applications. (Typically Offered: Fall)

AERE 5560: Guidance and Navigation of Aerospace Vehicles

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Principles of guidance systems for spacecraft, launch vehicles, homing and ballistic missiles. Optimal guidance. Interplanetary transfer guidance with low thrust. Principles of inertial navigation. Theory and applications of the Global Positioning System. Celestial navigation procedures. Application of Kalman filtering to recursive navigation theory. (Typically Offered: Fall)

AERE 5630: Introduction to Multidisciplinary Design Optimization

(Dual-listed with AERE 4630).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to the theory and methods of Multidisciplinary Design Optimization (MDO), including system coupling, system sensitivity methods, decomposition methods, MDO formulations (such as multi-discipline feasible (MDF), individual discipline feasible (IDF) and all-at-once (AAO) approaches, and MDO search methods. (Typically Offered: Fall)

AERE 5640: Fracture and Fatigue

(Cross-listed with EM 5640/ ME 5640/ MSE 5640).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Materials and mechanics approach to fracture and fatigue. Fracture mechanics, brittle and ductile fracture, fracture and fatigue characteristics, fracture of thin films and layered structures. Fracture and fatigue tests, mechanics and materials designed to avoid fracture or fatigue. Offered even-numbered years. (Typically Offered: Fall)

AERE 5650: Systems Engineering and Analysis

(Cross-listed with IE 5650/ EE 5650).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Classification or Permission of Department

Introduction to organized multidisciplinary approach to designing and developing systems. Concepts, principles, and practice of systems engineering as applied to large integrated systems. Life cycle costing, scheduling, risk management, functional analysis, conceptual and detail design, test and evaluation, and systems engineering planning and organization. Graduation Restrictions: Not available for degrees in industrial engineering.

AERE 5660: Avionics Systems Engineering

(Cross-listed with EE 5660).

Credits: 3. Contact Hours: Lecture 3.

Avionics functions. Applications of systems engineering principles to avionics. Top down design of avionics systems. Automated design tools. (Typically Offered: Spring)

AERE 5680: Large-Scale Complex Engineered Systems (LSCES)

(Dual-listed with AERE 4680/ IE 4680). (Cross-listed with IE 5680).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to the theoretical foundation and methods associated with the design for large-scale complex engineered systems, including objective function formation, design reliability, value-driven design, product robustness, utility theory, economic factors for the formation of a value function and complexity science as a means of detecting unintended consequences in the product behavior. (Typically Offered: Spring)

AERE 5690: Mechanics of Composite and Combined Materials

(Cross-listed with EM 5690/ MSE 5690).

Credits: 3. Contact Hours: Lecture 3.

Prereq: EM 3240

Mechanics of fiber-reinforced materials. Micromechanics of lamina. Macromechanical behavior of lamina and laminates. Strength and interlaminar stresses of laminates. Failure criteria. Stress analysis of laminates. Thermal moisture and residual stresses. Joints in composites. Offered even-numbered years. (Typically Offered: Spring)

AERE 5700: Wind Engineering

(Cross-listed with EM 5700).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ABE 3780 and ME 3450

Atmospheric circulations, atmospheric boundary layer wind, bluff-body aerodynamics, aeroelastic phenomena, wind-tunnel and full-scale testing, wind-load code and standards, effect of tornado and thunderstorm winds, design applications. Offered odd-numbered years. (Typically Offered: Spring)

AERE 5720: Turbulence

(Cross-listed with CHE 5720).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Qualitative features of turbulence. Statistical representation of turbulent velocity fields: averages, moments, correlations, length and time scales and the energy cascade. Averaged equations of motion, closure requirements, Reynolds averaged models. Homogeneous shear flows, free shear flows, boundary layers. Numerical simulation of turbulence: DNS, LES, DES.

AERE 5730: Random Signal Analysis and Kalman Filtering

(Cross-listed with EE 5730/ ME 5730).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Elementary notions of probability. Random processes. Autocorrelation and spectral functions. Estimation of spectrum from finite data. Response of linear systems to random inputs. Discrete and continuous Kalman filter theory and applications. Smoothing and prediction. Linearization of nonlinear dynamics. (Typically Offered: Fall)

AERE 5740: Optimal Control

(Cross-listed with EE 5740/ ME 5740).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

The optimal control problem. Variational approach. Pontryagin's principle, Hamilton-Jacobi equation. Dynamic programming. Time-optimal, minimum fuel, minimum energy control systems. The regulator problem. Structures and properties of optimal controls. (Typically Offered: Spring)

AERE 5750: Introduction to Robust Control

(Cross-listed with EE 5750/ ME 5750).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to modern robust control. Model and signal uncertainty in control systems. Uncertainty description. Stability and performance robustness to uncertainty. Solutions to the H₂, H_∞, and L₁ control problems. Tools for robustness analysis and synthesis.

AERE 5760: Digital Feedback Control Systems

(Cross-listed with EE 5760/ ME 5760).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Sampled data, discrete data, and the z-transform. Design of digital control systems using transform methods: root locus, frequency response and direct design methods. Design using state-space methods. Controllability, observability, pole placement, state estimators. Digital filters in control systems. Microcomputer implementation of digital filters. Finite wordlength effects. Linear quadratic optimal control in digital control systems. Simulation of digital control systems. (Typically Offered: Fall)

AERE 5770: Linear Systems

(Cross-listed with EE 5770/ ME 5770/ MATH 5770).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Linear algebra review. Least square method and singular value decomposition. State space modeling of linear continuous-time systems. Solution of linear systems. Controllability and observability. Canonical description of linear equations. Stability of linear systems. State feedback and pole placements. Observer design for linear systems. (Typically Offered: Fall)

AERE 5780: Nonlinear Systems

(Cross-listed with EE 5780/ ME 5780/ MATH 5780).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Linear vs nonlinear systems. Phase plane analysis. Bifurcation and center manifold theory. Lyapunov stability. Absolute stability of feedback systems. Input-output stability. Passivity theory and feedback linearization. Nonlinear control design techniques. (Typically Offered: Spring)

AERE 5810: Perturbation Methods

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Mathematical perturbation methods with applications to ordinary and partial differential equations. Perturbation expansions. Order of magnitude and gauge functions. Matched asymptotic expansions. Boundary layer problems. Multiple scales. Resonance and mode coupling. Solvability conditions for differential equations. Physical and engineering applications. (Typically Offered: Fall)

AERE 5830: Aeroacoustics

(Dual-listed with AERE 4830).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Noise metrics, Linear wave equation and its solution in 1-, 2-, and 3-D using Green's functions. Propagation of sound in free and confined spaces. Aerodynamic noise sources in engineering machines: aircraft engine noise, airfram noise, wind turbine noise, etc.

AERE 5900A: Aerospace Engineering Independent Study: Aero and/or Gas Dynamics

Credits: 1-5. Repeatable, maximum of 3 times.

Prereq: Instructor Permission for Course

AERE 5900B: Aerospace Engineering Independent Study: Propulsion

Credits: 1-5. Repeatable, maximum of 3 times.

Prereq: Instructor Permission for Course

AERE 5900C: Aerospace Engineering Independent Study: Aerospace Structures

Credits: 1-5. Repeatable, maximum of 3 times.

Prereq: Instructor Permission for Course

AERE 5900D: Aerospace Engineering Independent Study: Flight Dynamics

Credits: 1-5. Repeatable, maximum of 3 times.

Prereq: Instructor Permission for Course

AERE 5900E: Aerospace Engineering Independent Study: Spacecraft Systems

Credits: 1-5. Repeatable, maximum of 3 times.

Prereq: Instructor Permission for Course

AERE 5900F: Aerospace Engineering Independent Study: Flight Control Systems

Credits: 1-5. Repeatable, maximum of 3 times.

Prereq: Instructor Permission for Course

AERE 5900G: Aerospace Engineering Independent Study: Aeroelasticity

Credits: 1-5. Repeatable, maximum of 3 times.

Prereq: Graduate Standing or Permission of Instructor

AERE 5900H: Aerospace Engineering Independent Study: Viscous Aerodynamics

Credits: 1-5. Repeatable, maximum of 3 times.

Prereq: Instructor Permission for Course

AERE 5900I: Aerospace Engineering Independent Study: Design

Credits: 1-5. Repeatable, maximum of 3 times.

Prereq: Instructor Permission for Course

AERE 5900J: Aerospace Engineering Independent Study: Hypersonics

Credits: 1-5. Repeatable, maximum of 3 times.

Prereq: Instructor Permission for Course

AERE 5900K: Aerospace Engineering Independent Study: Computational Aerodynamics

Credits: 1-5. Repeatable, maximum of 3 times.

Prereq: Instructor Permission for Course

AERE 5900L: Aerospace Engineering Independent Study: Optimization

Credits: 1-5. Repeatable, maximum of 3 times.

Prereq: Instructor Permission for Course

AERE 5900M: Aerospace Engineering Independent Study: Non Destructive Evaluation

Credits: 1-5. Repeatable, maximum of 3 times.

Prereq: Instructor Permission for Course

AERE 5900N: Aerospace Engineering Independent Study: Wind Engineering

Credits: 1-5. Repeatable, maximum of 3 times.

Prereq: Instructor Permission for Course

AERE 5900Q: Aerospace Engineering Independent Study: Astrodynamics

Credits: 1-5. Repeatable, maximum of 3 times.

Prereq: Instructor Permission for Course

Independent Study for Astrodynamics. (Typically Offered: Fall, Spring, Summer)

AERE 5900R: Aerospace Engineering Independent Study: Ocean Wave Energy Conversion

Credits: 1-5. Repeatable, maximum of 3 times.

Prereq: Instructor Permission for Course

Independent Study for Ocean Wave Energy Conversion. (Typically Offered: Fall, Spring, Summer)

AERE 5910: Graduate Student Seminar Series

Credits: Required. Contact Hours: Lecture 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Presentation of professional topics by department graduate students. Development of presentation skills used in a professional conference setting involving question and answer format.

AERE 5990: Creative Component

Credits: 1-5. Repeatable.

Prereq: Instructor Permission for Course

Courses for graduate students:**AERE 6400: Stability of Fluid Flow**

Credits: 3. Contact Hours: Lecture 3.

Theoretical methods of stability analysis; linear analysis of exchange of stability and over stability; bifurcation of equilibria; most dangerous modes and pattern formation; shear flow stability theorems. Physical mechanisms. Tollmein-Schlichting waves, disintegration of capillary jets, Benard convection, Taylor-Couette flow, centrifugal instability, double diffusion.

AERE 6470: Advanced Computational Fluid Dynamics

(Cross-listed with ME 6470).

Credits: 3. Contact Hours: Lecture 3.

An examination of current methods in computational fluid dynamics. Differencing strategies. Advanced solution algorithms for unstructured meshes. Grid generation. Construction of higher-order CFD algorithms. Parallel computing. Current applications. Use of state of the art CFD codes. (Typically Offered: Spring)

AERE 6510: Space Trajectory Optimization

Credits: 3. Contact Hours: Lecture 3.

Classical methods and recent advances in space trajectory optimization. Primer vector theory, introduction to direct and indirect methods for trajectory optimization, the problem of multi gravity assist with deep space maneuvers (MGADSM), optimization of the MGADSM using evolutionary algorithms, hidden genes genetic algorithms for trajectory optimization, and shape-based methods for trajectory design. Offered odd-numbered years. (Typically Offered: Spring)

AERE 6730X: Nonlinear Estimation in Astrodynamics

(Cross-listed with ECPE 6730X/ STAT 6730X/ MATH 6730X).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (AERE 5730 or EE 5080 or STAT 5440) or (two of the following: STAT 3050, STAT 5000, STAT 5100, STAT 5200, MATH 5540)

Transformation and propagation of random variables. Understanding and developing linear and nonlinear filters. Covering Gaussian Multiple Models, Particle Filtering, Particle Flow, and Polynomial Update. Applications to navigation and estimation in astrodynamics, such as orbit determination, station keeping, attitude determination, and relative pose estimation.

AERE 6900A: Aerospace Engineering Independent Study: Aero and/or Gas Dynamics

Credits: 1-5. Repeatable.

Prereq: Instructor Permission for Course

AERE 6900B: Aerospace Engineering Independent Study: Propulsion

Credits: 1-5. Repeatable.

Prereq: Instructor Permission for Course

AERE 6900C: Aerospace Engineering Independent Study: Aerospace Structures

Credits: 1-5. Repeatable.

Prereq: Instructor Permission for Course

AERE 6900D: Aerospace Engineering Independent Study: Flight Dynamics

Credits: 1-5. Repeatable.

Prereq: Instructor Permission for Course

AERE 6900E: Aerospace Engineering Independent Study: Spacecraft Systems

Credits: 1-5. Repeatable.

Prereq: Instructor Permission for Course

AERE 6900F: Aerospace Engineering Independent Study: Flight Control Systems

Credits: 1-5. Repeatable.

Prereq: Instructor Permission for Course

AERE 6900G: Aerospace Engineering Independent Study: Aeroelasticity

Credits: 1-5. Repeatable.

AERE 6900H: Aerospace Engineering Independent Study: Viscous Aerodynamics

Credits: 1-5. Repeatable.

*Prereq: Instructor Permission for Course***AERE 6900I: Aerospace Engineering Independent Study: Design**

Credits: 1-5. Repeatable.

AERE 6900J: Aerospace Engineering Independent Study: Hypersonics

Credits: 1-5. Repeatable.

AERE 6900K: Aerospace Engineering Independent Study: Computational Aerodynamics

Credits: 1-5. Repeatable.

*Prereq: Instructor Permission for Course***AERE 6900L: Aerospace Engineering Independent Study: Non Destructive Evaluation**

Credits: 1-5. Repeatable.

*Prereq: Instructor Permission for Course***AERE 6900M: Aerospace Engineering Independent Study: Wind Engineering**

Credits: 1-5. Repeatable.

*Prereq: Instructor Permission for Course***AERE 6970: Engineering Internship**

Credits: Required. Repeatable.

One semester and one summer maximum per academic year professional work period. Offered on a satisfactory-fail basis only.

AERE 6990: Research

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Offered on a satisfactory-fail basis only.

African and African American Studies (AFAM)

Courses primarily for undergraduates:**AFAM 2010: Introduction to African American Studies**

Credits: 3. Contact Hours: Lecture 3.

An interdisciplinary introduction to the study of African American culture. Includes history, the social sciences, literature, religion, and the arts, as well as conceptual frameworks for investigation and analysis of the African American experience. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall, Spring)

AFAM 3100: Africa to 1880

(Cross-listed with HIST 3100).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Survey of the history of African societies, cultures and civilizations from earliest times to 1880. Evolution of states across the continent; social, economic, political, and cultural developments; nature and consequences of African interactions and relationship with Europeans. Meets International Perspectives Requirement.

AFAM 3110: Africa under Colonial Rule

(Cross-listed with HIST 3110).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Development of Africa from imposition of colonial rule to independence, including processes of European domination, African reaction and resistance, emergence of nationalism, and dismantling of colonialism. Meets International Perspectives Requirement.

AFAM 3270: Strategies of Resistance: From Slavery to Hip-Hop & Black Lives Matter

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Analysis of strategies of resistance and protest against inequality within African American communities; emphasis on the historical, socio-political and economic contexts in which resistance emerges; includes examination of contemporary forms of protests.

AFAM 3300: Ethnic and Race Relations

(Cross-listed with SOC 3300).

Credits: 3. Contact Hours: Lecture 3.

Analysis of ethnic and race relations, particularly in America; emphasis on the sociology and psychology of race and ethnic relations. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall, Spring, Summer)

AFAM 3340: Africana Religions

(Cross-listed with RELIG 3340).

Credits: 3. Contact Hours: Lecture 3.

A focused study of the religious histories and cultures of West Africans and their descendants in the Americas. Topics include West African traditions, Christianity, Islam, and indigenous Afro-Caribbean religions, with attention to their gendered, theological, and cultural dimensions. Prior course work in Religious Studies or African American Studies recommended. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall)

AFAM 3350: Race, Ethnicity, and the US Criminal Justice System

(Cross-listed with CJ 3350).

Credits: 3. Contact Hours: Lecture 2, Discussion 1.

Empirical and theoretical readings on the intersection of race, ethnicity, crime, and the criminal justice system in contemporary society. Topics include, but are not limited to racial and ethnic relations in society, media, violence, policing, and disparity and discrimination in crime and punishment. Criminological theories of racial and ethnic antagonism. Meets U.S. Cultures and Communities Requirement.

AFAM 3470: African American Literature

(Cross-listed with ENGL 3470).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500

Focused study of literature by African American writers. May include focus on a particular genre (fiction, non-fiction, poetry, film, drama, media), author, event, movement, or theme.

AFAM 3500: Women of Color in the U.S

(Cross-listed with WGS 3500).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 3 credits in WGS or AFAM

Economic, social, political and cultural roles of Women of Color in the U.S. Includes literary, philosophical, and artistic expressions. Myths and realities explored.

AFAM 3530: History of African Americans I

(Cross-listed with HIST 3530).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Examines African roots of black culture and the African American experience in the United States from the colonial period through the Civil War. Topics include Atlantic Slave Trade, slavery and American identity, abolition, the emergence of Black Nationalism, and black participation in the Civil War. Meets U.S. Cultures and Communities Requirement.

AFAM 3540: History of African Americans II

(Cross-listed with HIST 3540).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Explores African American political thought and political action from Reconstruction to the present. Topics include rise of Jim Crow segregation, urban migration, Garvey movement, Harlem Renaissance, Depression and world wars, Pan-Africanism, civil rights, Black Power, and black feminism. Meets U.S. Cultures and Communities Requirement.

AFAM 3550: Understanding Sub-Saharan Africa

(Cross-listed with ANTHR 3550).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Survey of economic, social, political and historical processes that have shaped representations of Africa and Africans. Topics include colonialism, globalization, gender and LGBTQ rights, conflict and representations in Western media. Offered even-numbered years. Meets International Perspectives Requirement. (Typically Offered: Spring)

AFAM 4600: Seminar in African American Culture

Credits: 3. Contact Hours: Lecture 3.

Prereq: Instructor Permission for Course

Intensive study of a selected topic in African-American Studies in one or more disciplines. Selected readings of various authors, movements, eras, or genres. Primary and secondary source materials. (Typically Offered: Spring)

AFAM 4690X: History of Racial Violence in Europe and the United States, 1865-1945

(Cross-listed with HIST 4690X).

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Permission of Instructor; Sophomore classification

History of racial and genocidal violence comparing the experiences of Black, Latino/a/x, Native, and Asian peoples in the United States with Jewish people, the Romani, and people of African descent in Europe. The class focuses on the forms of individual and state-sponsored violence, culminating in the Holocaust. Field trip to Washington, D.C. Meets U.S. Cultures and Communities Requirement.

AFAM 4730: Civil Rights and Ethnic Power

(Cross-listed with HIST 4730/ USLS 4730).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Comparative history of the civil rights and ethnic power movements (African American, Chicano, American Indian, Puerto Rican, among others) in the U.S. from World War II to the present. Topics include institutional foundations, leadership, gender and racial dynamics, and the convergences and divergences of these differing ethnic struggles for rights. Meets U.S. Cultures and Communities Requirement.

AFAM 4900: Independent Study

Credits: 1-3. Repeatable, maximum of 3 credits.

Prereq: Instructor Permission for Course

Agricultural and Biosystems Engineering (ABE)

Courses primarily for undergraduates:

ABE 1020: Learning Communities

Credits: 0.5. Contact Hours: Laboratory 1.

8 week learning communities course focusing on student success, engineering, and department curriculum. Building community within the ABE Department. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

ABE 1100: Experiencing Agricultural and Biosystems Engineering

Credits: 1. Contact Hours: Laboratory 2.

Laboratory-based, team-oriented experiences in a spectrum of topics common to the practice of agricultural and biosystems engineering. Report writing, co-ops, internships, careers, registration planning. (Typically Offered: Spring)

ABE 1600: Systematic Problem Solving and Computer Programming

Credits: 3.

Prereq: Credit or enrollment in MATH 1430 or MATH 1650

Systematic problem-solving using principles of dynamics, statics, mass/energy conservation, and algorithmic thinking. Use of spreadsheet programs and computer programming language(s) to solve engineering problems. Graduation Restriction: Only one of ENGR 1600, ABE 1600, AERE 1600, CE 1600, CHE 1600, CPRE 1850, EE 1850, IE 1480, ME 1600, and SE 1850 may count towards graduation. (Typically Offered: Fall, Spring)

ABE 1700: Engineering Graphics and Introductory Design

Credits: 3.

Applications of multi-view drawings and dimensioning. Techniques for visualizing, analyzing, and communicating 3-D geometries. Application of the design process including written and oral reports.

ABE 2010: Preparing for Workplace Seminar

(Cross-listed with TSM 2010).

Credits: 1. Contact Hours: Lecture 1.

Prereq: Major in AE, AST, BSE, or ITEC; Sophomore classification

8 week course. Professionalism in the context of the engineering/technical workplace. Development of intrapersonal and interpersonal qualities including talent assessment; key workplace competency demonstration; leadership practice assessment; preparation of resume; cover letter preparation and behavioral-based interviewing; readiness for internship attainment. (Typically Offered: Fall, Spring)

ABE 2160: Fundamentals of Agricultural and Biosystems Engineering

Credits: 3. Contact Hours: Lecture 3.

Prereq: ABE 1600 or Permission of Department

Application of mathematics and engineering sciences in agricultural and biosystems engineering. Emphasis is on solving engineering problems. (Typically Offered: Fall)

ABE 2180: Project Management & Design in Agricultural and Biosystems Engineering

Credits: 2. Contact Hours: Lecture 1, Laboratory 2.

Prereq: ABE 2160

Engineering design process with emphasis on criteria and constraints, ideation, and analysis. Fundamental principles of project management including project management software. Open-ended project(s) to apply core principles using concepts from prerequisite courses. (Typically Offered: Spring)

ABE 2710: Engineering Applications of Parametric Solid Modeling

Credits: 1. Contact Hours: Lecture 0.7, Laboratory 0.6.

Prereq: ABE 1700 or TSM 1160

8 week-course. Creating, editing, and documenting part and assembly models using Solidworks. Emphasis on developing engineering drawings to communicate designs. Portfolio creation to document learning and understanding of parametric modeling. (Typically Offered: Fall, Spring)

ABE 2720: Parametric Solid Models, Drawings, and Assemblies Using Creo Parametric

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Prereq: ABE 1700 or TSM 1160

8 week-course. Applications of Creo Parametric software. Create solid models of parts and assemblies. Utilize the solid models to create design documentation (standard drawing views, dimensions, and notes) and for the geometric analysis of parts and assemblies. (Typically Offered: Fall, Spring)

ABE 2730: CAD for Process Facilities and Land Use Planning

Credits: 1.

Prereq: ABE 1700 or TSM 1160

8-week course. Application of 2-D AutoCAD software to create and interpret 2-D drawings of factories, facilities, and landscape structures. Topics include geometric construction, and design documentation using views, dimension, notes, and title blocks, and AutoCAD specific features such as Layers, Blocks, Standards, Styles. (Typically Offered: Fall, Spring)

ABE 3160: Applied Numerical Methods for Agricultural and Biosystems Engineering

Credits: 3.

Prereq: ABE 1600 and MATH 2660 or MATH 2670

Computer aided solution of engineering problems by use of numerical techniques and mathematical models. Systems analysis and optimization applicable to agricultural and biological systems. (Typically Offered: Fall, Spring)

ABE 3250: Biorenewable Systems

(Cross-listed with TSM 3250).

Credits: 3. Contact Hours: Lecture 3.

Prereq: CHEM 1630 or higher; MATH 1400 or higher

Converting biorenewable resources into bioenergy and biobased products. Biorenewable concepts as they relate to drivers of change, feedstock production, processes, products, co-products, economics, and transportation/logistics. (Typically Offered: Fall)

ABE 3270L: Animal Production Systems Design Lab

Credits: 1. Contact Hours: Laboratory 2.

Prereq: Credit or enrollment in TSM 3270

Engineering analysis of Livestock and Poultry production systems as related to applications of Precision Livestock Farming Technology (PLFT), economic and environmental management, and manure and nutrient management. Focus on the design of animal production systems based on ASABE/NRCS Standards and Local Codes. Concrete and earthen manure storages and open-lot runoff management structures; utilization of RUSLE-2 and P-index in the development of comprehensive nutrient management plans; making economic and environmental management decisions related to improving production, gaseous emissions reporting, and odor mitigation. (Typically Offered: Fall)

ABE 3340X: Principles of Ecological Engineering

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Introduction to principles of ecological engineering including ecosystems ecology, nutrient cycling, material and energy balances; emphasize the interaction of soil, water, plants, and microbes in ecosystems, the role of humans in ecosystems, and the application of ecological principles to design.

ABE 3400: Functional Analysis of Soil, Crop, and Machine Systems

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: ABE 2160

Principles of machine systems operation (tillage, cropestablishment, harvesting and crop protection). Principles of soil and crop interactions with machine systems. Experimental and simulation techniques for testing and evaluation of agricultural field machinery for equipment performance, functional analysis and crop production management. (Typically Offered: Fall)

ABE 3420: Agricultural Tractor Power

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: CHE 3810 or ME 2310

Thermodynamic principles and construction of tractor engines. Fuels, combustion, and lubrication. Kinematics and dynamics of tractor power applications; drawbar, power take-off and traction mechanisms. (Typically Offered: Spring)

ABE 3630: Agri-Industrial Applications of Electric Power and Electronics

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: ABE 2160

Single phase and three phase circuit design. Electrical safety. Electric motors and controls. Programmable logic controllers. Digital logic, instrumentation and sensors. (Typically Offered: Fall, Spring)

ABE 3780: Mechanics of Fluids

Credits: 3. Contact Hours: Lecture 3.

Prereq: CE 2740

Properties of fluids. Fluid statics. Kinematics and kinetics of fluid flow. Mass, momentum, and energy conservation laws; dimensional analysis; flow in pipes and channels. (Typically Offered: Fall, Spring, Summer)

ABE 3780L: Mechanics of Fluids Laboratory

Credits: 1. Contact Hours: Laboratory 2.

Prereq: Credit or enrollment in EM 3780

Exploration of properties of fluids through selected laboratory experiments. Fluid statics. Kinematics and kinetics of fluid flow. Mass, momentum, and energy conservation laws. Dimensional analysis. Flow in pipes and channels. (Typically Offered: Fall, Spring)

ABE 3800: Principles of Biological Systems Engineering

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: ABE 3160

Engineering analysis of biological systems, through the study of mass, energy, and information transport. Quantification and modeling of biological interactions, biological activities and bioreactor operations. Includes laboratory experiences on biological materials characterization, unit operation for bioprocesses and fermentation for producing bioproducts. (Typically Offered: Spring)

ABE 3880: Sustainable Engineering and International Development

(Cross-listed with CE 3880/ EE 3880).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Junior Classification in an Engineering Major

Multi-disciplinary approach to sustainable engineering and international development, sustainable development, appropriate design and engineering, feasibility analysis, international aid, business development, philosophy and politics of technology, and ethics in engineering. Engineering-based projects from problem formulation through implementation. Interactions with partner community organizations or international partners such as nongovernment organizations (NGOs). Course readings, final project/design report. Meets International Perspectives Requirement. (Typically Offered: Fall)

ABE 4030: Physical Modeling and Control of Dynamic Systems

(Dual-listed with ABE 5030).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: ABE 3160, and ABE 3630, and MATH 2660 or MATH 2670

Modeling and simulation of dynamic systems with physical modeling tools such as Simscape or Modelica. System concepts and engineering system analogies. Time and frequency response of systems. Introduction to control theory. Open-ended term project required for graduate credit. Offered even-numbered years. (Typically Offered: Spring)

ABE 4040: Instrumentation for Agricultural and Biosystems Engineering

(Dual-listed with ABE 5040).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: ABE 3160 and ABE 3630

Interfacing techniques for computer-based data acquisition and control systems. Basic interfacing components including A/D and D/A conversion, signal filtering and process control. Sensors and theory of operation applied to practical monitoring and control problems. Data collection, analysis, and calibration of sensors and data acquisition systems. Individual project required for graduate credit. (Typically Offered: Fall)

ABE 4100: Electronic Systems Integration for Agricultural Machinery

(Dual-listed with ABE 5100).

Credits: 3.

System architecture and design of electronics used in agricultural machinery and production systems. Emphasis on information technology and systems integration for automated agriculture processes. Design of Controller Area Network (CAN BUS) communication systems and discussion of relevant standards (ISO 11783 and SAE J1939). Application of technologies for sensing, distributed control, and automation of agricultural machinery will be emphasized. (Typically Offered: Spring)

ABE 4130: Fluid Power Engineering

(Cross-listed with ME 4130).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: ABE 2160 or ME 2700 and Credit or concurrent enrollment in EM 3780 or ME 3350

Fundamental fluid power principles, symbols and schematics. Hydraulic fluid properties. Function and performance of components such as connections and fittings, filtration, pumps, valves, actuators, hydrostatic transmissions. Hydraulic system dynamics. Modeling and simulation of circuits. Analysis and design of hydraulic systems. Hydrostatic transmission design. Hands-on construction of circuits, measurement of system variables, and electrohydraulic control. (Typically Offered: Fall)

ABE 4150: Agricultural & Biosystems Engineering Design I

Credits: 2. Contact Hours: Lecture 1, Laboratory 2.

Prereq: ABE 3160 (majors only)

Engineering design process with emphasis on team delivery of: clearly defined deliverables; criteria and constraints; wide-field ideation; discipline-appropriate analysis methods; identification and application of relevant standards. (Typically Offered: Fall, Spring)

ABE 4160: Agricultural & Biosystems Engineering Design II

Credits: 2. Contact Hours: Lecture 1, Laboratory 2.

Prereq: ABE 4150

Final execution of the engineering design process with emphasis on team delivery of: oral and written communication in completion of the client-agreed deliverables. (Typically Offered: Fall, Spring)

ABE 4180: Fundamentals of Engineering Review

Credits: 1. Contact Hours: Lecture 1.

Prereq: Senior classification or above

8 week course. Review of core concepts covered in the Fundamentals of Engineering examination with emphasis on statics, dynamics, fluid mechanics, heat transfer, electric circuits, and engineering economics. Open to all College of Engineering seniors, however focus is on the general exam, not discipline specific exams.

ABE 4310: Design and Evaluation of Soil and Water Conservation Systems

(Dual-listed with ABE 5310/ ENSCI 5310).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: EM 3780 or CHE 3560

Hydrology and hydraulics in agricultural and urbanizing watersheds. Design and evaluation of systems for the conservation and quality preservation of soil and water resources. Use and analysis of hydrologic data in engineering design; relationship of topography, soils, crops, climate, and cultural practices in conservation and quality preservation of soil and water for agriculture. Small watershed hydrology, water movement and utilization in the soil-plant-atmosphere system, agricultural water management, best management practices, and agricultural water quality. (Typically Offered: Fall)

ABE 4320: Nonpoint Source Pollution and Control

(Dual-listed with ABE 5320/ ENSCI 5320).

Credits: 3.

Prereq: ABE 4310 or CE 3720

Characteristics and mechanisms of non-point source (NPS) pollution in agricultural and urban watersheds, modeling of NPS pollution for terrestrial and aquatic systems, statistical tools to assess environmental datasets, strategies to control and manage NPS pollution of water bodies, and integrated watershed management. Graduate students are required to develop/deliver lecture models on assigned topics and/or complete additional assignments. Offered irregularly. (Typically Offered: Spring)

ABE 4340: Ecosystem Restoration Engineering

(Dual-listed with ABE 5340).

Credits: 3. Contact Hours: Laboratory 3, Lecture 2.

Repeatable.

Prereq: (BIOL 2110, BIOL 2120 or BIOL 2510); (CHEM 1670, CHEM 1770, or CHEM 1780); (ABE 4310 or CE 3720)

Apply governing principles of ecological engineering, including biological, chemical, and physical conditions, to restoration design. Ecological concepts, such as water and elemental cycling, energy flow through systems, ecological disturbance, and natural and anthropogenic stresses. Design approaches focus on nature-based solutions, stakeholder engagement, and adaptive management. Restoration applications include streams, floodplains and riparian zones, wetlands, and prairies. (Typically Offered: Spring)

ABE 4370: Watershed Modeling and Policy

(Dual-listed with ABE 5370/ ENSCI 5370).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: CE 3720

A project-based course on watershed-scale models for improving water quality. Legislative and judicial basis of the Total Maximum Daily Load (TMDL) program; approaches to TMDL development; principles and techniques for implementation; stakeholder engagement strategies. Hands-on experiences with GIS-interfaced models, data sources, calibration/validation, statistical assessment of model results, and simulation using multiple tools. In addition to other assignments, graduate students will present case studies of TMDLs using different modeling tools. Offered irregularly. (Typically Offered: Fall)

ABE 4400: Modeling and Simulation of Soil-Crop-Machine Systems

(Dual-listed with ABE 5400).

Credits: 3. Contact Hours: Laboratory 2, Lecture 2.

Prereq: ABE 3160 AND ABE 3400

Soil-Crp-Mach System.

ABE 4500: Emerging Technologies in Biomanufacturing

(Dual-listed with ABE 5500).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: ABE 3800

Overview, theory, unit operations, modeling, and engineering design of new technologies used in food and biomanufacturing, including bioreactors, culture- and cell-based products, pumping, heat transfer, separations systems, emerging technologies and processes. (Typically Offered: Fall)

ABE 4510: Food and Bioprocess Engineering

(Dual-listed with ABE 5510).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ABE 2160 and Credit or concurrent enrollment in ME 4360 or CHE 3570 or FSHN 3510 and MATH 2660 or MATH 2670

Application of engineering principles and mathematical modeling to the quantitative analysis of transport phenomena in food and bioprocesses. Physical/chemical characteristics of foods and biological materials and systems, flow processes, thermal processes, cooling/freezing processes, dehydration processes and separation processes. (Typically Offered: Spring)

ABE 4690: Engineering for Grain Storage, Preservation, Handling, and Processing Systems

(Dual-listed with ABE 5690).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: ABE 2160

Cereal grain and oilseed production, properties, and quality assessment. Design of storage systems, drying systems, material handling, and size reduction systems. Design of cereal grain processing systems, including dry milling, wet milling, flour milling, feed milling, and fermentation facilities. Students enrolled in ABE 5690 will be required to conduct additional learning activities. (Typically Offered: Spring)

ABE 4720: Controlled Environments for Animals and Plants

(Dual-listed with ABE 5720).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ABE 2160 and ME 2310

Principles and design of environmental control systems for animal and plant facilities. Insulation, heat and mass transfer, fans, ventilation, air distribution, heating and cooling equipment, and controls. Individual projects required for graduate credit. Offered even-numbered years. (Typically Offered: Spring)

ABE 4780: Wood Frame and Agri-Industrial Structures

(Dual-listed with ABE 5780).

Credits: 3. Contact Hours: Lecture 3.

Prereq: EM 3240

Design of light-framed wood structures using LRFD and ASD design procedures. Includes analysis of wind, snow, dead, and live loads. Applications include animal housing, greenhouses, and storage structures. Fasteners, laminated posts, truss design and use of National Design Specifications. Offered odd-numbered years. (Typically Offered: Spring)

ABE 4800: Engineering Analysis of Biological Systems

(Dual-listed with ABE 5800). (Cross-listed with ENSCI 4800/ GLOBE 4800).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: ABE 3800 or Permission of Department

Systems-level quantitative analysis of various biological systems, including applications in foods, feeds, biofuels, bioenergy, and other bio-based systems. Introduction to techno-economic analysis and life-cycle assessment of these systems at multiple production scales. Applying these tools to evaluate and improve cost and sustainability performance. Students enrolled in ABE 5800 will be required to conduct additional learning activities. (Typically Offered: Fall)

ABE 4900A: ABE Independent Study: Animal Production Systems Engineering

Credits: 1-5. Repeatable.

Prereq: Instructor Permission for Course

Independent Study.

ABE 4900B: ABE Independent Study: Biorenewable Resources

Credits: 1-5. Repeatable.

Prereq: Instructor Permission for Course

Independent study. (Typically Offered: Fall, Spring, Summer)

ABE 4900E: ABE Independent Study: Environmental Bioprocessing Engineering

Credits: 1-5. Repeatable.

Prereq: Instructor Permission for Course

Independent study in environmental bioprocessing engineering. (Typically Offered: Fall, Spring, Summer)

ABE 4900F: ABE Independent Study: Food Engineering

Credits: 1-5. Repeatable.

Prereq: Instructor Permission for Course

Independent study in food engineering. (Typically Offered: Fall, Spring, Summer)

ABE 4900G: ABE Independent Study: General Topics in ABE

Credits: 1-5. Repeatable.

Prereq: Instructor Permission for Course

Independent study in general ABE topics. (Typically Offered: Fall, Spring, Summer)

ABE 4900L: ABE Independent Study: Land & Water Resources Engineering

Credits: 1-5. Repeatable.

Prereq: Instructor Permission for Course

Guided instruction in land and water resources engineering. (Typically Offered: Fall, Spring, Summer)

ABE 4900M: ABE Independent Study: Advanced Machinery Systems Engineering

Credits: 1-5. Repeatable.

Prereq: Instructor Permission for Course

Guided instruction in advance machinery systems engineering. (Typically Offered: Fall, Spring, Summer)

ABE 4950: Agricultural and Biosystems Engineering Department Study Abroad Preparation or Follow-up

(Cross-listed with TSM 4950).

Credits: 1-2. Repeatable.

Preparation for, or follow-up of, study abroad experience (4960). For preparation, course focuses on understanding the tour destination through readings, discussions, and research on topics such as the regional industries, climate, crops, culture, economics, food, geography, government, history, natural resources, and public policies. For follow-up, course focuses on presentations by students, report writing, and reflection. Students enrolled in this course intend to register for 4960 the following term or have had taken 4960 the previous term. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

ABE 4960: Agricultural and Biosystems Engineering Department Study Abroad

(Cross-listed with TSM 4960).

Credits: 1-4. Repeatable.

Prereq: Academic Advisor Permission for Course

Tour and study at international sites relevant to disciplines of industrial technology, biological systems engineering, agricultural systems technology, and agricultural engineering. Location and duration of tours will vary. Trip expenses paid by students. Pre-trip preparation and/or post-trip reflection and reports arranged through 4950. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

ABE 5030: Physical Modeling and Control of Dynamic Systems

(Dual-listed with ABE 4030).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Modeling and simulation of dynamic systems with physical modeling tools such as Simscape or Modelica. System concepts and engineering system analogies. Time and frequency response of systems. Introduction to control theory. Open-ended term project required for graduate credit. Offered even-numbered years. (Typically Offered: Spring)

ABE 5040: Instrumentation for Agricultural and Biosystems Engineering
(Dual-listed with ABE 4040).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Interfacing techniques for computer-based data acquisition and control systems. Basic interfacing components including A/D and D/A conversion, signal filtering and process control. Sensors and theory of operation applied to practical monitoring and control problems. Data collection, analysis, and calibration of sensors and data acquisition systems. Individual project required for graduate credit. (Typically Offered: Fall)

ABE 5060: Applied Computational Intelligence

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Applications of biologically inspired computational intelligence tools for data mining, system modeling, and optimization for agricultural, biological and other engineered systems. Introduction to Artificial Neural Networks, Support Vector Machines, Fuzzy Logic, Genetic Algorithms, Bayesian and Decision Tree learning. Fundamental Machine Vision techniques will be introduced in the first part of course and be integrated into the lab exercises for learning different computational intelligence techniques. MATLAB will be used throughout the course for algorithm implementation. Offered even-numbered years. (Typically Offered: Fall)

ABE 5100: Electronic Systems Integration for Agricultural Machinery
(Dual-listed with ABE 4100).

Credits: 3.

Prereq: Graduate Standing or Permission of Instructor

System architecture and design of electronics used in agricultural machinery and production systems. Emphasis on information technology and systems integration for automated agriculture processes. Design of Controller Area Network (CAN BUS) communication systems and discussion of relevant standards (ISO 11783 and SAE J1939). Application of technologies for sensing, distributed control, and automation of agricultural machinery will be emphasized. (Typically Offered: Spring)

ABE 5110: Bioprocessing and Bioproducts

Credits: 3. Contact Hours: Lecture 3.

Unit operations for production of bio-based, fermented fuels, beverages, chemicals, pharmaceuticals, and coproducts. Taxonomy, metabolism, kinetics, and modeling of aerobic and anaerobic fermentation systems. Mass/energy balances, pretreatments, liquefaction, saccharification, separations, and process integration. (Typically Offered: Spring)

ABE 5150: Integrated Crop and Livestock Production Systems

(Cross-listed with SUSAG 5150/ AGRON 5150/ ANS 5150).

Credits: 3. Contact Hours: Lecture 3.

Prereq: SUSAG 5090 or Graduate Classification

Methods to maintain productivity and minimize the negative ecological effects of agricultural systems by understanding nutrient cycles, managing manure and crop residue, and utilizing multispecies interactions. Crop and livestock production within landscapes and watersheds is also considered. Course includes a significant field component, with student teams analyzing Iowa farms. Offered odd-numbered years. (Typically Offered: Fall)

ABE 5160: Data Science and Analytics for Agricultural and Biosystem Engineers

Credits: 3. Repeatable.

Prereq: ABE 1600

Introduction to research methods associated with data science concepts and their applications. Analyses and research related to agricultural and biosystems engineering and technology; methods to develop and maintain reproducible data analysis pipelines; best practices of data visualization and communication of data-driven results to broad audiences; concepts of data integrity and ethics. (Typically Offered: Fall)

ABE 5310: Design and Evaluation of Soil and Water Conservation Systems

(Dual-listed with ABE 4310). (Cross-listed with ENSCI 5310).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Hydrology and hydraulics in agricultural and urbanizing watersheds. Design and evaluation of systems for the conservation and quality preservation of soil and water resources. Use and analysis of hydrologic data in engineering design; relationship of topography, soils, crops, climate, and cultural practices in conservation and quality preservation of soil and water for agriculture. Small watershed hydrology, water movement and utilization in the soil-plant-atmosphere system, agricultural water management, best management practices, and agricultural water quality. (Typically Offered: Fall)

ABE 5320: Nonpoint Source Pollution and Control

(Dual-listed with ABE 4320). (Cross-listed with ENSCI 5320).

Credits: 3.

Prereq: Graduate Standing or Permission of Instructor

Characteristics and mechanisms of non-point source (NPS) pollution in agricultural and urban watersheds, modeling of NPS pollution for terrestrial and aquatic systems, statistical tools to assess environmental datasets, strategies to control and manage NPS pollution of water bodies, and integrated watershed management. Graduate students are required to develop/deliver lecture models on assigned topics and/or complete additional assignments. Offered irregularly. (Typically Offered: Spring)

ABE 5330: Erosion and Sediment Transport

(Cross-listed with NREM 5330/ ENSCI 5330/ GEOL 5330).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Soil erosion processes, soil loss equations and their application to conservation planning, sediment properties, initiation of sediment motion and over land flow, flow in alluvial channels and theory of sediment transport, channel stability, reservoir sedimentation, wind erosion, BMPs for controlling erosion. Offered even-numbered years. (Typically Offered: Fall)

ABE 5340: Ecosystem Restoration Engineering

(Dual-listed with ABE 4340).

Credits: 3. Contact Hours: Laboratory 3, Lecture 2.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Apply governing principles of ecological engineering, including biological, chemical, and physical conditions, to restoration design. Ecological concepts, such as water and elemental cycling, energy flow through systems, ecological disturbance, and natural and anthropogenic stresses. Design approaches focus on nature-based solutions, stakeholder engagement, and adaptive management. Restoration applications include streams, floodplains and riparian zones, wetlands, and prairies. (Typically Offered: Spring Quarter)

ABE 5370: Watershed Modeling and Policy

(Dual-listed with ABE 4370). (Cross-listed with ENSCI 5370).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

A project-based course on watershed-scale models for improving water quality. Legislative and judicial basis of the Total Maximum Daily Load (TMDL) program; approaches to TMDL development; principles and techniques for implementation; stakeholder engagement strategies. Hands-on experiences with GIS-interfaced models, data sources, calibration/validation, statistical assessment of model results, and simulation using multiple tools. In addition to other assignments, graduate students will present case studies of TMDLs using different modeling tools. Offered irregularly. (Typically Offered: Fall)

ABE 5400: Modeling and Simulation of Soil-Crop-Machine Systems

(Dual-listed with ABE 4400).

Credits: 3. Contact Hours: Lecture 4.

Prereq: Graduate Standing or Permission of Instructor

Principles of soil and crop material characterization, constitutive relationships for modeling soil and crop material behaviors, and applied computational and experimental methods for soil-crop-machine interactions for design and evaluation of off-road machine systems.

ABE 5500: Emerging Technologies in Biomanufacturing

(Dual-listed with ABE 4500).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Overview, theory, unit operations, modeling, and engineering design of new technologies used in food and biomanufacturing, including bioreactors, culture- and cell-based products, pumping, heat transfer, separations systems, emerging technologies and processes. (Typically Offered: Fall)

ABE 5510: Food and Bioprocess Engineering

(Dual-listed with ABE 4510).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Application of engineering principles and mathematical modeling to the quantitative analysis of transport phenomena in food and bioprocesses. Physical/chemical characteristics of foods and biological materials and systems, flow processes, thermal processes, cooling/freezing processes, dehydration processes and separation processes. (Typically Offered: Fall, Spring, Summer)

ABE 5560: GIS Programming and Automation

(Dual-listed with CRP 4560). (Cross-listed with CRP 5560).

Credits: 3. Contact Hours: Lecture 3.

Prereq: CRP 3510 or AGRON 2700 or NREM 3450 or GEOL 4520 or LA 3020 or CRP 5510 or GEOL 5520

Introduction to automated geoprocessing in Geographic Information Systems using Python. Focus on learning scripting language and object-oriented programming, automation of custom-designed geoprocessing scripts, and application toward student research and/or interests. (Typically Offered: Fall)

ABE 5690: Engineering for Grain Storage, Preservation, Handling, and Processing Systems

(Dual-listed with ABE 4690).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Cereal grain and oilseed production, properties, and quality assessment. Design of storage systems, drying systems, material handling, and size reduction systems. Design of cereal grain processing systems, including dry milling, wet milling, flour milling, feed milling, and fermentation facilities. Students enrolled in ABE 5690 will be required to conduct additional learning activities. (Typically Offered: Spring)

ABE 5720: Controlled Environments for Animals and Plants

(Dual-listed with ABE 4720).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Principles and design of environmental control systems for animal and plant facilities. Insulation, heat and mass transfer, fans, ventilation, air distribution, heating and cooling equipment, and controls. Individual projects required for graduate credit. Offered even-numbered years. (Typically Offered: Spring)

ABE 5780: Wood Frame and Agri-Industrial Structures

(Dual-listed with ABE 4780).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Design of light-framed wood structures using LRFD and ASD design procedures. Includes analysis of wind, snow, dead, and live loads. Applications include animal housing, greenhouses, and storage structures. Fasteners, laminated posts, truss design and use of National Design Specifications. Offered odd-numbered years. (Typically Offered: Spring)

ABE 5800: Engineering Analysis of Biological Systems

(Dual-listed with ABE 4800/ ENSCI 4800/ GLOBE 4800).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Systems-level quantitative analysis of various biological systems, including applications in foods, feeds, biofuels, bioenergy, and other bio-based systems. Introduction to techno-economic analysis and life-cycle assessment of these systems at multiple production scales. Applying these tools to evaluate and improve cost and sustainability performance. Students enrolled in ABE 5800 will be required to conduct additional learning activities. (Typically Offered: Fall)

ABE 5850: Biosystems for Sustainable Development

Credits: 2. Contact Hours: Lecture 2.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Understanding and appreciation of sustainable development issues related to food, water, energy, and climate change nexus and its implications for environmental sustainability, nutrition security, one health, and economic development of communities in the US and other countries. Application of basic agricultural, biological, math, and engineering/applied sciences to solve society's problems for water, food, energy, and environment systems. Emphasis placed on learning from case studies and developing sustainable solutions for communities. Students will learn to lead by example, improve their leadership and communication skills to understand local conditions and motivate themselves and others to improve the world around us. Meets International Perspectives Requirement. (Typically Offered: Spring)

ABE 5900: Special Topics in Agricultural & Biosystems Engineering

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Guided instruction and self-study on special topics relevant to agricultural and biosystems engineering. (Typically Offered: Fall, Spring, Summer)

Courses for graduate students:**ABE 6010: Graduate Seminar**

(Cross-listed with TSM 6010).

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Keys to starting a successful graduate research project. Effective literature review, formulating research questions, and setting goals. Practicing effectively communicating research and science. Effective strategies for scholarly writing, professional development, responding to feedback, peer-reviewing, successful publishing in journals, and curating scholarly output. (Typically Offered: Fall)

ABE 6100: Foundations of Sustainable Agriculture

(Cross-listed with SUSAG 6100/ AGRON 6100/ ANTHR 6100/ SOC 6100).

Credits: 3. Contact Hours: Lecture 3.

Historical, biophysical, socioeconomic, and ethical dimensions of agricultural sustainability. Strategies for evaluating existing and emerging agricultural systems in terms of the core concepts of sustainability and their theoretical contexts. (Typically Offered: Fall)

ABE 6900: Advanced Topics

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Advanced topics. (Typically Offered: Fall, Spring, Summer)

ABE 6940: Teaching Practicum

(Cross-listed with TSM 6940).

Credits: 1-3.

Graduate student experience in the agricultural and biosystems engineering departmental teaching programs. (Typically Offered: Fall, Spring)

ABE 6970: Engineering Internship

Credits: Required. Repeatable.

One semester and one summer maximum per academic year professional work period. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

ABE 6990: Research

Credits: 1-6. Repeatable.

Prereq: Instructor Permission for Course

Guided graduate research. (Typically Offered: Fall, Spring, Summer)

Agricultural Education and Studies (AGEDS)

Courses primarily for undergraduates:

AGEDS 1100: Professional Development in Agricultural Education and Studies: New Student Seminar

Credits: 1. Contact Hours: Discussion 1, Lecture 0.5.

Introduction to professional and educational development within university, college, department and major. Development of Resumes and Cover Letters. Career planning and assessment of professional goals. (Typically Offered: Fall, Spring)

AGEDS 1110: Dean's Leadership Seminar

Credits: 1. Contact Hours: Lecture 1.

Prereq: College Registration Approver Permission for Course

Introduction to leadership in agriculture and the life sciences, problem solving applied to current case studies, global perspective required by leaders, and designing programs to respond to societal needs in the agricultural and life sciences. (Typically Offered: Fall)

AGEDS 1120: Agriculture Biotechnology Colloquium

Credits: 1. Contact Hours: Lecture 1.

Prereq: Department Permission for Course

The scientific basis of biological and social sciences in agriculture. (Typically Offered: Spring)

AGEDS 1130: Access to Success Seminar I

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Career skills, learning strategies, and social and academic integration techniques to student members of Step Forward Learning Community. Utilization of campus resources, encouragement of self-exploration, and development of academic skills. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

AGEDS 1150X: Professional Development in Agricultural Education and Studies: Seminar

Credits: 1. Contact Hours: Lecture 1.

Repeatable, maximum of 3 credits.

Topics vary according to student interest. Materials related to current issues in Agricultural Education and Studies.

AGEDS 1160: Initial Field Experience in Agricultural Education

Credits: 1. Contact Hours: Lecture 0.5.

Prereq: AGLSE major

Field experience in a formal education setting designed to explore teaching as a career through guided observation and interviews, reflection, and on-campus dialogue. (Typically Offered: Fall)

AGEDS 2110A: High School Agriculture Programs

Credits: 1. Repeatable, maximum of 3 credits.

Prereq: Credit or concurrent enrollment in AGEDS 1100 or ANS 1100 or AGRON 1100 or ECON 1100 or NREM 1100 or BIOL 1100 or HORT 1100 or SOC 1100 or FSHN 1100 or TSM 1100 or BUSAD 1020 or BUSAD 1030 or LAS 1010 or ENGR 1010

Forty hours on-site in an agricultural setting. Students will have an opportunity outside the classroom for career guidance, role modeling, and reflection on their observations that they can apply to their courses and other educational experiences. (Typically Offered: Fall, Spring, Summer)

AGEDS 2110C: Agricultural Industries and Agencies

Credits: 1. Repeatable, maximum of 3 credits.

Prereq: AGEDS 1100 or ANS 1100 or AGRON 1100 or ECON 1100 or NREM 1100 or BIOL 1100 or HORT 1100 or SOC 1100 or FSHN 1100 or TSM 1100 or BUSAD 1020 or BUSAD 1030 or LAS 1010 or ENGR 1010

Forty hours on-site in an agricultural setting. Students will have an opportunity outside the classroom for career guidance, role modeling, and reflection on their observations that they can apply to their courses and other educational experiences. (Typically Offered: Fall, Spring, Summer)

AGEDS 2150: Professional Development in Agricultural Education and Studies: Career Seminar

Credits: 1. Contact Hours: Lecture 1.

Prereq: Sophomore classification, credit or concurrent enrollment in AGEDS 1100 or ANS 1100 or AGRON 1100 or ECON 1100 or NREM 1100 or BIOL 1100 or HORT 1100 or SOC 1100 or FSHN 1100 or TSM 1100 or BUSAD 1020 or BUSAD 1030 or LAS 1010 or ENGR 1010

Career preparation including assessments, networking, interviewing skills and related life skill development. Survey of current issues in agriculture that impact career goals. (Typically Offered: Fall, Spring)

AGEDS 2270: Fundamentals of Visual Communication for Agriculture and Life Sciences

Credits: 3. Contact Hours: Lecture 3.

Introduction to the fundamentals of visual communication as used in agricultural and life sciences contexts. Overviews of photography and videography and how they are both used to communicate agricultural and life sciences topics to strategic audiences. (Typically Offered: Fall, Spring)

AGEDS 2400X: Introduction to Intercultural Competency in Agriculture

Credits: 3. Contact Hours: Lecture 3.

Overview of the theory of cultural competency through the lens of social justice and multicultural education. Role of cultural competency in agriculture and food system professions. Guided learning experiences, reflections, dialogues and conversations. (Typically Offered: Fall)

AGEDS 2630: Communicate with Impact in Agriculture, Natural Resources, and Life Science

Credits: 3. Contact Hours: Lecture 3.

This course covers communication concepts and practices in the context of agriculture, natural resources, and life sciences. Topics examined in this course include the foundation of communication, persuasion, message strategies on different communication channels with diverse audiences for various purposes, and ethical implications of persuasion in a number of agricultural communication contexts. (Typically Offered: Fall, Spring)

AGEDS 3100: Foundations of Agricultural Education Programs

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification AND credit or enrollment in AGEDS 2110A

Historical development of agricultural education programs. Philosophic premises, program goals and objectives. Educational and social issues impacting the implementation of agricultural education programs. (Typically Offered: Fall, Spring)

AGEDS 3110: Presentation and Sales Strategies for Agricultural Audiences

Credits: 3. Contact Hours: Lecture 3.

Utilizing instructional methods, techniques, and problem solving, presentation and sales strategies with agricultural audiences. (Typically Offered: Fall, Spring)

AGEDS 3120: Science With Practice

Credits: 3. Contact Hours: Lecture 1.

Repeatable.

Prereq: College of Agriculture and Life Sciences major

A planned learning experience wherein each student and faculty mentor develops a learning agreement that encompasses specific activities and expectations. Students are engaged in reflective activities that include journals, micro-reflections, formal presentations, and a comprehensive portfolio. (Typically Offered: Fall, Spring)

AGEDS 3150: Personal, Professional, and Entrepreneurial Leadership in Agriculture

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Leadership principles and strategies to influence and motivate team members to achieve personal, professional, and entrepreneurial goals in production agriculture, agricultural education, and agricultural organizations. (Typically Offered: Fall, Spring)

AGEDS 3270: Survey of Agriculture and Life Sciences Communication

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500

Development of written, oral, visual and electronic communications relevant to agriculture and life sciences. Students develop a set of communication skills applicable to agriculture and life science contexts and for various audiences. (Typically Offered: Fall, Spring)

AGEDS 3880: Agricultural Mechanics Applications

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Introduction to SMAW (Arc), GMAW (Mig), GTAW (Tig), Oxy-Fuel welding, Oxy-Fuel cutting, and Plasma cutting theories and applications. Emphasis will be on theoretical foundation of welding, safety, welding skill development, and management of equipment, and materials. Introduction to small engines and applications. Emphasis will be on theory of operating systems, maintenance, troubleshooting, failure analysis, and safety. (Typically Offered: Fall, Spring, Summer)

AGEDS 3980: Cooperative Education

Credits: Required.

Prereq: Junior or senior classification; permission of department

Required of all cooperative education students. Students must register for this course prior to commencing each work period. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

AGEDS 4010: Planning Agriculture and Life Sciences Education Programs (Dual-listed with AGEDS 5010).

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGEDS 3100

Responsibilities of an agricultural education teacher, curriculum development, experiential learning opportunities including FFA and SAE, and assessment and maintenance of program quality. (Typically Offered: Fall)

AGEDS 4020: Methods of Teaching in Agriculture and Life Sciences (Dual-listed with AGEDS 5020).

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGEDS 4010 AND concurrent enrollment in AGEDS 3110

Topics include: principles of teaching and learning, individualized and group methods, application of learning, instructional management, special populations, and evaluation. (Typically Offered: Fall)

AGEDS 4120: Internship in Agricultural Education and Studies

Credits: 2-6. Repeatable, maximum of 6 credits.

Prereq: Junior or Senior Classification AND Major in Agricultural Studies, Agriculture and Life Sciences Education, Agricultural Communication, or Agricultural Education

A supervised two to twelve week learning experience in an approved learning setting with application to educational, agricultural, communications and/or environmental practices and principles.

(Typically Offered: Fall, Spring, Summer)

AGEDS 4140: Developing Agricultural Education Programs in Non-Formal Settings

Credits: 2. Contact Hours: Lecture 2.

Basic concepts in planning, conducting, and evaluating educational programs in non-formal settings. Includes programming for youth and adults in Extension, agricultural industry, and related agencies. (Typically Offered: Spring)

AGEDS 4160: Pre-Student Teaching Experience in Agricultural Education

Credits: 1.

Prereq: (AGEDS 2110A or AGEDS 2110C) AND AGEDS 4020

A forty hour field-based experience in an approved secondary agricultural education program. Concurrent enrollment in 4170 is required. (Typically Offered: Fall, Spring)

AGEDS 4170: Supervised Teaching in Agriculture and Life Sciences

Credits: 1-16. Repeatable.

Prereq: (AGEDS 2110A or AGEDS 2110C) AND AGEDS 4020

Supervised teaching in public schools. (Typically Offered: Fall, Spring)

AGEDS 4250: Curriculum for Agricultural Science Education

(Dual-listed with AGEDS 5250).

Credits: 1-6. Repeatable, maximum of 18 credits.

Inquiry-based techniques for education related to science, technology, engineering, and mathematics (STEM) in agriculture in secondary classrooms. Analyze, demonstrate, and design activities, labs, and projects using inquiry-based frameworks for teaching and learning. (Typically Offered: Summer)

AGEDS 4500: Farm Management and Operation

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Repeatable, maximum of 9 credits.

Prereq: ECON 2350, ECON 2300 and Junior classification

Participation in the management and operation of a diversified Iowa farm. The class is responsible for the plans, records, and decisions for buying and selling the farm's livestock, crops, and equipment. Special speakers on current topics. May be taken for credit 3 times at different times of the year with permission of the instructor. (Typically Offered: Fall, Spring, Summer)

AGEDS 4510: Agricultural Law

Credits: 3. Contact Hours: Lecture 3.

Prereq: Senior classification

The legal framework impinging upon decision-making by firms, families, and individuals, real and personal property, contracts, secured transactions, negotiable instruments, debtor-creditor relations, bankruptcy, farm income tax organization of firms, intergenerational property transfers, trusts and farm estate planning, civil and criminal liabilities, environmental law, federal and state regulatory powers.

(Typically Offered: Spring)

AGEDS 4600: Capstone in Agricultural Studies - Multidisciplinary Option

Credits: 3. Contact Hours: Lecture 3.

Capstone course focusing on connecting the education, skills, and experiences gained during students' experience in the Agricultural Studies Multidisciplinary option program to aide in preparing for life after college. This course challenges students to uncover the wild and wicked challenges 21st century agriculture is facing, while employing their skills and expertise to develop solutions for these issues. (Typically Offered: Fall, Spring)

AGEDS 4610: Innovation Diffusion and the Role of Agricultural and Extension Education

(Dual-listed with AGEDS 5610).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior classification

Examine the processes by which innovations in agriculture, food, and natural resources are diffused across global societies based on their performance characteristics that influence rate of adoption. Diffusion of Innovations Theory and alternative models will be applied to analyze and solve issues facing communities, industries, and organizations in domestic and international settings. Meets International Perspectives Requirement. (Typically Offered: Fall)

AGEDS 4630: Communicating Contemporary Issues in Agriculture

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior or Senior Classification and AGEDS 2630X

Focuses on improving students' awareness, comprehension, and communication of current and emerging issues facing agriculture and natural resources in Iowa, the United States, and worldwide. Students will be exposed to these issues by reading articles, engaging in dialogue with various players, and identifying ways to address them. Course will enhance students' written and oral communication skills on contemporary agriculture and natural resources issues. (Typically Offered: Fall, Spring)

AGEDS 4750: Agri-Marketing and Communications Competition

Credits: 1-2. Contact Hours: Lecture 2.

Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

Specialized training in communication and agricultural marketing knowledge and skills in preparation for intercollegiate competition. Graduation Description: Maximum of 6 credits can be applied toward graduation. (Typically Offered: Fall, Spring)

AGEDS 4880: Methods of Teaching Agricultural Mechanics

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: AGEDS 3880 AND credit or concurrent enrollment in AGEDS 3100

Methods and management techniques in agricultural mechanics laboratories. Emphasis will be on safety, mechanical skills development and management of students, facilities, equipment, and materials. (Typically Offered: Fall, Spring)

AGEDS 4900A: Philosophy, Curriculum, and Methods

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

AGEDS 4900B: Leadership, Evaluation, and Administration

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

AGEDS 4900C: Business, Industry, and Production Agriculture

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

AGEDS 4900D: Extension and International Agriculture

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

AGEDS 4900E: Instructional Technology

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

AGEDS 4900F: Environmental Issues

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

AGEDS 4900G: Entrepreneurship

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

AGEDS 4900H: Independent Study in Agricultural Education and Studies: Honors

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: Permission of Instructor; Membership in the University Honors Program

(Typically Offered: Fall, Spring, Summer)

AGEDS 4900I: Communications

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

AGEDS 4960A: International

Credits: 1-3. Repeatable.

Limited enrollment. Extended field trips to study agriculture and education related topics. Location and duration of trips will vary. Pre-trip sessions arranged. Trip expenses paid by students. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

AGEDS 4960B: Domestic

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Instructor Permission for Course

Limited enrollment. Extended field trips to study agriculture and education related topics. Location and duration of trips will vary. Pre-trip sessions arranged. Trip expenses paid by students. (Typically Offered: Fall, Spring, Summer)

AGEDS 4990: Undergraduate Research

Credits: 1-30. Repeatable.

Prereq: Department Permission for Course

Research experience in agricultural education and studies with application to selected problems. (Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:**AGEDS 5010: Planning Agriculture and Life Sciences Education Programs**
(Dual-listed with AGEDS 4010).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Classification as AGEDS grad student

Responsibilities of an agricultural education teacher, curriculum development, experiential learning opportunities including FFA and SAE, and assessment and maintenance of program quality. (Typically Offered: Fall)

AGEDS 5020: Methods of Teaching in Agriculture and Life Sciences
(Dual-listed with AGEDS 4020).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Concurrent enrollment in AGEDS 5110, classification as AGEDS grad student

Topics include: principles of teaching and learning, individualized and group methods, application of learning, instructional management, special populations, and evaluation. (Typically Offered: Fall)

AGEDS 5100: Introduction to Research in Agricultural Education

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Determining your research focus; developing research problems and objectives; reviewing the literature and establishing a theoretical framework; establishing procedures for data collection and analysis; ethical issues. (Typically Offered: Spring)

AGEDS 5110: Professional Agricultural Presentation Practices

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

The identification and use of key planning, delivery and evaluation of presentations using audience engagement techniques focused on research-based principles and field-based practices of professional presenters in agriculture and the life sciences. (Typically Offered: Fall, Summer)

AGEDS 5170: Student Teacher Education Practicum

Credits: 2-6.

Prereq: Classification as AGEDS grad student

Supervised 5th-12th grade public and private schools teaching practicum for graduate students in Masters degree teacher certification program. (Typically Offered: Fall, Spring)

AGEDS 5200: Instructional Methods for Adult and Higher Education in Agriculture and Natural Resources

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Theory and practice of adult education. Teaching and learning in formal and non-formal instructional programs for adult learners. (Typically Offered: Spring)

AGEDS 5240: Program Development and Evaluation in Agricultural and Extension Education

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Theories and practice of program planning for nonformal education. Addresses use of program logic modeling and considers critical theories of planning to address power and interests in program development, needs assessment, and evaluation. (Typically Offered: Fall)

AGEDS 5250: Curriculum for Agricultural Science Education
(Dual-listed with AGEDS 4250).

Credits: 1-6. Repeatable, maximum of 3 times.

Prereq: Graduate Standing or Permission of Instructor

Inquiry-based techniques for education related to science, technology, engineering, and mathematics (STEM) in agriculture in secondary classrooms. Analyze, demonstrate, and design activities, labs, and projects using inquiry-based frameworks for teaching and learning. (Typically Offered: Summer)

AGEDS 5330: Introduction to Learning Theory in Agricultural Education

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to a variety of theoretical perspectives of learning and how they may be used within the context of agricultural education. Emphasis will be on the major domains of learning, developmental considerations, basic assumptions, concepts, and principles of various learning theories; understanding how each theoretical perspective may be used in both formal and non-formal educational settings. (Typically Offered: Spring)

AGEDS 5500: Foundations of Agricultural Education

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Philosophical premises, ethical principles, historical development, contextual applications, and knowledge bases for agricultural education. (Typically Offered: Fall)

AGEDS 5610: Innovation Diffusion and the Role of Agricultural and Extension Education

(Dual-listed with AGEDS 4610).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Examine the processes by which innovations in agriculture, food, and natural resources are diffused across global societies based on their performance characteristics that influence rate of adoption. Diffusion of Innovations Theory and alternative models will be applied to analyze and solve issues facing communities, industries, and organizations in domestic and international settings. Meets International Perspectives Requirement. (Typically Offered: Fall)

AGEDS 5680: Qualitative Interviews and Focus Groups

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Understanding the role of interviews in agricultural education research, basis for theory of meaning, and variations of interview technique among qualitative traditions. Development of facilitation technique for individual interviews; and focus groups. Transcription and basic qualitative analysis. Use of interview findings to prepare manuscripts. (Typically Offered: Spring)

AGEDS 5800X: A Survey of Leadership Theories

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Examine postulates, applications and limitations of various leadership theories such as Transformational Leadership, Authentic Leadership, Servant Leadership, and Adaptive Leadership. Valuable to individuals interested in pursuing leadership opportunities in academia and business; and specifically Agricultural Education, Communication and Extension Education. (Typically Offered: Fall)

AGEDS 5900A: Curriculum

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

AGEDS 5900B: Methods

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

AGEDS 5900C: Philosophy

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

AGEDS 5900D: Evaluation

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

AGEDS 5900E: Administration

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

AGEDS 5900F: Leadership

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

AGEDS 5900G: Guidance

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

AGEDS 5900I: Instructional Technology

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

AGEDS 5900J: Extension

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

AGEDS 5900K: International Agriculture

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

AGEDS 5900L: Program Planning

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

AGEDS 5930A: Curriculum

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

(Typically Offered: Fall, Spring, Summer)

AGEDS 5930B: Methods

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

(Typically Offered: Fall, Spring, Summer)

AGEDS 5930C: Evaluation

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

(Typically Offered: Fall, Spring, Summer)

AGEDS 5930D: Administration

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

(Typically Offered: Fall, Spring, Summer)

AGEDS 5930E: Leadership

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

(Typically Offered: Fall, Spring, Summer)

AGEDS 5930F: Extension

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

(Typically Offered: Fall, Spring, Summer)

AGEDS 5930G: Program Planning

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

(Typically Offered: Fall, Spring, Summer)

AGEDS 5930H: Instructional Technology

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

(Typically Offered: Fall, Spring, Summer)

AGEDS 5930M: Biotechnology Workshop

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

(Typically Offered: Fall, Spring, Summer)

AGEDS 5990: Creative Component

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

For nonthesis masters degree programs. (Typically Offered: Fall, Spring, Summer)

Courses for graduate students:

AGEDS 6150A: Writing for Publication

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

AGEDS 6150B: Ethics

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

AGEDS 6150C: Grant Writing

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

AGEDS 6150D: Career Planning

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

AGEDS 6150E: Contemporary Issues

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

AGEDS 6170: Professional Internship for Agricultural Educators

Credits: 1-6. Contact Hours: Lecture 6.

Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

Analysis of the roles and activities of professionals in agricultural education. Supervised professional field-based experience in public and private settings. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

AGEDS 6250: Leadership, Administration, Supervision and Management of Agricultural Education Programs

Credits: 3. Contact Hours: Lecture 3.

Principles and best practices for leading, administering, supervising, and managing agricultural education programs. Analyzing selected case studies that apply theory to practice in agricultural situations.

AGEDS 6990: Research

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Agronomy (AGRON)

Courses primarily for undergraduates:

AGRON 1050: Leadership Experience

Credits: Required.

A participatory experience in activities or completion of a course that enhances the development of leadership and group-dynamic skills. See advisor for departmental requirements.

AGRON 1100: Professional Development in Agronomy: Orientation

Credits: 1. Contact Hours: Lecture 1.

Orientation to college life, the profession of agronomy, and the agronomy curriculum. (Typically Offered: Fall)

AGRON 1200: Introduction to Renewable Resources

(Cross-listed with NREM 1200/ ENVS 1200).

Credits: 3. Contact Hours: Lecture 3.

Overview of soil, water, plants, and animals as renewable natural resources in an ecosystem context. History and organization of resource management. Concepts of integrated resource management. (Typically Offered: Fall, Spring)

AGRON 1400: Climate and Society

(Cross-listed with MTEOR 1400/ ENVS 1400/ GEOL 1400/ CLSCI 1400).

Credits: 3. Contact Hours: Lecture 3.

The climate system of our planet. How nature and our actions alter the existing energy balance leading to climate change. Past climates on our planet. The influence of climate on society and resource availability during the Holocene (~ 11,000 years ago to present) with focus on changes post industrial revolution. Significant climate events that have altered our way of life in the past. Projected changes in future climate and potential impacts on society, environment and resources. Adaption to and mitigation of climate change. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

AGRON 1600: Water Resources of the World

(Cross-listed with MTEOR 1600/ ENVS 1600/ GEOL 1600).

Credits: 3. Contact Hours: Lecture 3.

Study of the occurrence, history, development, and management of world water resources. Basic hydrologic principles including climate, surface water, groundwater, and water quality. Historical and current perspectives on water policy, use, and the role of water in society and the environment. Meets International Perspectives Requirement. (Typically Offered: Spring)

AGRON 1800: Global Agriculture in a Changing World

Credits: 3. Contact Hours: Lecture 3.

A scientific investigation of the global distribution of climate, soils and agricultural production and consumption. Physical processes that connect natural resources to agriculture and the environment. How global change drives increasing demand for agricultural production. Meets International Perspectives Requirement. (Typically Offered: Fall)

AGRON 1810: Introduction to Crop Science

Credits: 3. Contact Hours: Lecture 3.

Basic structure and function of plants, origin and classification, growth and development. Fundamentals of photosynthesis, plant water use, plant nutrition and genetics that regulate plant growth, development and responses to the environment. (Typically Offered: Fall, Spring)

AGRON 1820: Introduction to Soil Science

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or concurrent enrollment in CHEM 1630 or CHEM 1670 or CHEM 1770

Introduction to physical, chemical, and biological properties of soils; soil formation, classification and global distribution; soil health, soils and humanity and sustainable land management. (Typically Offered: Fall, Spring)

AGRON 1830: Basic Skills for Agronomists

Credits: 1. Contact Hours: Laboratory 3.

Developing the skills that agronomists employ in their work with crops, soil, and the environment through activities involving tools and methodologies used by agronomists. Enrollment is restricted to first-year students majoring in agronomy. (Typically Offered: Fall)

AGRON 2060: Introduction to Weather and Climate

(Cross-listed with MTEOR 2060).

Credits: 3. Contact Hours: Lecture 3.

Basic concepts in weather and climate, including atmospheric measurements, radiation, stability, precipitation, winds, fronts, forecasting, and severe weather. Applied topics include global warming, ozone depletion, world climates and weather safety. (Typically Offered: Fall, Spring)

AGRON 2100: Professional Development in Agronomy: Career Planning

Credits: 1. Contact Hours: Lecture 1.

Career planning, resume and cover letter preparation. (Typically Offered: Fall, Spring)

AGRON 2170: Weed Identification

Credits: 1.

Prereq: 3 credits in Biological Sciences

Half-semester course. Identification of important weeds of agricultural, horticultural and native habitats. Principles of plant taxonomy and classification. Field trips. (Typically Offered: Fall, Spring)

AGRON 2400: Hemp: Potential and Constraints for a New Crop

(Cross-listed with ENT 2400).

Credits: 2. Contact Hours: Lecture 2.

Repeatable.

History, biology, and agronomy of hemp as it is allowed to be grown in Iowa. (Typically Offered: Spring)

AGRON 2500: Environmental Geography

(Cross-listed with ENSCI 2500/ ENVS 2500/ NREM 2500).

Credits: 3. Contact Hours: Lecture 3.

The distribution, origins and functions of the earth's physical systems and the spatial relationship between human activity and the natural world. (Typically Offered: Fall)

AGRON 2590: Organic Compounds in Plants and Soils

Credits: 3. Contact Hours: Lecture 3.

Prereq: (AGRON 1820 or GEOL 2100 or ENSCI 2500); BIOL 2120; (CHEM 1630 or CHEM 1770); MATH 1400 or higher

Structure, function, and transformations of organic compounds significant in plant and soil environments. (Typically Offered: Fall, Spring)

AGRON 2700: Geospatial Technologies

(Cross-listed with ENSCI 2700).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Concepts and tools for acquiring, managing, analyzing, and displaying geographic information, including GIS, remote sensing, spatial analysis, and cartography. Focus on applications in biological, ecological, environmental, and agricultural sciences. (Typically Offered: Spring)

AGRON 2790: Field Exploration of Agronomy

Credits: 3.

Prereq: AGRON 1810 and AGRON 1820

Field-based investigation of Iowa's agronomic systems. Application of principles learned in introductory soils, crops and agronomy courses. For students majoring in agronomy. (Typically Offered: Fall)

AGRON 2800: Crop Development, Production and Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 1810 and AGRON 1820

Overview of crops and cropping systems in the context of global and US agriculture. Focus on agronomic principles, constraints and opportunities as they apply to various locations in Iowa, the USA and the world. (Typically Offered: Fall, Spring)

AGRON 2810: Crop Physiology

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 1810

Science governing plant growth and development in the context of cropping and genetic improvements. (Typically Offered: Spring)

AGRON 2820: Soil Conservation and Land Use

Credits: 3. Contact Hours: Lecture 3.

Principles of soil conservation and land use with emphasis on best management practices and use of soil maps and databases such as Web Soil Survey. AGRON 1820 recommended. Graduation Restriction: Credit In Either AGRON 2600 Or AGRON 2820, But Not Both, May Be Applied Toward Graduation. (Typically Offered: Fall, Spring)

AGRON 2830: Pesticide Application Certification

(Cross-listed with ENT 2830/ FOR 2830/ HORT 2830).

Credits: 2. Contact Hours: Lecture 2.

Core background and specialty topics in agricultural, and horticultural pesticide applicator certification. Students can select certification categories and have the opportunity to obtain pesticide applicator certification at the completion of the course. Commercial pesticide applicator certification is emphasized. (Typically Offered: Spring)

AGRON 2980: Cooperative Education

Credits: Required.

Prereq: Instructor Permission for Course

Students register for this course in order to retain full-time status while on a professional work experience. Students must register for this course prior to commencing each work period. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

AGRON 3100: Professional Development in Agronomy: Work Experience

Credits: Required.

Professional work experience in agronomy. See advisor for departmental requirements.

AGRON 3110: Professional Internship in Agronomy

Credits: 1. Contact Hours: Lecture 1.

Prereq: Academic Advisor Permission for Course

A supervised learning experience in a professional setting related to crop production, plant breeding, soil science or environmental science. For students majoring in Agronomy or Seed Science. (Typically Offered: Fall)

AGRON 3160: Crop Structure-Function Relationships

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 1810; 3 credits of BIOL

Basic principles concerning the growth, development, and production of crop communities in relation to their environment. (Typically Offered: Fall, Spring)

AGRON 3170: Principles of Weed Science

Credits: 3. Contact Hours: Lecture 3.

Biology and ecology of weeds. Interactions between weeds and crops. Principles and practices of integrated weed management systems. Herbicide mechanisms, classification, and fate in plants and soils. (Typically Offered: Fall)

AGRON 3180: Introduction to Ecosystems

(Cross-listed with ENSCI 3180/ BIOL 3180/ NREM 3180).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 12 credits in AECL, AGRON, BIOL, CHEM, FOR, GEOL, NREM

Biological and physical processes affecting material and energy flows in natural and managed ecosystems. Understanding and predicting climate and management impacts on ecosystem services and sustainability. (Typically Offered: Spring)

AGRON 3200: Genetics, Agriculture and Biotechnology

(Cross-listed with GEN 3200).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2110 or BIOL 2120 or BIOL 2510

Transmission and molecular genetics with an emphasis on applications in agriculture, the structure and expression of the gene, how genes behave in populations and how recombinant DNA technology can be used to improve agriculture. Graduation Restriction: Credit for graduation will not be allowed for more than one of the following: GEN 2600, 3130, 3200 and BIOL 3130 and 3130L. (Typically Offered: Fall, Spring)

AGRON 3310: Crops Practicum

Credits: 2. Repeatable.

Prereq: Instructor Permission for Course

Identification of crops, weeds and diseases of agronomic importance. Diagnostic skills related to seed purity, grain grading, herbicide injury, nutrient deficiency, insect injury, disease symptoms, and/or abiotic environmental stress. Students may participate in intercollegiate judging contests. (Typically Offered: Fall, Spring)

AGRON 3340: Forage Crop Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 1810

Production and management of forage crops; concepts applied to yield, quality, and stand persistence; systems of forage utilization including grazing, hay, and silage. (Typically Offered: Spring)

AGRON 3380: Seed Science and Technology

(Cross-listed with HORT 3380).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: (AGRON 1810 or HORT 2210); 3 credits of BIOL

Seed production, maturation, dormancy, vigor, deterioration, and related aspects of enhancement, conditioning, storage, and quality evaluation. Aspects of the seed industry and regulation of seed marketing. (Typically Offered: Fall)

AGRON 3420: World Food Issues: Past and Present

(Cross-listed with ENVS 3420/ FSHN 3420).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior classification

Issues associated with global agricultural and food systems including ethical, social, economic, environmental, and policy contexts. Investigation of various causes and consequences of overnutrition/ undernutrition, global health, poverty, hunger, access, and distribution. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

AGRON 3510: Turfgrass Establishment and Management

(Cross-listed with HORT 3510).

Credits: 3. Contact Hours: Lecture 3.

Prereq: HORT 2210 or AGRON 1810 or BIOL 2110

Principles and practices of turfgrass propagation, establishment, and management. Specialized practices relative to professional lawn care, golf courses, athletic fields, highway roadsides, and seed and sod production. The biology and control of turfgrass pests. (Typically Offered: Fall)

AGRON 3510L: Turfgrass Establishment and Management Laboratory

(Cross-listed with HORT 3510L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Credit or enrollment in HORT 3510

Those enrolled in the horticulture curriculum are required to take 3510L in conjunction with 3510 except by permission of the instructor. (Typically Offered: Fall)

AGRON 3540: Soils and Plant Growth

(Cross-listed with HORT 3540).

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 1820; 3 credits of BIOL

Effects of chemical, physical, and biological properties of soils on plant growth, with emphasis on nutritive elements, pH, organic matter maintenance, and rooting development. (Typically Offered: Fall, Spring)

AGRON 3540L: Soils and Plant Growth Laboratory

(Cross-listed with HORT 3540L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: AGRON or HORT major AND (Credit or concurrent enrollment in AGRON 3540)

Laboratory exercises in soil testing that assess a soil's ability to support nutritive requirements for plant growth. (Typically Offered: Fall, Spring)

AGRON 3600: Environmental Soil Science

(Cross-listed with ENSCI 3600).

Credits: 3. Contact Hours: Lecture 3.

Application of soil science to contemporary environmental problems; comparison of the impacts that different management strategies have on short- and long-term environmental quality and land development. Emphasis on participatory learning activities. AGRON 1820 or ENSCI 2500 or GEOL 1010 recommended. (Typically Offered: Spring)

AGRON 3700: Field Experience in Soil Description and Interpretation

Credits: 1. Repeatable, maximum of 4 times.

Prereq: Credit or concurrent enrollment in AGRON 1820

Description and interpretation of soils in the field and laboratory, emphasizing hands-on experience. Evaluation of soil information for land use. Students may participate in intercollegiate judging contests. (Typically Offered: Fall, Spring)

AGRON 3830: Evaluation of Agronomic Systems

Credits: 4. Contact Hours: Laboratory 3, Lecture 3.

Integration of agronomic principles across environments, crops, and systems. Evaluation of field data to recommend appropriate practices. (Typically Offered: Fall, Spring)

AGRON 3920: Systems Analysis in Crop and Soil Management

Credits: 3. Contact Hours: Lecture 2, Studio 3.

Prereq: AGRON 3160 and AGRON 3540

Management strategies at the level of the farm field. Emphasis will be on participatory learning activities. (Typically Offered: Fall, Spring)

AGRON 3980: Cooperative Education

Credits: Required.

Prereq: Permission of Instructor; Junior classification

Student register for this course in order to retain full-time status while on a professional work experience. The student must register for this course prior to commencing each work period. (Typically Offered: Fall, Spring, Summer)

AGRON 4040: Global Change

(Dual-listed with MTEOR 5040/ AGRON 5040/ ENSCI 5040). (Cross-listed with MTEOR 4040/ ENSCI 4040/ ENV5 4040/ CLSCI 4040).

Credits: 3. Contact Hours: Lecture 3.

Recent changes in global biogeochemical cycles and climate; models of future changes in the climate system; impacts of global change on agriculture, water resources and human health; ethical issues of global environmental change. (Typically Offered: Fall, Spring)

AGRON 4050: Soil-Plant-Animal-Atmosphere Physics

(Dual-listed with AGRON 5050/ ENSCI 5050/ MTEOR 5050). (Cross-listed with ENSCI 4050/ MTEOR 4050).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 1600 or MATH 1650

The movement of energy and mass among the soil, vegetation, and atmosphere. The heat and water budget of humans, other animals, plants, and plant communities. Relevance to weather and climate, the effect of climate change on organisms, and remote sensing. Some exposure to computer programming (any language) recommended. Offered odd-numbered years. (Typically Offered: Spring)

AGRON 4060: World Climates

(Cross-listed with ENSCI 4060/ MTEOR 4060).

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 2060 or MTEOR 2060

Distribution and causes of different climates around the world. Effects of climate and climate variations on human activities including society, economy and agriculture. Current issues such as climate change and international efforts to assess and mitigate the consequences of a changing climate. Semester project and in-class presentation required. Meets International Perspectives Requirement. (Typically Offered: Spring)

AGRON 4070: Mesoscale Meteorology

(Dual-listed with MTEOR 5070/ AGRON 5070). (Cross-listed with MTEOR 4070).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 1660; MTEOR 4430

Physical nature and practical consequences of mesoscale atmospheric phenomena. Mesoscale convective systems, fronts, terrain-forced circulations. Observation, analysis, and prediction of mesoscale atmospheric structure. Offered even-numbered years. (Typically Offered: Spring)

AGRON 4100: Professional Development in Agronomy: Senior Forum

Credits: 1. Contact Hours: Lecture 1.

Prereq: Senior classification

Development of an appropriate content for professionalism. Topics include professional certification, ethics, and maintaining an active network of information sources and professional contacts in support of lifelong learning. Student interpretation, writings, presentations, and discussions. (Typically Offered: Fall, Spring)

AGRON 4210: Introduction to Plant Breeding

(Cross-listed with HORT 4210).

Credits: 3. Contact Hours: Lecture 3.

Prereq: GEN 3200 or BIOL 3130

Fundamental principles of plant breeding and cultivar development, breeding methods for self-pollinated, cross-pollinated and clonal crops. (Typically Offered: Fall)

AGRON 4250: Crop and Soil Modeling

(Dual-listed with AGRON 5250).

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 3160 or AGRON 3540; MATH 1650

Understanding basic crop physiology and soil processes through the use of mathematical and statistical approaches. Structure of crop models, dynamics and relationship among components such as leaf-level photosynthesis, canopy architecture, root dynamics and soil carbon and nitrogen pools. (Typically Offered: Fall)

AGRON 4500: Issues in Sustainable Agriculture

(Cross-listed with ENVS 4500).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior classification

Agricultural science as a human activity; contemporary agricultural issues from agroecological perspective. Comparative analysis of intended and actual consequences of agricultural practices from the perspective of ethics and sustainable agriculture. (Typically Offered: Spring)

AGRON 4520: Intro GIS for Geoscientists

(Dual-listed with GEOL 5520/ AGRON 5520/ ENSCI 5520). (Cross-listed with GEOL 4520/ ENSCI 4520).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Introduction to geographic information systems (GIS) using ArcGIS Pro with particular emphasis on geoscientific data. Teaches typical GIS operations and analyses in the geosciences to prepare students for practical GIS use in industry and academia. Includes a class project for GEOL 5520. Very suitable for Juniors. GEOL 4520 can be taken as a substitute for CPR 3510 for the GIS Minor. (Typically Offered: Fall, Spring)

AGRON 4590: Soil and Water Chemistry

(Dual-listed with AGRON 5590/ ENSCI 5590). (Cross-listed with ENSCI 4590).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: 6 credit of CHEM; (AGRON 1820 or AGRON 3600); MATH 1400 or higher

Applied chemistry in the context of soil and environmental sciences. Mobility, bioavailability, and retention of nutrients, metals, and organic compounds in water, soils, and sediments. Includes solution-phase chemistry, solid-phase chemistry, interface chemistry, and practical agricultural and environmental applications that involve integrated chemical reactions. AGRON 3540 and GEOL 1000 recommended. (Typically Offered: Fall)

AGRON 4630: Soil Formation and Landscape Relationships

(Dual-listed with AGRON 5630/ ENSCI 5630). (Cross-listed with ENSCI 4630).

Credits: 3. Contact Hours: Lecture 3.

Relationships between soil formation, geomorphology, and environment. Soil description, classification, geography, mapping, and interpretation for land use. Two weekend field trips. AGRON 1820 or ENSCI 2500 recommended. Graduation Restriction: Credit for one of AGRON 4630 or AGRON 4630L may be applied for graduation. (Typically Offered: Fall)

AGRON 4770: Soil Physics

(Dual-listed with AGRON 5770/ ENSCI 5770). (Cross-listed with ENSCI 4770).

Credits: 3. Contact Hours: Lecture 3.

The physical soil system: the soil components and their physical interactions; transport processes involving water, air, and heat.

AGRON 1820 recommended. (Typically Offered: Spring)

AGRON 4820: Soils of the Tropics

(Cross-listed with GLOBE 4820).

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: AGRON 3540 and 9 credits in AGRON, GLOBE, ENSCI, or related discipline

Properties, classification, and geographic distribution of tropical and near-tropical soils and landscapes with emphasis on their suitability for cropping. (Typically Offered: Spring)

AGRON 4840: Organic Agricultural Theory and Practice

(Dual-listed with AGRON 5840/ HORT 5840/ SUSAG 5840). (Cross-listed with HORT 4840).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 9 credits in biological or physical sciences

Understanding of the historical origins and ecological theories underpinning the practices involved in organic agriculture.

Interdisciplinary examination of crop and livestock production and socio-economic processes and policies in organic agriculture from researcher and producer perspectives. Offered odd-numbered years. (Typically Offered: Spring)

AGRON 4850: Soil and Environmental Microbiology

(Dual-listed with AGRON 5850/ ENSCI 5850/ MICRO 5850). (Cross-listed with ENSCI 4850/ MICRO 4850).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: AGRON 1820

The living organisms in the soil and what they do. Emphasis on soil biota composition, the carbon cycle and bioremediation, soil-plant-microbial relationships, and environmental issues. MICRO 2010; MICRO 2010L recommended. (Typically Offered: Fall)

AGRON 4880: Raster GIS for Geoscientists

(Dual-listed with GEOL 5880/ AGRON 5880/ ENSCI 5880). (Cross-listed with GEOL 4880/ ENSCI 4880).

Credits: 3.

GIS course with focus on the spatial analysis and modeling of raster and triangulated irregular network (TIN) data using ArcGIS Pro. Includes practical exercises during lectures, lab exercises, homework assignments, and (for GEOL 5880) a class project. Basic knowledge of ArcGIS Pro is a plus but not required. Course can be taken concurrently to any other Intro GIS course. Sophomore classification or above recommended. Offered odd-numbered years. (Typically Offered: Spring)

AGRON 4900E: Independent Study: Entrepreneurship

Credits: 1-3. Repeatable, maximum of 4 credits.

Prereq: Instructor Permission for Course

Selected studies in crops, soils, or agricultural meteorology according to the needs and interests of the student. (Typically Offered: Fall, Spring, Summer)

AGRON 4900G: Independent Study: General

Credits: 1-3. Repeatable, maximum of 4 credits.

Prereq: Instructor Permission for Course

Selected studies in crops, soils, or agricultural meteorology according to the needs and interests of the student. (Typically Offered: Fall, Spring, Summer)

AGRON 4900H: Independent Study: Honors

Credits: 1-3. Repeatable, maximum of 4 credits.

Prereq: Permission of Instructor; Membership in the University Honors Program

Selected studies in crops, soils, or agricultural meteorology according to the needs and interests of the student. (Typically Offered: Fall, Spring, Summer)

AGRON 4900Z: Independent Study: Service Learning

Credits: 1-3. Repeatable, maximum of 4 credits.

Prereq: Instructor Permission for Course

Selected studies in crops, soils, or agricultural meteorology according to the needs and interests of the student. (Typically Offered: Fall, Spring, Summer)

AGRON 4910: Seed Science Internship Experience

(Cross-listed with HORT 4910).

Credits: 1-2. Repeatable, maximum of 2 credits.

Prereq: AGRON 3380; Permission of Instructor

A professional work experience and creative project for seed science secondary majors. The project requires the prior approval and participation of the employer and instructor. The student must submit a written report. Advanced approval and participation of employer and instructor required. (Typically Offered: Fall, Spring, Summer)

AGRON 4930: Workshop in Agronomy

Credits: 1-30. Repeatable, maximum of 4 times.

Prereq: Instructor Permission for Course

Workshop experience in crops, soils, or agricultural meteorology.

AGRON 4960A: International Tour

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

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

AGRON 4960B: Domestic Tour

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Limited enrollment. Tour and study of production methods in major crop and livestock regions of the world. Influence of climate, economics, geography, soils, landscapes, markets, and other factors on crop and livestock production. Location and duration of tours will vary. Tour expenses paid by students. Check with department for current offerings.

AGRON 4970: Agroecology Field Course

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior or Senior classification; 8 credits in AGRON

A one-week intensive class, offered off-campus. Student will visit farms within the Midwest and analyze the sustainability of each farm. (Typically Offered: Fall)

AGRON 4980: Cooperative Education

Credits: Required. Repeatable.

Prereq: Senior classification; Permission of Instructor

Students register for this course in order to retain full-time status while on a professional work experience. Students must register for this course prior to commencing each work period. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

AGRON 5000: Orientation Seminar

Credits: 1. Contact Hours: Lecture 2.

Prereq: Agronomy students only

An introduction to Iowa and U.S. agriculture for scholars in agronomic majors. Field trips when possible. Departmental role in the functioning of research, teaching, and extension in fulfilling the charge given the land-grant university. (Typically Offered: Fall)

AGRON 5010: Crop Growth and Development

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 1810 or equivalent, BIOL 1010, CHEM 1630, MATH 1400

Physiological processes in crop growth, development and yield: photosynthesis, respiration, water relations, mineral nutrition, assimilate partitioning, seedling vigor, light interception and canopy growth, root growth, reproduction and yield. (Typically Offered: Fall, Spring, Summer)

AGRON 5020: Chemistry, Physics, and Biology of Soils

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Soil chemical, physical, and biological properties that control processes within the soil, their influence on plant/soil interactions, and soil classification. Basic concepts in soil science and their applications. Offered odd-numbered years. (Typically Offered: Spring)

AGRON 5030: Climate and Crop Growth

Credits: 3. Contact Hours: Lecture 3.

Prereq: Qualified Undergrads need AGRON 1810, MATH 1400

Applied concepts in climate and agricultural meteorology with emphasis on the climate-agriculture relationship and the microclimate-agriculture interaction and crop risk management. Basic meteorological principles are also presented to support these applied concepts. (Typically Offered: Summer)

AGRON 5040: Global Change

(Dual-listed with ENVS 4040/ MTEOR 4040/ AGRON 4040/ ENSCI 4040). (Cross-listed with MTEOR 5040/ ENSCI 5040).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Recent changes in global biogeochemical cycles and climate; models of future changes in the climate system; impacts of global change on agriculture, water resources and human health; ethical issues of global environmental change. (Typically Offered: Fall, Spring)

AGRON 5050: Soil-Plant-Animal-Atmosphere Physics

(Dual-listed with AGRON 4050/ ENSCI 4050/ MTEOR 4050). (Cross-listed with ENSCI 5050/ MTEOR 5050).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 1600 or MATH 1650 or Graduate Standing

The movement of energy and mass among the soil, vegetation, and atmosphere. The heat and water budget of humans, other animals, plants, and plant communities. Relevance to weather and climate, the effect of climate change on organisms, and remote sensing. Some exposure to computer programming (any language) recommended. Offered odd-numbered years. (Typically Offered: Spring)

AGRON 5060: Crop Genetics

(Cross-listed with HORT 5060).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to plant reproductive systems, gene segregation and linkage analysis, molecular nature of genes and how genes confer phenotypes, mutation and biotechnology, quantitative inheritance and population genetics to prepare students for subsequent courses in crop improvement. Enrollment is restricted to off-campus MS in Plant Breeding students. (Typically Offered: Fall)

AGRON 5070: Mesoscale Meteorology

(Dual-listed with MTEOR 4070/ AGRON 4070). (Cross-listed with MTEOR 5070).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 1660; MTEOR 4540 OR Graduate Classification

Physical nature and practical consequences of mesoscale atmospheric phenomena. Mesoscale convective systems, fronts, terrain-forced circulations. Observation, analysis, and prediction of mesoscale atmospheric structure. Offered even-numbered years. (Typically Offered: Spring)

AGRON 5080: Biophysical Crop Ecology

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

The physics behind how humans use plant photosynthesis to convert energy from the sun into useful products. Techniques for quantifying and predicting ecological interactions in the soil-plant-atmosphere continuum. Offered even-numbered years. (Typically Offered: Spring)

AGRON 5090: Agroecosystems Analysis

(Cross-listed with SUSAG 5090/ SOC 5090).

Credits: 4. Contact Hours: Lecture 3, Laboratory 4.

Prereq: Graduate Standing or Permission of Instructor

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

AGRON 5100: Crop Improvement

(Cross-listed with STB 5100).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

A study of agriculture from its origins with the domestication of crop plants through basic genetics, demonstrating the challenges and elements of breeding strategies intended to manage gene x environmental interactions. Elements of biotechnology including use of molecular markers, development of genetically modified cultivars, gene mapping, cloning, and gene editing will be covered. Methods to measure the effectiveness of plant breeding (genetic gain) and the impact of improved agronomic practices contributing to increased agricultural productivity will be covered. Use of intellectual property protection, and the conservation and utilization of exotic genetic resources.

AGRON 5110: Crop Improvement

(Cross-listed with STB 5110).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Basic principles in the genetic improvement of crop plants. Methods of cultivar development in self-pollinated and cross-pollinated crop species. (Typically Offered: Fall, Spring)

AGRON 5120: Soil-Plant Environment

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 5020 or graduate standing

Soil properties and their impact on soil/plant relationships. Soil structure, aeration, moisture, and nutrients will be discussed in the context of soil fertility and environmental quality management. (Typically Offered: Spring)

AGRON 5130: Data Science for Agricultural Professionals

(Cross-listed with STB 5130).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (AGRON 1810 or equivalent, MATH 1400, STAT 1040) OR Graduate Classification

Quantitative methods for analyzing and interpreting agronomic information. Principles of experimental design, hypothesis testing, analysis of variance, regression, correlation, and graphical representation of data. Use of SAS and Excel for organization, analyzing, and presenting data. (Typically Offered: Fall, Spring)

AGRON 5140: Integrated Pest Management

Credits: 3. Contact Hours: Lecture 3.

*Prereq: AGRON 1810 or equivalent, AGRON 5010,**BIOL 1010, CHEM 1630, MATH 1400; AGRON 5020 and AGRON 5030 recommended*

Principles and practices of weed science, entomology, and plant pathology applied to crop production systems. Biology, ecology and principles of integrated crop pest management.

AGRON 5150: Integrated Crop and Livestock Production Systems

(Cross-listed with ABE 5150/ SUSAG 5150/ ANS 5150).

Credits: 3. Contact Hours: Lecture 3.

Prereq: SUSAG 5090 or Graduate Classification

Methods to maintain productivity and minimize the negative ecological effects of agricultural systems by understanding nutrient cycles, managing manure and crop residue, and utilizing multispecies interactions. Crop and livestock production within landscapes and watersheds is also considered. Course includes a significant field component, with student teams analyzing Iowa farms. Offered odd-numbered years. (Typically Offered: Fall)

AGRON 5160: Crop Physiology

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Investigation of Molecular, whole plant, and plant community processes essential to biomass production and seed formation, and analysis of molecular approaches to overcome the limitations imposed on these processes by the environment. (Typically Offered: Spring)

AGRON 5180: Microwave Remote Sensing

(Cross-listed with EE 5180/ MTEOR 5180).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Microwave remote sensing of Earth's surface and atmosphere using satellite-based or ground-based instruments. Specific examples include remote sensing of atmospheric temperature and water vapor, precipitation, ocean salinity, and soil moisture. Offered even-numbered years. (Typically Offered: Spring)

AGRON 5190: Herbicide Physiology and Biochemistry

Credits: 2. Contact Hours: Lecture 2.

Prereq: Qualified Undergrads need AGRON 3160 and AGRON 3170

Herbicide mechanisms of action, selectivity, uptake, and translocation. Specific sites of herbicide action as they affect plant physiology. Herbicide resistance in weeds and crops. Implications of herbicides on weed management. Offered even-numbered years. (Typically Offered: Spring)

AGRON 5200: Plant Breeding Methods

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 5060

Breeding methods used in the genetic improvement of self-pollinated, cross-pollinated and clonal crops. (Typically Offered: Fall)

AGRON 5210: Principles of Cultivar Development

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Theoretical and practical exploration of breeding methods to develop clonal, pureline, inbred and hybrid cultivars. Principles and strategies to set breeding objectives, parental selection and germplasm management, population development, generation advancements, multiple trait selection, experimental designs in breeding programs; seed production and certification. Introduce tools available to a breeder. (Typically Offered: Spring)

AGRON 5220: Field Methods in Plant Breeding

Credits: 1-2.

Prereq: AGRON 5210

Field experience in planning and conducting plant breeding research for germplasm and cultivar development. Offered odd-numbered years. (Typically Offered: Summer)

AGRON 5230: Molecular Plant Breeding

Credits: 3.

Prereq: AGRON 5210 OR AGRON 5110 OR AGRON 4210

Plant breeding in the era of sequenced genomes and transformation. High throughput genomic technologies will be presented in relation to various applications in plant breeding. (Typically Offered: Spring)

AGRON 5240: Applied Plant Molecular Genetics & Biotechnology

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 5060

Basic principles and applied techniques used in the genetic improvement of crop plants. Discussion of structure and function of genes that control traits of value. Types of molecular markers, analysis of quantitatively inherited traits, genome mapping, analyses of databases. (Typically Offered: Fall)

AGRON 5250: Crop and Soil Modeling

(Dual-listed with AGRON 4250).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (MATH 1650; AGRON 3160 or AGRON 3540) or graduate classification

Understanding basic crop physiology and soil processes through the use of mathematical and statistical approaches. Structure of crop models, dynamics and relationship among components such as leaf-level photosynthesis, canopy architecture, root dynamics and soil carbon and nitrogen pools. (Typically Offered: Fall)

AGRON 5260: Field Plot Technique

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: STAT 5870

Planning experiments for agricultural research, analysis of data, and concepts in data interpretation. (Typically Offered: Spring)

AGRON 5280: Quantitative Genetics for Plant Breeding

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 5060 AND (AGRON 5130 OR AGRON 5370)

An introduction to the application of quantitative genetics to plant breeding programs. (Typically Offered: Spring)

AGRON 5300: Ecologically Based Pest Management Strategies

(Cross-listed with SUSAG 5300/ ENT 5300/ PLP 5300).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Durable, least-toxic strategies for managing weeds, pathogens, and insect pests, with emphasis on underlying ecological processes. Offered odd-numbered years. (Typically Offered: Fall)

AGRON 5310: Crop Ecology and Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 5010 or AGRON 5020 or AGRON 5030 or graduate standing

Ecological principles underlying crop production systems. Crop production in the context of management approaches, system resources and constraints, and interactions. Emphasis on the ecology of row and forage crops common to the Midwest. Required course for the Master of Science in Agronomy degree program. (Typically Offered: Fall)

AGRON 5320: Soil Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 5010; AGRON 5030; AGRON 5120 or graduate standing

Evaluates the impact of various soil management practices on soil and water resources. Combines and applies basic information gained in AGRON 5020 and AGRON 5120. Emphasizes the agronomic, economic, and environmental effects of soil management strategies. Required course for the Master of Science in Agronomy degree program. (Typically Offered: Fall)

AGRON 5330: Crop Protection

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 5140

Integrated management systems for important crop pests. Cultural, biological and chemical management strategies applicable to major crops grown in the Midwest. Required course for the Master of Science in Agronomy degree program.

AGRON 5340: Seed and Variety, Testing and Technology

(Cross-listed with STB 5340).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Admission to the Graduate Program in Seed Technology and Business or Permission of Instructor

The components of seed quality and how they are assessed in the laboratory, including traits derived from modern biotechnology. The impact of new technologies on seed quality testing. Variety maintenance procedures and breeder seed. Variety identification: phenotype and grow-out trials, isozyme testing, and DNA marker testing. Procedures for evaluating varieties. The variance tests appropriate for fixed effects analysis of variance. Statistical inference and stratification for yield trials. Use of strip plot testing. (Typically Offered: Summer)

AGRON 5360: Quantitative Methods for Seed

(Cross-listed with STB 5360).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Quantitative Methods for analyzing and interpreting agronomic and business information for the seed industry. Principles of experimental design and hypothesis testing, regression, correlation, analysis of variance, and graphical representation of data. Use of spreadsheets and statistical software for manipulating, analyzing and presenting data. (Typically Offered: Fall)

AGRON 5370: Quantitative Analytics for Plant Breeding

Credits: 3. Contact Hours: Lecture 3.

Qualified Undergrad Prereq: AGRON 1810; MATH 1400 or graduate standing

Methods to quantify consequences of decisions based on analytical methods used in crop genetic improvement and cultivar development. (Typically Offered: Fall, Spring)

AGRON 5380: Seed Physiology and the Environment

(Cross-listed with HORT 5380).

Credits: 2. Contact Hours: Lecture 2.

Prereq: AGRON 3160; CHEM 2310 or CHEM 3310 or graduate standing

Physiological aspects of seed development, maturation, longevity, dormancy, and germination of agronomic and horticultural crops and their interactions with field and storage environments. Emphasis on current literature and advanced methodology. Offered even-numbered years. (Typically Offered: Fall)

AGRON 5390: Seed Conditioning and Storage

(Cross-listed with STB 5390).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Admission to the Graduate Program in Seed Technology and Business or Permission of Instructor

The technical operations which may be carried out on a seed lot from harvest until it is ready for marketing and use. The opportunities for quality improvement and the risks of deterioration which are present during that time. Analysis of the costs of and benefits of operations. Evaluation of equipment based on benefits to the customer and producer. Interpretation of the role of the conditioning plant and store as a focal points within the overall operations of a seed company. (Typically Offered: Spring)

AGRON 5440: Host-Pest Interactions

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Incorporation of the principles of integrated pest management and crop protection. Management systems (biological, cultural, chemical) and strategies which practice principles of weed science, plant pathology, and entomology. (Typically Offered: Spring)

AGRON 5460: Strategies for Diversified Food and Farming Systems

(Cross-listed with SUSAG 5460/ HORT 5460).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Project-focused engagement in food and farming systems using tools and perspectives drawn from multiple disciplines. Includes a field component. Offered odd-numbered years. (Typically Offered: Spring)

AGRON 5470: Seed Production

(Cross-listed with STB 5470).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Admission to the Graduate Program in Seed Technology and Business or Permission of Instructor

Survey of crop production; including management of soil fertility, planting dates, populations, weed control, and insect control. Analysis of the principles of seed multiplication and the key practices which are used to ensure high quality in the products. Field inspection procedures and production aspects that differ from other crop production. Foundation seed production. Analysis of the typical organization of field production tasks. Survey of the differences in seed production strategies between crops and the impact of these differences on seed production.

AGRON 5510: Growth and Development of Perennial Grasses

(Cross-listed with HORT 5510).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Selected topics onatomy, morphology, and physiology relative to growth and development of perennial grasses. Emphasis on growth and development characteristics peculiar to grasses and variations of such characteristics under natural and managed conditions. Offered even-numbered years. (Typically Offered: Spring)

AGRON 5520: Intro GIS for Geoscientists

(Dual-listed with GEOL 4520/ AGRON 4520/ ENSCI 4520). (Cross-listed with GEOL 5520/ ENSCI 5520).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Introduction to geographic information systems (GIS) using ArcGIS Pro with particular emphasis on geoscientific data. Teaches typical GIS operations and analyses in the geosciences to prepare students for practical GIS use in industry and academia. Includes a class project for GEOL 5520. Very suitable for Juniors. GEOL 4520 can be taken as a substitute for CPR 3510 for the GIS Minor. (Typically Offered: Fall, Spring)

AGRON 5530: Soil-Plant Relationships

(Cross-listed with ENSCI 5530).

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 3540 or graduate standing

Composition and properties of soils in relation to the nutrition and growth of plants. (Typically Offered: Spring)

AGRON 5540: Advanced Soil Management

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Application of soil physics principles to address soil management (tillage, residue management, cropping system) impacts on water availability, water movement, soil temperature, soil compaction, and soil erosion. Concepts associated with soil erosion and water quality modeling will also be presented. Math 165 and introductory physics recommended; 6 credits of Soil Sciences recommended. (Typically Offered: Fall)

AGRON 5560: Agroecosystem Ecology

Credits: 3. Contact Hours: Lecture 3.

Prereq: Undergraduate coursework in Biology, Physics, and Chemistry

Understanding controls on the transport, transformation, and storage of carbon, nutrients and water. Effects of agricultural production and management on cycling within systems and transfer among systems at local, regional and global scales will be emphasized. Offered odd-numbered years. (Typically Offered: Fall)

AGRON 5590: Soil and Water Chemistry

(Dual-listed with AGRON 4590/ ENSCI 4590). (Cross-listed with ENSCI 5590).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: Graduate standing OR [6 credit of CHEM; (AGRON 1820 or AGRON 3600); MATH 1400 or higher]

Applied chemistry in the context of soil and environmental sciences. Mobility, bioavailability, and retention of nutrients, metals, and organic compounds in water, soils, and sediments. Includes solution-phase chemistry, solid-phase chemistry, interface chemistry, and practical agricultural and environmental applications that involve integrated chemical reactions. AGRON 3540 and GEOL 1000 recommended. (Typically Offered: Fall)

AGRON 5610: Population and Quantitative Genetics for Breeding

(Cross-listed with ANS 5610).

Credits: 4. Contact Hours: Lecture 4.

Prereq: STAT 5870 or Graduate Classification

Population and quantitative genetics for plant and animal genetics. Study of the genetic basis and analysis of variation in quantitative traits in domestic or experimental populations using phenotypic and molecular marker data, including estimation of heritability and other genetic parameters, linkage analysis and mapping of quantitative trait loci, and the impact of inbreeding, heterosis, and genotype-by-environment interaction. (Typically Offered: Fall)

AGRON 5630: Soil Formation and Landscape Relationships

(Dual-listed with AGRON 4630/ ENSCI 4630). (Cross-listed with ENSCI 5630).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Relationships between soil formation, geomorphology, and environment. Soil description, classification, geography, mapping, and interpretation for land use. Two weekend field trips. AGRON 1820 or ENSCI 2500 recommended. Graduation Restriction: Credit for one of AGRON 4630 or AGRON 4630L may be applied for graduation. (Typically Offered: Fall)

AGRON 5700: Risk Assessment for Food, Agriculture and Veterinary Medicine

(Cross-listed with TOX 5700/ VDPAM 5700).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Risk assessment principles as applied to biological systems. Exposure and effects characterization in human and animal health and ecological risk assessment. Risk analysis frameworks and regulatory decision-making. Introduction to quantitative methods for risk assessment using epidemiological and distributional analysis. Uncertainty analysis. Offered odd-numbered years. (Typically Offered: Fall)

AGRON 5750: Soil Formation and Transformation

(Cross-listed with ENSCI 5750).

Credits: 1. Contact Hours: Lecture 1.

Prereq: Graduate Standing or Permission of Instructor

A one-week intensive field class examining the pedology of Iowa under natural and transformed con. (Typically Offered: Fall)

AGRON 5770: Soil Physics

(Dual-listed with AGRON 4770/ ENSCI 4770). (Cross-listed with ENSCI 5770).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

The physical soil system: the soil components and their physical interactions; transport processes involving water, air, and heat.

AGRON 1820 recommended. (Typically Offered: Spring)

AGRON 5780: Laboratory Methods in Soil Physics

(Cross-listed with ENSCI 5780).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: concurrent enrollment in AGRON 4770 or AGRON 5770

Methods of measuring soil physical properties such as texture, density, and water content, and transport of heat, water, and gases. (Typically Offered: Spring)

AGRON 5810: Experience in Plant Science Extension and Outreach

(Cross-listed with PLP 5810/ ENT 5810/ HORT 5810).

Credits: 1.

Prereq: Graduate Standing or Permission of Instructor

A supervised learning experience in several extension delivery methods used in the plant sciences. Participation in Iowa State University-based extension programs that may include field crops horticulture, or Master Gardener programming. Offered odd-numbered years. (Typically Offered: Summer)

AGRON 5840: Organic Agricultural Theory and Practice

(Dual-listed with AGRON 4840/ HORT 4840/ SUSAG 4840). (Cross-listed with HORT 5840/ SUSAG 5840).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Understanding of the historical origins and ecological theories underpinning the practices involved in organic agriculture.

Interdisciplinary examination of crop and livestock production and socio-economic processes and policies in organic agriculture from researcher and producer perspectives. Offered odd-numbered years. (Typically Offered: Spring)

AGRON 5850: Soil and Environmental Microbiology

(Dual-listed with AGRON 4850/ ENSCI 4850/ MICRO 4850). (Cross-listed with ENSCI 5850/ MICRO 5850).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: AGRON 1820 or graduate standing

The living organisms in the soil and what they do. Emphasis on soil biota composition, the carbon cycle and bioremediation, soil-plant-microbial relationships, and environmental issues. MICRO 2010; MICRO 2010L recommended. (Typically Offered: Fall)

AGRON 5880: Raster GIS for Geoscientists

(Dual-listed with GEOL 4880/ AGRON 4880/ ENSCI 4880). (Cross-listed with GEOL 5880/ ENSCI 5880).

Credits: 3.

Prereq: (GEOL 4520; CRP 4510; CRP 4520; NREM 3450; NREM 4460; AE 4080) or graduate standing

GIS course with focus on the spatial analysis and modeling of raster and triangulated irregular network (TIN) data using ArcGIS Pro.

Includes practical exercises during lectures, lab exercises, homework assignments, and (for GEOL 5880) a class project. Basic knowledge of ArcGIS Pro is a plus but not required. Course can be taken concurrently to any other Intro GIS course. Sophomore classification or above recommended. Offered odd-numbered years. (Typically Offered: Spring)

AGRON 5900: Special Topics

Credits: 1-30. Repeatable.

Prereq: 15 credits in AGRON or graduate standing; Permission of Instructor for Course

Literature reviews and conferences on selected topics in crops, soils, or agricultural meteorology according to needs and interest of student.

AGRON 5910: Agronomic Systems Analysis

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 5110, AGRON 5130, AGRON 5310, AGRON 5320, AGRON 5330

Analysis of cropping systems from a problem-solving perspective. Case studies will be used to develop the students' ability to solve agronomic problems. (Typically Offered: Spring)

AGRON 5920: Current Issues in Agronomy

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 5010, AGRON 5030, AGRON 5110, AGRON 5120, AGRON 5130, AGRON 51

Critical analysis and discussion of agricultural practices, programs, and policies of current interest to the field of agronomy. Leadership skill development through consideration of technical, social, and ethical components underlying controversial topics. Enhancement of communication proficiency through debate and writing in order to define problems, articulate possible solutions, and propose appropriate courses of action. Required course for the Master of Science in agronomy degree program. (Typically Offered: Fall, Spring)

AGRON 5930: Workshop in Agronomy

Credits: 1-30. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

AGRON 5940: Agronomy MS Practicum

Credits: 1.

Prereq: Graduate Standing or Permission of Instructor

Practical field and laboratory experiences integrating coursework in climatology, crops, and soils. Includes lectures, labs and field tours. (Typically Offered: Summer)

AGRON 5950: Seed Quality, Production, and Research Management

(Cross-listed with STB 5950).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Admission to the Graduate Program in Seed Technology and Business or Permission of Instructor

Advanced survey of the organization, staff capabilities and management characteristics typical in seed production and crop improvement in seed enterprises. Analysis of the use of quality information in the management of seed operations and sales. Process management applications for seed. Production planning for existing capacity. Analysis of the manager's tasks in the annual cycle and how the tasks of these managers relate to the general categories of business management roles. Difference in management strategies used with different situations and groups of employees.

AGRON 5990A: Agricultural Meteorology

Credits: 1-30. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee. (Typically Offered: Fall, Spring, Summer)

AGRON 5990B: Crop Production and Physiology

Credits: 1-30. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AGRON 5990C: Plant Breeding

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AGRON 5990K: Seed Science

Credits: 1-30. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AGRON 5990L: Weed Science

Credits: 1-30. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AGRON 5990M: Agronomy

Credits: 1-30. Repeatable.

Prereq: Department Permission for Course

A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee. Offered on a satisfactory-fail basis only.

AGRON 5990S: Soil Science

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

Courses for graduate students:**AGRON 6000A: Seminar: Plant Breeding**

Credits: 1. Contact Hours: Lecture 1.

Repeatable, maximum of 6 times.

Instruction and practice in giving scientific presentations related to the fields of plant breeding, genetics, or genomics, with an emphasis on effective communication and presentation techniques. (Typically Offered: Spring)

AGRON 6000B: Seminar: Soils

Credits: 1. Contact Hours: Lecture 1.

Repeatable, maximum of 6 times.

Reports and discussion of recent literature and research. (Typically Offered: Spring)

AGRON 6000C: Seminar: Crop Production and Physiology

Credits: 1. Contact Hours: Lecture 1.

Repeatable, maximum of 6 times.

Reports and discussion of recent literature and research. (Typically Offered: Fall, Spring)

AGRON 6010: Agronomic Science Presentations

Credits: 2. Contact Hours: Lecture 2.

Prereq: AGRON students only

Experience in critical communications in exchange of ideas through oral and poster presentations and scientific questioning/evaluation. (Typically Offered: Spring)

AGRON 6050: Boundary-Layer Meteorology

(Cross-listed with MTEOR 6050).

Credits: 3. Contact Hours: Lecture 3.

Atmospheric boundary-layer structure and dynamics. Diurnal and seasonal variations, turbulent fluxes and turbulence kinetic energy. Measurements and empirical relations for wind and temperature near the ground. Numerical simulation and applications to wind energy. Offered odd-numbered years. (Typically Offered: Fall)

AGRON 6100: Foundations of Sustainable Agriculture

(Cross-listed with ABE 6100/ SUSAG 6100/ ANTHR 6100/ SOC 6100).

Credits: 3. Contact Hours: Lecture 3.

Historical, biophysical, socioeconomic, and ethical dimensions of agricultural sustainability. Strategies for evaluating existing and emerging agricultural systems in terms of the core concepts of sustainability and their theoretical contexts. (Typically Offered: Fall)

AGRON 6210: Advanced Plant Breeding

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 5210; AGRON 5260; AGRON 5610; or Graduate Classification

Genetics of breeding populations, means of genotypes and breeding populations, mapping quantitative trait loci, variation in breeding populations, genetic design, genotype by environment interaction, selection in breeding populations, recurrent selection, marker-assisted selection, best linear unbiased prediction, genome-wide association studies, genomic selection, heterosis and hybrid prediction, and multiple traits. (Typically Offered: Spring)

AGRON 6250: Genetic Strategies in Plant Breeding

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 5210; GDCB 5100; or Graduate Classification

Evaluation of genetic, molecular, and cellular approaches to crop improvement; gene transfer methods. Application and role of basic plant biology in breeding programs and processes; genome structure and function, gene isolation, expression, regulation, and modification. Integration of molecular and cellular methods in breeding strategies; analysis of alternative breeding methods, regulatory and ethical issues. Offered odd-numbered years. (Typically Offered: Spring)

AGRON 6650: Spatial Soil Informatics

(Cross-listed with ENSCI 6650).

Credits: 3. Contact Hours: Lecture 3.

Application of geographic principles and geospatial technologies to study soil landscapes. Emphasis on detecting spatial patterns for research planning and answering research questions. Hands-on activities include designing sampling strategies, management of large spatial data sets, and spatial modelling. Prior GIS and soil science experience recommended. (Typically Offered: Spring)

AGRON 6770: Advanced Soil Physics

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 5770 or Graduate Classification

The flow and distribution of water, chemicals, and heat in soils. Physical principles and applications. Offered even-numbered years. (Typically Offered: Fall)

AGRON 6930: Entrepreneurship for Graduate Students in Science and Engineering

(Cross-listed with EE 6930/ BCB 6930/ ENGR 6930/ GENET 6930/ ME 6930).

Credits: 1. Contact Hours: Lecture 3.

Repeatable, maximum of 2 credits.

Understanding key topics of starting a technology based company, from development of technology-led idea to early-stage entrepreneurial business. Concepts discussed include: entrepreneurship basics, starting a business, funding your business, protecting your technology/ business IP. Subject matter experts and successful, technology-based entrepreneurs will provide real world examples from their experience with entrepreneurship. Learn about the world class entrepreneurship ecosystem at ISU and Central Iowa. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

AGRON 6960: Research Seminar

(Cross-listed with PLBIO 6960/ BBMB 6960/ FOR 6960/ GDCB 6960/ HORT 6960).

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Research seminars by faculty and graduate students. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

AGRON 6980: Agronomy Teaching Practicum

Credits: 1-2. Repeatable.

Prereq: Graduate classification; M.S. or Graduate Certificate in Agronomy; Permission of Instructor

Graduate student experience in the agronomy teaching program. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

AGRON 6990A: Agricultural Meteorology

Credits: 1-30. Repeatable.

*Prereq: Instructor Permission for Course***AGRON 6990B: Crop Production and Physiology**

Credits: 1-30. Repeatable.

*Prereq: Instructor Permission for Course***AGRON 6990C: Plant Breeding**

Credits: 1-30. Repeatable.

*Prereq: Instructor Permission for Course***AGRON 6990J: Plant Physiology**

Credits: 1-30. Repeatable.

*Prereq: Instructor Permission for Course***AGRON 6990K: Seed Science**

Credits: 1-30. Repeatable.

*Prereq: Instructor Permission for Course***AGRON 6990L: Weed Science**

Credits: 1-30. Repeatable.

*Prereq: Instructor Permission for Course***AGRON 6990S: Soil Science**

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

Air Force Aerospace Studies (AFAS)

Courses primarily for undergraduates:

AFAS 1030: Introductory Leadership Laboratory with Physical Training

Credits: 2. Contact Hours: Laboratory 4.

Repeatable, maximum of 4 credits.

Instruction for new cadets on Air Force customs and courtesies; drill and ceremonies, issuing military commands, studying the environment of an Air Force officer and learning about areas of opportunity available to commissioned officers while also using basic military training skills and instruction to develop confidence, leadership, and communication skills through physical fitness. Full participation in all events will be determined based on student's physical and medical eligibility. Membership as a cadet in AFROTC recommended. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

AFAS 1410: Foundations of the United States Air Force

Credits: 1. Contact Hours: Lecture 1.

Explore the core values of the Department of the Air Force through hands-on activities designed to foster personal growth. This course develops practical skills in followership, accountability, initiative, resilience, and problem-solving. Students will cultivate essential leadership traits and a growth mindset, preparing them to excel in both military and professional environments. (Typically Offered: Fall)

AFAS 1420: Foundations of the United States Air Force

Credits: 1. Contact Hours: Lecture 1.

Examine the nature of conflict and the Air Force's role in national security through engaging, hands-on exercises. Students will explore how the instruments of power shape the global landscape and review strategic concepts vital to safeguarding U.S. interests. Through active learning, this course emphasizes the development of leadership traits and a deeper understanding of the Air Force's critical contributions to national and global security. (Typically Offered: Spring)

AFAS 2030: Basic Leadership Laboratory with Physical Training

Credits: 2. Contact Hours: Laboratory 4.

Repeatable, maximum of 4 credits.

Instruction and critique of cadets on Air Force customs and courtesies, drill and ceremonies, and issuing military commands in preparation for AFROTC summer Field Training while also using basic military training skills and instruction to develop confidence, leadership, and communication skills through physical fitness. Full participation in all events will be determined based on student's physical and medical eligibility. Membership as a cadet in AFROTC recommended. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

AFAS 2410: The Evolution of USAF Air & Space Power I

Credits: 1. Contact Hours: Lecture 1.

Examines the general aspects of air and space power through a historical perspective. Utilizing this perspective, the course covers a time period from the first balloons and dirigibles to the Korean War. Historical examples are provided to illustrate the development of airpower capabilities and missions to demonstrate the evolution of what has become today's USAF air and space power. (Typically Offered: Fall)

AFAS 2510: Team and Leadership Fundamentals

Credits: 1. Contact Hours: Lecture 1.

Measuring character through self-assessment and its importance for leadership and team building. The importance of listening and communication for mission accomplishment. Leadership, team building, and problem solving skills in the context of Air Force core values. (Typically Offered: Fall)

AFAS 2520: Team and Leadership Fundamentals II

Credits: 1. Contact Hours: Lecture 1.

Defining leadership through the lens of human relations, conflict and stress management, and ethical decision making. The importance of leveraging diversity and collaborative relationships with negotiating and resiliency techniques in the context of Air Force core values. (Typically Offered: Spring)

AFAS 3030: Intermediate Leadership Laboratory with Physical Training

Credits: 2. Contact Hours: Laboratory 4.

Repeatable, maximum of 4 credits.

Mid-level management of leadership experience involving planning and controlling of most AFROTC military activities. Students will help senior leadership to prepare and present briefings and other oral and written communications; provide interviews, guidance, and information that will increase the understanding, motivation, and performance of other cadets; and use advanced military training skills and instruction to develop confidence, leadership, and communication skills through physical fitness. Full participation in all events will be determined based on student's physical and medical eligibility. Membership as a cadet in AFROTC recommended. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

AFAS 3410: Air Force Leadership Studies I

Credits: 3. Contact Hours: Lecture 3.

Presents the complex issues of leadership and management in the U.S Air Force; a large and diverse organization. The theoretical aspects of leadership, management, communications, motivation and problem-solving are examined and studied against the backdrop of the U.S. Air Force. (Typically Offered: Fall)

AFAS 3420: Air Force Leadership Studies II

Credits: 3. Contact Hours: Lecture 3.

Prereq: AFAS 3410

A continuation of AFAS 3410. Examines the theoretical aspects of leadership, management, communications, and supervisory skills while studying them against the backdrop of the U.S. Air Force. (Typically Offered: Spring)

AFAS 4030: Advanced Leadership Laboratory with Physical Training

Credits: 2. Contact Hours: Laboratory 4.

Repeatable, maximum of 6 credits.

Advanced leadership experience involving the planning and controlling of all upper-level AFROTC military activities. Students will prepare and present briefings and other oral and written communications; provide interviews, guidance, and information that will increase the understanding, motivation, and performance of other cadets; and use advanced military training skills and instruction to develop confidence, leadership, and communication skills through physical fitness. Full participation in all events will be determined based on student's physical and medical eligibility. Membership as a cadet in AFROTC recommended. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

AFAS 4410: National Security Studies

Credits: 3. Contact Hours: Lecture 3.

Traces constitutional roots of authority and responsibilities to the Air Force officer, to include development of national security and strategy that defines US military policy and priorities. Applies legislation, joint doctrine, and relationships of operational and administrative authority concepts in the US military in the context of regional studies. (Typically Offered: Fall)

AFAS 4420: Preparation for Active Duty

Credits: 3. Contact Hours: Lecture 3.

Explores the range of professional, personal and social support structures available to US Air Force officers on active duty. Examines practical supervision tools to manage expectations, career development, and disciplinary action leading to the oath of office and acceptance of a commission in the US Air Force. Meets International Perspectives Requirement. (Typically Offered: Spring)

AFAS 4830: Situational Leadership Laboratory with Physical Training

Credits: 2. Contact Hours: Laboratory 4.

Repeatable, maximum of 4 times.

Situational leadership laboratory is for extended cadets that have completed the AFROTC curriculum but have not finished their degree. This provides an opportunity to continue growing as a leader in supervisory and mentorship positions while assisting the cadre with planning and controlling of all upper-level AFROTC military activities. Extended cadets will have the opportunity to work directly with cadre on special projects and duties that further prepare them for life as an active duty officer. Full participation in all events will be determined based on student's physical and medical eligibility. Membership as a cadet in AFROTC recommended. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

American Indian Studies (AMIN)

Courses primarily for undergraduates:

AMIN 2010: Native People in American Culture

Credits: 3. Contact Hours: Lecture 3.

Perceptions and realities of Native people living in and responding to American society and culture. Topics include representations, contemporary Native identity, literature, the arts, history, film, and issues of diversity. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall, Spring, Summer)

AMIN 2050: American Indians in the Movies

Credits: 3. Contact Hours: Lecture 3.

Examines the role of American Indians in the movie industry. Explores the development of American Indian characters and filmmaking, and the relevance for Native communities, through feature films and academic analysis. One focus is a comparison of non-Native and Native films in form, content, and message, and the changing character of Native representation in both. Offered irregularly. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Summer)

AMIN 2100: Introduction to American Indian Studies

Credits: 3. Contact Hours: Lecture 3.

Introduction to the multidisciplinary aspects of American Indian Studies. Topics include the relevant events and ideas defining the contemporary American Indian experience, on and off reservation, in the United States. Sovereignty, identity, jurisdiction, taxes, economic development, education, and other issues are addressed. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall, Spring, Summer)

AMIN 2250: American Indians of Iowa

(Cross-listed with ANTHR 2250).

Credits: 3. Contact Hours: Lecture 3.

Cultures and histories of Native people who have called the present state of Iowa home; primary focus on the period between 1700 CE and the present; Native interactions with Spanish, French, British, and American people. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall)

AMIN 2400: Introduction to American Indian Literature

(Cross-listed with ENGL 2400).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit in or enrollment in ENGL 1500 or 2500

Survey of American Indian Literature of varying genres, including fiction, non-fiction, poetry, film, drama, and media. Focuses on interdisciplinary approaches to American Indian cultural, social, and environmental issues. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall)

AMIN 3100: Contemporary Topics in American Indian Studies

Credits: 3. Contact Hours: Lecture 3.

Examines contemporary issues and important topics affecting Native communities overall. AMIN 2100 recommended. Offered irregularly. (Typically Offered: Fall, Spring)

AMIN 3110: Federal Indian Law and Policy

Credits: 3. Contact Hours: Lecture 3.

Examines the impact of federal American Indian policies on Native communities, especially contemporary Indian Country and communities. Topics include sovereignty, recognition, the role of the Supreme Court, specific policies like allotment, and other relevant issues. AMIN 2100 recommended. Meets U.S. Cultures and Communities Requirement.

AMIN 3120: American Indian Education

Credits: 3. Contact Hours: Lecture 3.

Examines current and historical issues in American Indian education. Topics include traditional education, changes to formal education, tribal colleges and universities, current school systems, and other relevant topics. AMIN 2100 recommended. Offered odd-numbered years. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall)

AMIN 3130: Native Land, Water, and Resources

(Cross-listed with NREM 3130).

Credits: 3. Contact Hours: Lecture 3.

Examines Native land rights, water rights, and natural resources. Topics may include Native relations to landscapes, cultural resources and infrastructure projects, land rights, water usage agreements, and resource policies as they apply to on- and off-reservation Native communities. AMIN 2100 recommended. Offered even-numbered years. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Spring)

AMIN 3150: Archaeology of North America

(Dual-listed with ANTHR 5150). (Cross-listed with ANTHR 3150).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ANTHR 2020

Prehistory and early history of North America as reconstructed from archaeological evidence; peopling of the New World; culture- historical sequences of major culture areas; linkages of archaeological traditions with selected ethnohistorically known Native American groups. (Typically Offered: Spring)

AMIN 3200: Great Plains Archaeology

(Dual-listed with ANTHR 5200). (Cross-listed with ANTHR 3200).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ANTHR 2020

Prehistoric societies of the Great Plains region of North America, from initial occupation to European contact; emphasis on sociocultural changes, continuities, and adaptations to changing environments using archaeological, ecological, ethnographic information. (Typically Offered: Fall)

AMIN 3220: Peoples and Cultures of Native North America

(Dual-listed with ANTHR 5220). (Cross-listed with ANTHR 3220).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ANTHR 2010 or AMIN 2100

Origin, distribution, and pre-contact life of the indigenous peoples of North America. Survey of culture areas; language families, social and political systems, ecological and economic adaptations, religion and spirituality; impact of European contact; cultural resilience and revitalization in contemporary American Indian life. Meets U.S. Cultures and Communities Requirement.

AMIN 3240: Health and Native American Communities

(Cross-listed with ANTHR 3240/ POLS 3240).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500

Overview of historic and contemporary health and health care in Native Communities. Indian Health Service and specific regulations. Consideration of both cultural and scientific approaches to medicine. Specific health issues (e.g., diabetes, alcoholism, depression, etc.) in American Indian communities. Meets U.S. Cultures and Communities Requirement.

AMIN 3270X: Native American Agriculture

Credits: 3. Contact Hours: Lecture 3.

Indigenous agriculture in North America. Topics include pre-contact agriculture in North America, cultural perspectives on agriculture, the changes caused by contact with Europeans, and the state of contemporary Native agriculture in a global market. Themes may include Native solutions to challenges of hunger and inadequate nutrition, food sovereignty, seed saving, and food deserts. Meets U.S. Cultures and Communities Requirement.

AMIN 3320A: Current Issues in Native North America: Gender and Family

(Dual-listed with AMIN 5320A/ ANTHR 5320A). (Cross-listed with

ANTHR 3320A).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ANTHR 2010 or ANTHR 3060

Exploration of key contemporary and historical issues in Native North America; discussion of current anthropological approaches to studying Native North America in a global context. Topics vary each time offered. ANTHR 3220 or AMIN 2100 recommended. Graduation Restriction: Only 9 credits of ANTHR/AMIN 3320A, 3320B, 3320C, 3320D may count toward graduation.

AMIN 3320B: Current Issues in Native North America: Indigenous Ecologies and Geographies

(Dual-listed with AMIN 5320B/ ANTHR 5320B). (Cross-listed with

ANTHR 3320B).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ANTHR 2010 or ANTHR 3060

Exploration of key contemporary and historical issues in Native North America; discussion of current anthropological approaches to studying Native North America in a global context. Topics vary each time offered. ANTHR 3220 or AMIN 2100 recommended. Graduation Restriction: Only 9 credits of ANTHR/AMIN 3320A, 3320B, 3320C, 3320D may count toward graduation.

AMIN 3320C: Current Issues in Native North America: Cultural and Political Movements

(Dual-listed with AMIN 5320C/ ANTHR 5320C). (Cross-listed with

ANTHR 3320C).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ANTHR 2010 or ANTHR 3060

Exploration of key contemporary and historical issues in Native North America; discussion of current anthropological approaches to studying Native North America in a global context. Topics vary each time offered. ANTHR 3220 or AMIN 2100 recommended. Graduation Restriction: Only 9 credits of ANTHR/AMIN 3320A, 3320B, 3320C, 3320D may count toward graduation.

AMIN 3320D: Current Issues in Native North America: Regional Focus

(Dual-listed with AMIN 5320D/ ANTHR 5320D). (Cross-listed with

ANTHR 3320D).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ANTHR 2010 or ANTHR 3060

Exploration of key contemporary and historical issues in Native North America; discussion of current anthropological approaches to studying Native North America in a global context. Topics vary each time offered. ANTHR 3220 or AMIN 2100 recommended. Graduation Restriction: Only 9 credits of ANTHR/AMIN 3320A, 3320B, 3320C, 3320D may count toward graduation.

AMIN 3460: American Indian Literature

(Cross-listed with ENGL 3460).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500

Focused study of American Indian literature of varying genres, including fiction, non-fiction, poetry, film, drama, and media. Examines interdisciplinary approaches to American Indian cultural, social, and environmental issues. Meets U.S. Cultures and Communities Requirement.

AMIN 4260: Topics in Native American Architecture

(Cross-listed with ARCH 4260).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: Junior classification

History, theory, and principles of Native American/American Indian architecture, landscape architecture and planning considering relationships to the culture, visual arts, site, and surroundings. Credit counts toward fulfillment History, Theory, Culture. Graduation Restriction: A maximum of 6 credits of ARCH/AMIN 4260 may be applied to degree program.

AMIN 4900: Independent Study

Credits: 1-30. Repeatable, maximum of 9 credits.

Prereq: 6 credits AMIN; Permission of Program Director

Designed to meet the needs of students who wish to study in areas other than those in which courses are offered. Graduation Restriction: No more than 6 credits in AMIN 4900 may be counted toward graduation. If more than 3 credits in AMIN 4900 are taken, they must be from different instructors.

Courses primarily for graduate students, open to qualified undergraduates:

AMIN 5320A: Current Issues in Native North America: Gender and Family

(Dual-listed with AMIN 3320A/ ANTHR 3320A). (Cross-listed with ANTHR 5320A).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Exploration of key contemporary and historical issues in Native North America; discussion of current anthropological approaches to studying Native North America in a global context. Topics vary each time offered. ANTHR 3220 or AMIN 2100 recommended. Graduation Restriction: Only 9 credits of ANTHR/AMIN 3320A, 3320B, 3320C, 3320D may count toward graduation.

AMIN 5320B: Current Issues in Native North America: Indigenous Ecologies and Geographies

(Dual-listed with AMIN 3320B/ ANTHR 3320B). (Cross-listed with ANTHR 5320B).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Exploration of key contemporary and historical issues in Native North America; discussion of current anthropological approaches to studying Native North America in a global context. Topics vary each time offered. ANTHR 3220 or AMIN 2100 recommended. Graduation Restriction: Only 9 credits of ANTHR/AMIN 3320A, 3320B, 3320C, 3320D may count toward graduation.

AMIN 5320C: Current Issues in Native North America: Cultural and Political Movements

(Dual-listed with AMIN 3320C/ ANTHR 3320C). (Cross-listed with ANTHR 5320C).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Exploration of key contemporary and historical issues in Native North America; discussion of current anthropological approaches to studying Native North America in a global context. Topics vary each time offered. ANTHR 3220 or AMIN 2100 recommended. Graduation Restriction: Only 9 credits of ANTHR/AMIN 3320A, 3320B, 3320C, 3320D may count toward graduation.

AMIN 5320D: Current Issues in Native North America: Regional Focus

(Dual-listed with AMIN 3320D/ ANTHR 3320D). (Cross-listed with ANTHR 5320D).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Exploration of key contemporary and historical issues in Native North America; discussion of current anthropological approaches to studying Native North America in a global context. Topics vary each time offered. ANTHR 3220 or AMIN 2100 recommended. Graduation Restriction: Only 9 credits of ANTHR/AMIN 3320A, 3320B, 3320C, 3320D may count toward graduation.

American Sign Language (ASL)

Courses primarily for undergraduates:

ASL 1010: American Sign Language I

Credits: 4. Contact Hours: Lecture 4.

Introduction to American Sign Language (ASL). Development of expressive and receptive skills including vocabulary, grammar, usage, and cultural information. Note: Distinct from 'Signed English'. ASL is a natural language with its own rules of grammar and usage. (Typically Offered: Fall, Spring)

ASL 1020: American Sign Language II

Credits: 4. Contact Hours: Lecture 4.

Prereq: ASL 1010

Introduction to American Sign Language (ASL) II continues development of expressive and receptive skills introduced in American Sign Language I, including vocabulary, grammar, usage, and cultural information. Distinct from 'Signed English'. ASL is a natural language with its own rules of grammar and usage. (Typically Offered: Spring)

ASL 1070: Introduction to the Deaf-World

Credits: 1. Contact Hours: Lecture 1.

Nature and significance of the Deaf-World as a cultural and linguistic minority.

ASL 2010: Intermediate American Sign Language I

Credits: 4. Contact Hours: Lecture 4.

Prereq: ASL 1020

Development of fluency for intermediate conversational skills. Review of grammar and varying grammatical forms for both structured and unstructured social situations such as sharing opinions, discussing weekend activities, and exchanging views on current topics. (Typically Offered: Fall)

ASL 2020: Intermediate American Sign Language II

Credits: 4. Contact Hours: Lecture 4.

Prereq: ASL 2010

A continuation and further application of language principles learned in ASL 2010, to deepen ability to actively engage in dialogue both in structured and unstructured social situations. Further fluency in intermediate conversational skills will be developed, particularly in the areas of semantic equivalence and dialogic/monologic register. (Typically Offered: Spring)

ASL 2750: Topics in Deaf Culture

Credits: 3. Contact Hours: Lecture 3.

Focus on contemporary topics in Deaf Culture, Communities, and History. Readings and discussion from a wide range of sources. Topics vary according to faculty interest.

ASL 3050: ASL Classifiers and Depiction

Credits: 3. Contact Hours: Lecture 3.

Prereq: ASL 2010

Focused analysis, documentation, discussion, and increased development of classifiers and depiction in ASL. Investigation in how these grammatical features are deliberately incorporated into conversational, presentational, scientific, and artistic language production.

ASL 3250: Deaf Peoples: Pre-World War II

Credits: 3. Contact Hours: Lecture 3.

Prereq: ASL 2020 or Permission of Instructor

Perspectives on and treatment of deaf people as individuals and groups prior to World War II. Taught in American Sign Language. (Typically Offered: Fall)

ASL 4900: Independent Study

Credits: 1-6. Repeatable, maximum of 6 credits.

Designed to meet the needs of students in areas other than those in which courses are offered, or who desire to integrate a study of literature or language with special problems in major fields. Graduation Restriction: No more than 6 credits of ASL 4900 may be counted towards graduation. (Typically Offered: Fall, Spring, Summer)

Animal Ecology (AECL)

Courses primarily for undergraduates:

AECL 2310: Principles of Wildlife & Fisheries Conservation

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2110, BIOL 2120, and NREM 1200

Introduction to the principles of wildlife and fisheries management. Case studies will be explored along with assessment methods used to understand management including conservation of populations, species and communities, as well as habitat preservation and restoration. (Typically Offered: Spring)

AECL 3120: Ecology

(Cross-listed with BIOL 3120/ ENSCI 3120).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: BIOL 2110; (BIOL 2120 or BIOL 2510)

Fundamental concepts and principles of ecology dealing with organisms, populations, communities, and ecosystems. Laboratory and field exercises examine ecological principles and methods as well as illustrate habitats. (Typically Offered: Fall, Summer)

AECL 3210: Ichthyology

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: AECL 3650

Biology, ecology, and evolution of fishes. Emphasis on structure, physiology, and behavior, including a focus on the conservation and management of fishes and their habitats. Laboratory focus on fish morphology, survey methods, identification, distribution, habits, and habitats of fishes. (Typically Offered: Spring)

AECL 3330: Fisheries Techniques

Credits: 2. Contact Hours: Lecture 1, Laboratory 3.

Prereq: BIOL 2120

Introduction to techniques used in the collection and interpretation of fish population data in the field and in the lab. Course objectives include an understanding of population survey methodology and improving student critical thinking and teamwork skills. Laboratory focuses on field trips and hands-on sampling experience. (Typically Offered: Fall)

AECL 3650: Vertebrate Biology

(Cross-listed with BIOL 3650).

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: BIOL 2110 and BIOL 2110L

Evolution, biology, and classification of fish, amphibians, reptiles, birds, and mammals. Emphasis on a comparative analysis of the structure and function of organ systems. Laboratory exercises concentrate on morphology and identification of orders of vertebrates. (Typically Offered: Fall)

AECL 3660: Natural History of Iowa Vertebrates

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: BIOL 2110 and BIOL 2110L

Vertebrate fauna of Iowa, including fishes, amphibians, reptiles, birds, and mammals. Species identification, habitat requirements, community structure and assessment, conservation issues that include historical population changes and value of wild animals to the region's ecological and economic health. (Typically Offered: Spring)

AECL 3710: Ecological Methods

(Cross-listed with BIOL 3710).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: AECL 3120 or NREM 3110; STAT 1010 or STAT 1040

Quantitative techniques used in management of natural resources with emphasis on inventory and manipulation of habitat and animal populations. (Typically Offered: Fall)

AECL 3720: Wildlife Population Methods

Credits: 4. Contact Hours: Lecture 1, Laboratory 8.

Prereq: BIOL 3120 or NREM 3110

Field-intensive study of population ecology. Emphasis on hands-on learning of study design and techniques to assess population trends in plants, invertebrates, and vertebrates inhabiting terrestrial and aquatic ecosystems. (Typically Offered: Summer)

AECL 3750: Marine Ecology and Ecosystems Dynamics

(Cross-listed with BIOL 3750/ ENSCI 3750).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2110

Overview of the ecological processes, ecosystems, and biodiversity in marine environments. Ever-changing dynamics caused by environmental disturbances, internal forces, or by human impacts on species and ecosystems. (Typically Offered: Spring)

AECL 4060: Wildlife Camp

Credits: 3. Contact Hours: Lecture 1, Laboratory 6.

Prereq: BIOL 2110 and Permission of Instructor; restricted to Animal Ecology majors

Introduction to methods and career options in wildlife research and management through field work. Two-week field work experience followed by on-campus reflection, analysis and presentation of field data. (Typically Offered: Fall)

AECL 4150: Ecology of Freshwater Invertebrates, Plants, and Algae

(Dual-listed with AECL 5150).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: AECL 3120

Identification, biology, and ecological requirements of freshwater invertebrates, plants and algae. Additional emphases on community sampling methods and analysis, and use of organisms as tools for aquatic ecosystem health assessment. (Typically Offered: Fall)

AECL 4180: Stream Ecology

(Dual-listed with AECL 5180/ ENSCI 5180). (Cross-listed with ENSCI 4180).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: AECL 4860

Biological, chemical, physical, and geological processes that determine the structure and function of flowing water ecosystems. Current ecological theories as well as applications to stream management for water quality and fisheries. Offered odd-numbered years. (Typically Offered: Fall)

AECL 4250: Aquatic Insects

(Dual-listed with ENT 5250/ AECL 5250). (Cross-listed with ENT 4250).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: BIOL 3120

Morphology, ecology, diversity, and significance of aquatic insects, with emphasis on the collection, curation and identification of taxa in local streams and lakes. Offered odd-numbered years. (Typically Offered: Spring)

AECL 4350: Entomology Field Trip

(Cross-listed with ENT 4350).

Credits: 2. Repeatable, maximum of 2 credits.

Prereq: BIOL 3120; Permission of Instructor

Field trip to study insects of major terrestrial and aquatic ecosystems.

Location and duration vary. ENT 3700 or ENT 4250 recommended.

Offered irregularly. (Typically Offered: Spring, Summer)

AECL 4400: Fishery Management

(Dual-listed with AECL 5400).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: AECL 3120, AECL 3210, AECL 3330; STAT 1010 or STAT 1040; Credit or Enrollment in AECL 4860

Biological basis of fishery management, fishery problems, and management practices for freshwater, anadromous, and marine fisheries. (Typically Offered: Fall)

AECL 4420: Aquaculture

(Dual-listed with AECL 5420).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2110 and BIOL 2120

Concepts related to the culture of aquatic organisms including culture systems, water quality, nutrition, genetics, diseases, and marketing. (Typically Offered: Spring)

AECL 4510: Wildlife Ecology and Management

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Ecological theory and practice of wildlife management, including, population ecology, habitat management, and current issues in the field. Course involves a series of case studies addressing actual wildlife issues using field and quantitative methods. (Typically Offered: Spring)

AECL 4540: Principles of Wildlife Disease

(Dual-listed with AECL 5540).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior standing and at least 10 credits in biological sciences at the 3000+ level

Ecological and epidemiological aspects of diseases as they relate to wildlife populations. Topics to be covered include: major classes of disease; detection, description, monitoring, and management of disease; characteristics and interactions between disease agents and wildlife hosts; relationships among wildlife, domestic animal, and human health. (Typically Offered: Spring)

AECL 4550: International Wildlife Issues

Credits: 3. Contact Hours: Lecture 3.

Prereq: AECL 3650, AECL 3120 or Graduate classification and NREM 1200

Biological, political, social, and economic factors affecting the management of international wildlife resources. Meets International Perspectives Requirement. (Typically Offered: Fall)

AECL 4570: Herpetology

(Cross-listed with BIOL 4570).

Credits: 2. Contact Hours: Lecture 2.

Prereq: (BIOL 3510 AND BIOL 3510L) OR AECL/BIOL 3650

Biology, ecology, and evolution of amphibians (salamanders, frogs, caecilians) and reptiles (lizards, snakes, tuatara, turtles, crocodilians). Emphasis on structure, physiological adaptation to different environments, behavior, reproduction, roles of amphibians and reptiles in ecosystems, and conservation. Laboratory focus on survey methods, identification, relationships, distribution, habits, and habitats of amphibians and reptiles. (Typically Offered: Fall)

AECL 4570L: Herpetology Laboratory

(Cross-listed with BIOL 4570L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: (BIOL 3510 AND BIOL 3510L) OR AECL/BIOL 3650; Concurrent enrollment in AECL/BIOL 4570

Laboratory to accompany Biology/Animal Ecology 4570. Focus on survey methods, identification, relationships, distribution, habits, and habitats of amphibians and reptiles. (Typically Offered: Fall)

AECL 4580: Ornithology

(Cross-listed with BIOL 4580).

Credits: 2. Contact Hours: Lecture 2.

Prereq: (BIOL 3510 AND BIOL 3510L) OR AECL/BIOL 3650

Biology, evolution, ecology and taxonomy of birds. Emphasis on structure, physiology, behavior, communication, navigation, reproduction, and conservation. (Typically Offered: Spring)

AECL 4580L: Ornithology Laboratory

(Cross-listed with BIOL 4580L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: (BIOL 3510 AND BIOL 3510L) OR AECL/BIOL 3650; Credit OR concurrent enrollment in AECL/BIOL 4580

Laboratory complements lecture topics with emphasis on external anatomy, identification and distribution of Midwest birds, and field trips. (Typically Offered: Spring)

AECL 4590: Mammalogy

(Cross-listed with BIOL 4590).

Credits: 2. Contact Hours: Lecture 2.

Prereq: (BIOL 3510 AND BIOL 3510L) OR AECL/BIOL 3650

Biology, ecology, and evolution of mammals. Emphasis on structure, physiological adaptation to different environments, behavior, reproduction, roles of mammals in ecosystems, and conservation. (Typically Offered: Spring)

AECL 4590L: Mammalogy Laboratory

(Cross-listed with BIOL 4590L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: (BIOL 3510 AND BIOL 3510L) OR AECL/ BIOL 3650; Concurrent enrollment in AECL/BIOL 4590

Laboratory focus on identification, survey methods, distribution, habits, and habitats of mammals. Several field trips. (Typically Offered: Spring)

AECL 4710: Introductory Conservation Biology

(Cross-listed with BIOL 4710).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 3120

Examination of conservation issues from a population and community perspective. The role of genetics, demography, and environment in determining population viability, habitat fragmentation, reserve design, biodiversity assessment, and restoration ecology. (Typically Offered: Spring)

AECL 4800: Studies in Marine Biology

Credits: 1-8. Contact Hours: Lecture 8.

Repeatable.

Courses taken at Gulf Coast Research Laboratory and other marine biological stations are transferred to Iowa State University under this number. (Typically Offered: Summer)

AECL 4860: Aquatic Ecology

(Dual-listed with AECL 5860/ EEOB 5860/ ENSCI 5860). (Cross-listed with BIOL 4860/ ENSCI 4860).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 3120 or ENSCI 3190 or ENSCI 4020 or NREM 3010

Structure and function of aquatic ecosystems with application to fishery and pollution problems. Emphasis on lacustrine, riverine, and wetland ecology. (Typically Offered: Fall)

AECL 4860L: Aquatic Ecology Laboratory

(Dual-listed with AECL 5860L/ EEOB 5860L/ ENSCI 5860L). (Cross-listed with BIOL 4860L/ ENSCI 4860L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Credit or concurrent enrollment in BIOL 4860

Field trips and laboratory exercises to accompany 4860. Hands-on experience with aquatic research and monitoring techniques and concepts. (Typically Offered: Fall)

AECL 4890: Population Ecology

(Dual-listed with AECL 5890/ EEOB 5890). (Cross-listed with BIOL 4890).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: BIOL 3120; (STAT 1010 or STAT 1040); (MATH 1510, 1600, 1650 or Graduate standing)

Concepts and theories of population dynamics with emphasis on models of growth, predation, competition, and regulation. Offered even-numbered years. (Typically Offered: Fall)

Courses primarily for graduate students, open to qualified undergraduates:

AECL 5150: Ecology of Freshwater Invertebrates, Plants, and Algae

(Dual-listed with AECL 4150).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: AECL 3120 or graduate standing

Identification, biology, and ecological requirements of freshwater invertebrates, plants and algae. Additional emphases on community sampling methods and analysis, and use of organisms as tools for aquatic ecosystem health assessment. (Typically Offered: Fall)

AECL 5160: Avian Ecology

Credits: 3. Contact Hours: Lecture 3.

Prereq: AECL 3650; AECL 3120; or graduate standing

Current topics and theories including avian breeding and foraging ecology, population biology, community structure, habitat selection, field methodologies, and data interpretation. Offered even-numbered years. (Typically Offered: Spring)

AECL 5180: Stream Ecology

(Dual-listed with AECL 4180/ ENSCI 4180). (Cross-listed with ENSCI 5180).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: AECL 4860; or graduate standing

Biological, chemical, physical, and geological processes that determine the structure and function of flowing water ecosystems. Current ecological theories as well as applications to stream management for water quality and fisheries. Offered odd-numbered years. (Typically Offered: Fall)

AECL 5200: Fisheries Science

Credits: 3. Contact Hours: Lecture 3.

Prereq: AECL 3120; AECL 3210; or graduate standing

Concepts, approaches, and techniques for assessment of recreational and commercial fisheries. Scope will range from individual fish to entire ecosystems, both freshwater and marine. Offered odd-numbered years. (Typically Offered: Spring)

AECL 5250: Aquatic Insects

(Dual-listed with ENT 4250/ AECL 4250). (Cross-listed with ENT 5250).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: BIOL 3120 or graduate standing

Morphology, ecology, diversity, and significance of aquatic insects, with emphasis on the collection, curation and identification of taxa in local streams and lakes. Offered odd-numbered years. (Typically Offered: Spring)

AECL 5310: Conservation Biology

(Cross-listed with EEOB 5310).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 3120, BIOL 3130; or graduate standing

Examination of conservation issues from a population and a community perspective. Population-level analysis will focus on the role of genetics, demography, and environment in determining population viability. Community perspectives will focus on topics such as habitat fragmentation, reserve design, biodiversity assessment, and restoration ecology. Offered even-numbered years. (Typically Offered: Spring)

AECL 5400: Fishery Management

(Dual-listed with AECL 4400).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: AECL 3120; AECL 3210; AECL 3330; (STAT 1010 or STAT 1040); credit or enrollment in AECL 4860 or graduate standing

Biological basis of fishery management, fishery problems, and management practices for freshwater, anadromous, and marine fisheries. (Typically Offered: Fall)

AECL 5420: Aquaculture

(Dual-listed with AECL 4420).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2110; BIOL 2120 or graduate standing

Concepts related to the culture of aquatic organisms including culture systems, water quality, nutrition, genetics, diseases, and marketing. (Typically Offered: Spring)

AECL 5510: Behavioral Ecology

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: (BIOL 3120 or NREM 3110 or BIOL 3540 or ANS 3360 or ANTHR 3170) or graduate classification

The study of how an animal's behavior affects its ability to survive and reproduce in its environment. Course topics, such as foraging behavior, sexual selection, parental care, etc., represent the interface of ecology, evolution, and behavior. Offered odd-numbered years. (Typically Offered: Fall)

AECL 5540: Principles of Wildlife Disease

(Dual-listed with AECL 4540).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Ecological and epidemiological aspects of diseases as they relate to wildlife populations. Topics to be covered include: major classes of disease; detection, description, monitoring, and management of disease; characteristics and interactions between disease agents and wildlife hosts; relationships among wildlife, domestic animal, and human health. (Typically Offered: Spring)

AECL 5860: Aquatic Ecology

(Dual-listed with AECL 4860/ BIOL 4860/ ENSCI 4860). (Cross-listed with EEOB 5860/ ENSCI 5860).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 3120 or ENSCI 3810 or ENSCI 4020 or NREM 3010 or graduate classification

Structure and function of aquatic ecosystems with application to fishery and pollution problems. Emphasis on lacustrine, riverine, and wetland ecology. (Typically Offered: Fall)

AECL 5860L: Aquatic Ecology Laboratory

(Dual-listed with AECL 4860L/ BIOL 4860L/ ENSCI 4860L). (Cross-listed with EEOB 5860L/ ENSCI 5860L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Concurrent enrollment in BIOL 4860.

Field trips and laboratory exercises to accompany 4860. Hands-on experience with aquatic research and monitoring techniques and concepts. (Typically Offered: Fall)

AECL 5890: Population Ecology

(Dual-listed with AECL 4890/ BIOL 4890). (Cross-listed with EEOB 5890).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (BIOL 3120, STAT 1010 OR STAT 1040, MATH 1510 OR 1600 OR 1650) or graduate classification

Concepts and theories of population dynamics with emphasis on models of growth, predation, competition, and regulation. Offered even-numbered years. (Typically Offered: Fall)

AECL 5990: Creative Component

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

Courses for graduate students:

AECL 6110: Analysis of Populations

Credits: 3. Contact Hours: Lecture 3.

Prereq: (BIOL 3120; STAT 5870; MATH 1510 or 1600 or 1650) or graduate classification

Quantitative techniques for analyzing vertebrate population data to estimate parameters such as density and survival. Emphasis on statistical inference and computing. Offered even-numbered years. (Typically Offered: Fall)

AECL 6980: Animal Ecology Teaching Practicum

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Graduate student experience in the animal ecology teaching program. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

AECL 6990: Research

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

Animal Science (ANS)

Courses primarily for undergraduates:

ANS 1010: Working with Animals

Credits: 2. Contact Hours: Lecture 1, Laboratory 2.

An introductory course in skills for proper care, handling, and management of domestic animals. Terminology and skills in working with animals, identification, life-cycle management practices, and animal health management are introduced and examined. (Typically Offered: Fall, Spring)

ANS 1020X: Introduction to Livestock, Dairy, and Meat Evaluation

Credits: 1. Contact Hours: Laboratory 2.

Introduction to evaluation techniques for livestock, dairy, and meat judging. Emphasis on basic anatomical terms, selection criteria, decision-making, and communication skills necessary for livestock, dairy, and meat evaluation competitions. (Typically Offered: Fall)

ANS 1100: Orientation in Animal Science and ISU

Credits: 1. Contact Hours: Discussion 1, Lecture 1.

Orientation to the university and Department of Animal Science. Challenges and opportunities available to the professional animal agriculturalist. Professional goal setting, portfolio development, and development of interpersonal skills in the context of pursuing a career in animal science. (Typically Offered: Fall)

ANS 1140: Survey of the Animal Industry

Credits: 2. Contact Hours: Lecture 2.

Principles of management and care of domestic animals, including genetics, nutrition, and reproduction. Service of domestic animals to society in terms of food, shelter, protection, fuel and emotional well-being. Basic biology, industry structure, management practices and production systems. (Typically Offered: Fall, Spring)

ANS 1160: Practicum in Safe Equine Handling and Welfare

Credits: 1. Contact Hours: Laboratory 3.

Development of best practices for safe horse handling and practical equine health care tasks. Course will focus on equine welfare and human safety as well as provide training in necessary every day skills needed to own a horse or to work at a horse farm. Certificate of Safe Equine Handling and Welfare available upon course completion. (Typically Offered: Fall)

ANS 1900: Livestock Handling, Safety and Welfare

Credits: 2. Contact Hours: Lecture 1.5, Laboratory 1.

Prereq: Co-requisite of ANS 1010 or 1140; Instructor permission

Understanding of animal perception to develop best care practices involved in handling of livestock species (beef, sheep, swine, dairy, equine, poultry). Intensive development of skills associated with handling and moving healthy and compromised livestock in respect to human and animal welfare. Integration of scientific and theoretical knowledge of biosecurity and animal-human interactions as it related to livestock handling and movement. (Typically Offered: Fall, Spring)

ANS 1990A: Marketing and Management of Livestock Events: Beef

Credits: 1. Contact Hours: Laboratory 2.

Repeatable.

Prereq: Credit or enrollment in ANS 1010 or ANS 1140

Management and coordination of livestock shows, sales and events, including program planning, staff and volunteer management, time management, publicity and promotion for fairs, shows, clinics, expos, and other events. Graduation Restriction: A maximum of two credits of ANS 1990 may be applied toward the total credits required for graduation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

ANS 1990E: Marketing and Management of Livestock Events: Horses

Credits: 1. Repeatable.

Prereq: Credit or enrollment in ANS 1010 or ANS 1140

Management and coordination of livestock shows, sales and events, including program planning, staff and volunteer management, time management, publicity and promotion for fairs, shows, clinics, expos, and other events. Graduation Restriction: A maximum of two credits of ANS 1990 may be applied toward the total credits required for graduation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

ANS 2070: The Art and Heritage of Livestock

Credits: 3. Contact Hours: Lecture 3.

Using art as a venue to understand the legacy and heritage of livestock production and livestock's contribution to civilization and society; livestock's contributions to warfare, social class, industry, economies, etc.; history of the impact of livestock on painting, poetry, music, sculpture, advertising, pop culture, movies, religion and sports in society. (Typically Offered: Fall)

ANS 2100: Career Preparation in Animal Science

Credits: 1.

Prereq: Sophomore classification; ANS major or DYS major

Life skill development emphasized in the context of career preparation. Assist students with career goal clarification, interview skills, resume and cover letter preparation. Internship development, job shadowing, and exploration of career option. (Typically Offered: Fall, Spring)

ANS 2110: Issues Facing Animal Science

Credits: 1. Contact Hours: Laboratory 2.

Prereq: ANS 1140 and Sophomore classification

Overview of the factors that define contemporary ethical and scientifically based issues facing animal agriculture. Life skill development (including interactive skills, communication ability, organization, information gathering, and leadership skills) emphasized in the context of issues study. (Typically Offered: Fall, Spring)

ANS 2140: Domestic Animal Physiology

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2120; (CHEM 1630 or CHEM 1670 or CHEM 1770)

Introduction to anatomy and physiology of the muscular, renal, skeletal, neural, mammary, cardiovascular, respiratory, immune, endocrine, reproductive, and digestive systems of domestic animals. (Typically Offered: Fall, Spring)

ANS 2140L: Domestic Animal Anatomy and Physiology Lab

Credits: 1. Contact Hours: Laboratory 2.

Basic anatomy of domestic animals. (Typically Offered: Fall, Spring)

ANS 2160: Equine Science

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: (ANS 1010 or ANS 1140); (BIOL 1010 or BIOL 2110 or BIOL 2120)

Introduction to contemporary concepts, and basic practices and decisions necessary when managing horses through stages of their lives. (Typically Offered: Fall, Spring)

ANS 2170: Equine Farm Practicum

Credits: 2. Contact Hours: Lecture 1, Laboratory 2.

Prereq: Credit or concurrent enrollment in ANS 2160 or Permission of Instructor

Intensified management of the equine farm. Provide students with experiential learning in all phases of horse production and management. Students assist with general farm management, horse health care, weekly farm management, and related topics. (Typically Offered: Fall, Spring)

ANS 2190X: Survey of Animal Nutrition

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 1010 or BIOL 2120

Nutrients, simple digestion and absorption, feed management strategies, nutrient requirements, ration formulation for livestock and companion animals. Non-major credit only. Graduation Restriction: Students may not receive graduation credit for both ANS 2190 and ANS 3190 or for both ANS 2190 and ANS 3200. (Typically Offered: Fall)

ANS 2230: Poultry Science

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: ANS 1010 and ANS 1140

Introduction to modern production trends with a focus on broiler, layer, and turkey industries. Topics covered include breeds, handling, management, physiology, nutrition, genetics, health & disease, and products. Weekly labs meet off campus. (Typically Offered: Fall)

ANS 2240: Companion Animal Science

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: BIOL 1010 or BIOL 2110 or BIOL 2120

Introduction to the science of managing companion animals through life stages. Topics covered will include human-animal bond, common and uncommon species kept as pets, breeds, behavior, basic training, nutrition, genetics, and breeding. (Typically Offered: Fall, Spring)

ANS 2250: Swine Science

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: ANS 1010 and ANS 1140

Introduction to principles, practices and decisions necessary when raising swine through the vertically integrated production cycle. Graduation Restriction: Only ANS 2800 and ANS 2800L or ANS 2250 may count toward graduation. (Typically Offered: Fall, Spring)

ANS 2260: Beef Cattle Science

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: ANS 1010 and ANS 1140

Introduction to principles, practices and decisions necessary when raising beef cattle through the vertically integrated production cycle. (Typically Offered: Fall, Spring)

ANS 2280: Laboratory Animal Science

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: ANS 1010 and ANS 1140

Introduction to the species, uses, biology, facilities, care, and diseases of animals used in research. ANS 2140 recommended. (Typically Offered: Spring)

ANS 2290: Sheep Science

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: ANS 1010 and ANS 1140

Introduction to principles, practices and decisions necessary when raising sheep through their production cycle. (Typically Offered: Spring)

ANS 2350: Dairy Cattle Science

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: ANS 1010 and ANS 1140

Introduction to principles, practices and decisions necessary when raising dairy cattle through the vertically integrated production cycle. (Typically Offered: Fall)

ANS 2700: Foods of Animal Origin

Credits: 2. Contact Hours: Lecture 2.

Principles, practices and issues impacting the production, processing and preservation of safe, wholesome, nutritious, and palatable meat, dairy, and egg products. Product evaluation, classification, value, and utilization. (Typically Offered: Fall, Spring)

ANS 2700L: Foods of Animal Origin Laboratory

Credits: 1. Contact Hours: Laboratory 2.

Prereq: Credit or current enrollment in ANS 2700

Determination of composition and quality of meat, eggs and milk based on industry and USDA standards. Fundamentals of processing foods of animal origin to add value, maintain quality and ensure safety. (Typically Offered: Fall, Spring)

ANS 2800: Basic Swine Science

Credits: 2. Contact Hours: Lecture 2.

Prereq: ANS 1010 and ANS 1140

Basic disciplines and concepts involved in swine production including industry structure, trends and statistics; production phases and buildings; genetic improvement; reproduction; nutrition; health and biosecurity; nutrient management; marketing and meat quality and career opportunities in the swine industry. Graduation Restriction: Only ANS 2800 or ANS 2250 may count toward graduation.

ANS 3040X: Principles of Meat Evaluation

Credits: 3. Contact Hours: Laboratory 6.

Prerequisite for ANS 4750C. Detailed evaluation and application of USDA grading standards and yield characteristics as they relate to beef, pork, and lamb carcass and wholesale cut composition. Critical-thinking, decision-making and written communication skills will develop through their evaluation skills. Concurrent enrollment in ANS 2700L is preferred, but not required. (Typically Offered: Fall)

ANS 3050: Livestock Evaluation

Credits: 3. Contact Hours: Laboratory 6.

Prereq: Junior classification

Fall semester leads to 4750A or D. Breeding animal and market animal evaluation of beef, swine and sheep using contemporary techniques and tools. Communication and decision-making skills are practiced in the context of making selection decisions. ANS 2700L recommended. (Typically Offered: Fall)

ANS 3060: Equine Evaluation

Credits: 3. Contact Hours: Laboratory 6.

Prereq: Sophomore classification

Detailed visual evaluation of conformation and performance of the equine athlete. Decision-making skills are practiced in the context of making selection choices. Development of written and oral communication skills as students defend their judgments. Industry trends will be addressed. (Typically Offered: Spring)

ANS 3130: Exercise Physiology of Animals

Credits: 3. Contact Hours: Lecture 3.

Prereq: ANS 2140; BIOL 2110; (CHEM 1630 or CHEM 1670 or CHEM 1770)

Physiological adaptations to athletic training in canine and equine athletes. Topics of emphasis include exercise-related adaptations in metabolism, locomotion, the cardiovascular system, musculoskeletal system, and endocrine system. The roles of nutrition and conditioning programs are assessed. (Typically Offered: Fall, Spring)

ANS 3160: Equine Reproduction Lab

Credits: 3. Contact Hours: Lecture 1.

Prereq: (ANS 1160; credit or concurrent enrollment in ANS 3310) or Permission of Instructor

Reproductive anatomy with emphasis on the physiology of normal reproductive function; breeding season management; ways to control and improve reproduction; semen collection, evaluation, and processing; artificial insemination; pregnancy testing; parturition in the mare, foal care. Participation outside of class time is expected. (Typically Offered: Spring)

ANS 3170A: Fundamentals of Equine Behavior and Training: Young Horses at Halter

Credits: 1-3. Contact Hours: Lecture 3.

Modifying the behavior of the horse using systematic approaches to horse training emphasizing the psychology of training horses. Equipment and its use and preparation of horses for competition. Graduation

Restriction: A maximum of 4 credits of ANS 3170 may be applied toward graduation. (Typically Offered: Fall)

ANS 3170B: Fundamentals of Equine Behavior and Training: Yearlings

Credits: 3. Contact Hours: Laboratory 6.

Prereq: Instructor Permission for Course

Modifying the behavior of the horse using systematic approaches to horse training emphasizing the psychology of training horses. Equipment and its use and preparation of horses for competition. Graduation

Restriction: A maximum of 4 credits of ANS 3170 may be applied toward graduation.

ANS 3170C: Fundamentals of Equine Behavior and Training: Two-year olds and older

Credits: 3. Contact Hours: Laboratory 6.

Modifying the behavior of the horse using systematic approaches to horse training emphasizing the psychology of training horses. Equipment and its use and preparation of horses for competition. Graduation

Restriction: A maximum of 4 credits of ANS 3170 may be applied toward graduation.

ANS 3190: Animal Nutrition

Credits: 3. Contact Hours: Lecture 3.

Prereq: ANS 2140 AND (Credit or enrollment in BBMB 2210 OR CHEM 3310)

Structure and function of organic and inorganic nutrients. Digestion, absorption, metabolism and utilization of nutrients for maintenance and productive functions. Essential nutritive requirements of domestic livestock, poultry, and companion animals. Sources of nutrients, application of energy systems and concepts, and regulation of feed intake in animals. Graduation Restriction: Students may not receive graduation credit for both ANS 2190 and ANS 3190. (Typically Offered: Fall, Spring)

ANS 3200: Animal Feeds and Feeding

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: ANS 3190

Principles and practices of animal feed evaluation including nutrient composition and physical properties of common feedstuffs. Utilization of nutrient requirements at various physiological stages to formulate diets using manual and software-based computer methodologies. Graduation Restriction: Students may not receive graduation credit for both ANS 2190 and ANS 3190. (Typically Offered: Fall, Spring)

ANS 3240: Food Processing for Companion Animals

Credits: 3. Contact Hours: Lecture 3.

Prereq: ANS 3190, Junior Classification

Food processing and nutrition for carnivorous companion animals.

Topics covered include meat processing and meat preservation for companion animal diets, regulatory standards, cutting edge technologies for processing meat for companion animals, dietary needs of carnivorous companion animals, effect of different processing methods on safety and nutrient bioavailability. (Typically Offered: Fall)

ANS 3310: Domestic Animal Reproduction

Credits: 3. Contact Hours: Lecture 3.

Prereq: ANS 2140 or (BIOL 2550 and BIOL 2560) or BIOL 3350 or BMS 3290

Comparative anatomy, physiology, and endocrinology of domestic mammalian animal reproduction. Techniques for the control and manipulation of reproductive processes. (Typically Offered: Fall, Spring)

ANS 3320A: Laboratory Methods in Animal Reproduction: Livestock, Companion, and Laboratory Animals

Credits: 1. Contact Hours: Laboratory 2.

Prereq: Credit or enrollment in ANS 3310

Comparative reproductive anatomy with emphasis on the physiology of normal reproductive function; ways to control and improve reproduction; principles of semen collection and artificial insemination; pregnancy testing. (Typically Offered: Fall, Spring)

ANS 3320E: Laboratory Methods in Animal Reproduction: Equine

Credits: 1. Contact Hours: Laboratory 2.

Prereq: Credit or enrollment in ANS 3310

Reproductive anatomy with emphasis on the physiology of normal reproductive function; breeding season management; ways to control and improve reproduction; semen collection, evaluation, and processing; artificial insemination; pregnancy testing; parturition in the mare, foal care. (Typically Offered: Spring)

ANS 3330: Embryo Transfer and Related Technologies

Credits: 3. Contact Hours: Lecture 3.

Prereq: ANS 3310

Application of embryo transfer and related technologies to genetic improvement of mammalian livestock. Techniques for control of female reproduction, embryo collection and transfer, embryo cryopreservation, and embryo manipulation. Gender selection. Economic and genetic aspects of embryo transfer. (Typically Offered: Fall)

ANS 3340: Embryo Transfer Laboratory

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Credit or enrollment in ANS 3330 and instructor permission

Selected laboratory exercises related to embryo transfer such as synchronization of estrus, superovulation, detection of estrus, artificial insemination, embryo collection, embryo evaluation, microscopy, embryo cryopreservation, in vitro fertilization, embryo sexing, rectal palpation, and ultrasonography will be demonstrated and/or performed. (Typically Offered: Fall)

ANS 3350: Dairy Cattle Evaluation

Credits: 3. Contact Hours: Lecture 2, Laboratory 4.

Prereq: Sophomore classification

Evaluation of dairy heifers and lactating dairy cows. Emphasis placed on familiarity with anatomical terms/structures, the use of comparative terminology, decision-making skills, and presentation of oral reasons. (Introduction and skills development course for ANS 4750B.). (Typically Offered: Spring)

ANS 3360: Domestic Animal Behavior and Well-Being

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: ANS 2140

Understand how managed animals cope and perceive the environment. Principles of behavior and well-being relative to animal care, management and housing. Methods to objectively assess animal well-being. Awareness of animal protection through education/assessments, audits and law. (Typically Offered: Fall)

ANS 3370: Lactation

Credits: 3. Contact Hours: Lecture 3.

Prereq: ANS 2140

The structure, development and evolution of the mammary gland. Mammary metabolism, milk synthesis; neural and endocrine regulation of mammary function. Immune function and health of the mammary gland. Current events related to lactation. (Typically Offered: Spring)

ANS 3450: Growth and Development of Domestic Animals

Credits: 3. Contact Hours: Lecture 3.

Prereq: ANS 2140

Basic principles of animal growth and development covered at the tissue, cellular and molecular level. Emphasis placed on skeletal muscle, adipose, bone, and immune system growth and development. The effects of genetics, nutrition, and pharmaceuticals on growth. Course(s) in nutrition, genetics, meat science and/or biochemistry recommended. (Typically Offered: Spring)

ANS 3510: Principles of Domestic Animal Genetics

(Cross-listed with GEN 3510).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2120; STAT 1010 or STAT 1040

Foundation of genetics, genomics, and statistical concepts in domestic animal populations. Graduation Restriction: Only one of ANS 3510, BIOL/GEN 3130, and GEN 3200 may count toward graduation. (Typically Offered: Fall)

ANS 3520: Genetic Improvement of Domestic Animals

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: STAT 1010 or STAT 1040; (BIOL 3130 or GEN 3200 or ANS 3510)

Principles of qualitative and quantitative genetics applied to improve domestic animal populations. Impact of selection and mating schemes in achieving breeding program goals. Applications and impacts of biotechnological advancements in genetics and genomics. (Typically Offered: Fall, Spring)

ANS 3600: Fresh Meat Science and Applied Muscle Biology

Credits: 3. Contact Hours: Lecture 3.

Prereq: ANS 2700; (BBMB 2210 or CHEM 3310)

Impact of muscle structure, composition, rigor mortis, inspection, fabrication, handling, packaging and cooking on the palatability, nutritional value, yields, market value, and safety of fresh meat. (Typically Offered: Fall)

ANS 3730A: Poultry Products Technology

Credits: 3.

Prereq: ((CHEM 1630 or CHEM 1670 or CHEM 1770); (BIOL 2110 or 2120)) or Permission of Instructor

Basic principles of meat-producing and egg-laying poultry management, meat science, product functionality, egg quality, and food safety, product quality, product functionality, and food safety. 2-week course. Enrollment restricted to participants in the Midwest Poultry Consortium Center of Excellence Scholarship/Internship program. (Typically Offered: Summer)

ANS 3730B: Applied Avian Physiology

Credits: 3.

Prereq: ((CHEM 1630 or CHEM 1670 or CHEM 1770); (BIOL 2110 or 2120)) or Permission of Instructor

Introduction of industry-relevant aspects of avian physiology with emphasis on behavior, neurology, muscle, cardiovascular, immunology, digestive, endocrinology, and reproductive systems for egg and meat producing birds. Focus on avian physiology and relevance to production management and outcomes. 2-week course. Enrollment restricted to participants in the Midwest Poultry Consortium Center of Excellence Scholarship/Internship program. (Typically Offered: Summer)

ANS 3730C: Avian Health

Credits: 3.

Prereq: ((CHEM 1630 or CHEM 1670 or CHEM 1770); (BIOL 2110 or 2120)) or Permission of Instructor

Identification, diagnosis, management, and prevention of diseases in commercial poultry. 2-week course. Enrollment restricted to participants in the Midwest Poultry Consortium Center of Excellence Scholarship/Internship program. (Typically Offered: Summer)

ANS 3730D: Poultry Nutrition

Credits: 3.

Prereq: ((CHEM 1630 or CHEM 1670 or CHEM 1770); (BIOL 2110 or 2120)) or Permission of Instructor

Commercial poultry-specific nutrition with an emphasis on species and age-specific diet formulation, ingredient selection, feed production, and production system. Use of feed additives and production outcomes. 2-week course. Enrollment restricted to participants in the Midwest Poultry Consortium Center of Excellence Scholarship/Internship program. (Typically Offered: Summer)

ANS 3800A: Swine Breeding and Gestation Management

Credits: 1. Contact Hours: Lecture 1.

Prereq: ANS 2250 or ANS 2800

Concepts related to: reproductive physiology and endocrinology of boars and sows; genetic selection programs; development programs for future replacement gilts and boars; semen collection, evaluation, and preparation; detection of estrus and artificial insemination; pregnancy diagnosis; feeding and housing programs for gestating sows; environmental management; records; diseases, and development of quality assurance programs for identifying and solving reproductive problems. (Typically Offered: Spring)

ANS 3800B: Contemporary Issues in the Swine Industry

Credits: 1. Contact Hours: Lecture 1.

Prereq: ANS 2250 or ANS 2800

Evaluation of issues facing today's swine industry including: welfare, nutrient management, and food safety and security. Development of skills needed for effective community relations such as media interviews and message points. (Typically Offered: Spring)

ANS 3800C: Employee Management for the Swine Industry

Credits: 1. Contact Hours: Lecture 1.

Prereq: ANS 2250 or ANS 2800

Effective employee management in swine production units. Principles, policies, and practices related to procurement, development, maintenance, and utilization of employees. (Typically Offered: Fall)

ANS 3800D: Farrowing Management

Credits: 1. Contact Hours: Lecture 1.

Prereq: ANS 2250 or ANS 2800

Advanced integration and application of reproductive management concepts during farrowing and lactation. Identification of production trends; formulation of strategies to improve productivity, and parturition and neonatal management. (Typically Offered: Spring, Summer)

ANS 3800E: Swine Feed Mill Management

Credits: 1. Contact Hours: Lecture 1.

Prereq: ANS 2250 or ANS 2800

Principles of feed manufacturing, equipment operation, feed and ingredient quality assurance and regulatory compliance in a modern feed milling operation. Overview of feed mill regulations and safety. (Typically Offered: Fall)

ANS 3800F: Marketing and Risk Management in the Swine Industry

Credits: 1. Contact Hours: Lecture 1.

Prereq: ANS 2250 or ANS 2800

A comprehensive view of industry structure and trends and marketing options available in the swine industry. Management of risk between markets and/or contracts. (Typically Offered: Spring)

ANS 3800G: Swine Nursery and Finishing Management

Credits: 1. Contact Hours: Lecture 1.

Prereq: ANS 2250 or ANS 2800

Overview of the critical management, housing, and financial considerations relevant to the successful operation of a swine nursery, grow-finish, or wean to finish enterprise, including nutrient requirements; building and facility management; and marketing. (Typically Offered: Spring)

ANS 3800I: Pork Export Markets

Credits: 1. Contact Hours: Lecture 1.

Prereq: ANS 2250 or ANS 2800

Introduction to global markets; cultural preferences and customs associated with the global swine industry. International trade regulations potential impact of foreign animal diseases and bioterrorism affecting the U.S. swine industry. (Typically Offered: Summer)

ANS 3800J: Pork Product Quality and Safety

Credits: 1. Contact Hours: Lecture 1.

Prereq: ANS 2250 or ANS 2800

Pre- and post-harvest affecting pork product quality and safety. Overview of pork harvesting process and traits and characteristics of quality pork products. (Typically Offered: Spring)

ANS 3800K: Swine Nutrition

Credits: 1. Contact Hours: Lecture 1.

Prereq: ANS 2250 or ANS 2800; ANS 3190

Principles of developing and implementing a swine feeding program. Fundamentals of feeding pigs including nutrients; factors affecting nutrient recommendations; feeding systems and management; feed ingredients, and formulation of swine diets. (Typically Offered: Fall)

ANS 3820: Swine Ventilation Systems and Management

Credits: 1. Contact Hours: Lecture 1.

Prereq: ANS 2250 or ANS 2800

Response of swine to thermal environment, ventilation system design and analysis, heating and cooling systems, and examples of various designs for all phases of production. Troubleshooting ventilation systems and energy analysis of production units. TSM 2100 recommended. (Typically Offered: Spring)

ANS 3830: Swine Manure and Nutrient Management

Credits: 1. Contact Hours: Lecture 1.

Prereq: ANS 2250 or ANS 2800

Function, application, and advantages and disadvantages of nutrient management systems. Manure production rates, manure handling systems, storage and manure management planning for land application and odor mitigation strategies.

ANS 3840: Swine Health and Biosecurity

Credits: 1. Contact Hours: Lecture 1.

Prereq: ANS 2250 or ANS 2800

Overview of standard biosecurity protocols and identification of behavior and clinical signs of illness in pigs. Treatment administration and prevention methods. Introduction to immune system function and basic swine disease transmission. Recommended a course in microbiology.

ANS 3990A: Animal Science Internship: Graded Internship Experience

Credits: 2-6. Repeatable.

Prereq: Instructor Permission for Course

Learning experience focused on professional development for a career related to animal science. Journal, presentation, and scientific component. (Typically Offered: Fall, Spring, Summer)

ANS 3990B: Animal Science Internship: Supervised Internship Experience

Credits: Required. Repeatable, maximum of 0 credits.

Prereq: Instructor Permission for Course

Learning experience focused on professional development for a career related to animal science. Journal, presentation, and scientific component. This course is designed for those students who are completing a semester long internship located off campus. (Typically Offered: Fall, Spring, Summer)

ANS 4110: Addressing Issues in Animal Science

Credits: 1. Contact Hours: Laboratory 2.

Prereq: Senior classification; ANS major

Life skill development emphasized in the context of exploring one's perspective of the most pressing moral and scientific issues facing animal agriculture. Clarification and communication of personal conclusions in small and large group settings expected. (Typically Offered: Fall, Spring)

ANS 4150: Equine Systems Management

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: ANS 2160, ANS 3190, ANS 3200, ANS 3310

Identification and development of financial and production goals in a horse business. Scientific approach to make decisions in management of enterprises in the horse industry. (Typically Offered: Fall, Spring)

ANS 4190: Advanced Animal Nutrition

Credits: 2. Contact Hours: Lecture 2.

Prereq: ANS 3190

Detailed consideration of digestion, metabolism, and assimilation of nutrients. Recent advances and developments in basic nutrition. (Typically Offered: Fall)

ANS 4230X: Poultry Systems Management

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: ANS 2230

Decisions facing the administrator of a poultry enterprise. Financial and production goal identification, problem clarification, and resource allocation to manage the poultry enterprise. (Typically Offered: Spring)

ANS 4240: Companion Animal Systems Management

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: ANS 2240 and ANS 3190; credit or enrollment in ANS 3200, ANS 3310, ANS 3520

Factors that affect managers of a companion animal enterprise. Financial and business goal identification, problem clarification, behavior modification, animal training, humane education, and resource allocation to manage a companion animal system. (Typically Offered: Fall, Spring)

ANS 4250: Swine Systems Management

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: (ANS 2250; ANS 2700; ANS 2700L; ANS 3190; ANS 3200; ANS 3310; ANS 3520) or Permission of Instructor

Decisions facing the administrator of a swine enterprise. Financial and production goal identification, problem clarification, and resource allocation to manage the swine enterprise. ECON 2300 or equivalent recommended. (Typically Offered: Fall)

ANS 4260: Beef Cattle Systems Management

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: (ANS 2260; ANS 2700; ANS 2700L; ANS 3200) or Permission of Instructor

Decisions facing the administrator of a beef cow-calf or feedlot enterprise. Financial and production goal identification, problem clarification, and resource allocation to manage the beef enterprise. Computer aided study. ECON 2300 or equivalent recommended. (Typically Offered: Fall, Spring)

ANS 4290: Sheep Systems Management

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: (ANS 2290; ANS 3190; ANS 3200; ANS 3310; ANS 3520) or Permission of Instructor

Decisions facing the administrator of a sheep enterprise. Financial and production goal identification, problem clarification, and resource allocation to manage the sheep enterprise. ECON 2300 and AGRON 3340 or equivalents recommended. (Typically Offered: Spring)

ANS 4340: Dairy Systems Management

Credits: 3. Contact Hours: Laboratory 2, Lecture 2.

Prereq: ANS 2350, ANS 3310, ANS 3370; credit or enrollment in ANS 3520

The scientific foundation of dairy cattle management. The impact of dairy farm management practices on the biological processes of the cow. Integrates concepts from the disciplines of lactation, reproduction, nutrition, genetics, and animal health. (Typically Offered: Fall)

ANS 4350: Applied Dairy Farm Evaluation

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: ANS 4340

Evaluate nutrition, reproduction, milk quality, breeding, and related management practices of commercial dairy herds in a case study format. Students will apply knowledge gained in the classroom to commercial dairy farm situations and develop skills in information gathering, decision making, problem solving, and interpersonal communications. ECON 2300 or equivalent recommended. (Typically Offered: Spring)

ANS 4410: International Animal Agriculture

(Cross-listed with GLOBE 4410).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ANS 2230 or ANS 2250 or ANS 2260 or ANS 2290 or ANS 2350 or instructor permission

An overview of animal agriculture with emphasis in developing countries. Historical, economic, environmental, and political considerations will be assessed and evaluated. Issues related to gender, resilience and sustainability for different production systems including alternative livestock species, will be investigated. The role of animal source foods in attainment of global food security will be discussed. Meets International Perspectives Requirement. (Typically Offered: Spring)

ANS 4600: Science and Technology of Value Added Meat Products

(Dual-listed with ANS 5600).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: ANS 2700

Physical, chemical and biological properties of meat important to achieving value-added meat product characteristics. Ingredients, technology and equipment used for processing, preservation and safety of cured meats, loaf products and fresh, cooked, dry and semi-dry sausage products. (Typically Offered: Spring)

ANS 4730A: Poultry Enterprise Management

Credits: 3.

Prereq: (CHEM 1630 or CHEM 1670 or CHEM 1770); (BIOL 2110 or BIOL 2120)

Business and management aspects of the poultry industry. Emphasis on personal interactions, effective communication, interview skills, poultry management, writing a business plan, and business decisions. 2-week course. Enrollment restricted to participants in the Midwest Poultry Consortium Center of Excellence Scholarship/Internship program. (Typically Offered: Summer)

ANS 4730B: Breeder Flock and Hatchery Management

Credits: 3.

Prereq: (CHEM 1630 or CHEM 1670 or CHEM 1770); (BIOL 2110 or BIOL 2120)

Topics associated with the management of poultry breeder flocks and hatcheries: nutrition, lighting management, reproductive physiology, and husbandry for breeder flocks. Embryology, incubation techniques, biosecurity, and hatchery management. 2-week course. Enrollment restricted to participants in the Midwest Poultry Consortium Center of Excellence Scholarship/Internship program. (Typically Offered: Summer)

ANS 4750A: Intercollegiate Judging Training and Competition: Meat Animals

Credits: 1-2. Contact Hours: Laboratory 4.

Repeatable.

Prereq: Instructor Permission for Course

Specialized training in evaluation and grading of livestock. Development and advancement of decision-making skills, comparative techniques and terminology, familiarity with anatomical terms/structures, and presentation of oral reasons. Graduation Restriction: Maximum of 6 credits may be applied toward graduation. (Typically Offered: Fall, Spring)

ANS 4750B: Intercollegiate Judging Training and Competition: Dairy Cattle

Credits: 1-2. Contact Hours: Laboratory 4.
Repeatable.

Prereq: Instructor Permission for Course

Specialized training in evaluation of dairy cattle, in particular heifers and lactating dairy cows. Development and advancement of decision-making skills, comparative techniques and terminology, familiarity with anatomical terms/structures, and presentation of oral reasons. Graduation Restriction: Maximum of 6 credits may be applied toward graduation. (Typically Offered: Fall, Spring)

ANS 4750C: Intercollegiate Judging Training and Competition: Meats

Credits: 1-2. Contact Hours: Laboratory 4.
Repeatable.

Prereq: Instructor Permission for Course

Specialized training in evaluation and grading of livestock/meat products. Development and advancement of decision-making skills, comparative techniques and terminology, familiarity with anatomical terms/structures, and presentation of written reasons. Graduation Restriction: Maximum of 6 credits may be applied toward graduation. (Typically Offered: Fall, Spring)

ANS 4750D: Intercollegiate Judging Training and Competition: Meat Animal Evaluation

Credits: 1-2. Contact Hours: Laboratory 4.
Repeatable.

Prereq: Instructor Permission for Course

Specialized training in evaluation and grading of livestock, livestock products, and livestock production management plans. Emphasis placed on the impact of management decisions on marketability and profitability. Development and advancement of decision-making skills, and communication and comparative techniques. Graduation Restriction: Maximum of 6 credits may be applied toward graduation. (Typically Offered: Fall, Spring)

ANS 4750E: Intercollegiate Judging Training and Competition: Horses

Credits: 1-2. Repeatable.

Prereq: Instructor Permission for Course

Specialized training in evaluation of horses and horse events. Emphasis placed on familiarity with anatomical terms/structures, form to function, application of breed association rules and current maneuver scoring, and the use of comparative terminology. Development and advancement of decision-making skills, comparative techniques, and presentation of oral reasons. Graduation Restriction: Maximum of 6 credits may be applied toward graduation. (Typically Offered: Fall, Spring)

ANS 4750F: Intercollegiate Judging Training and Competition: Management Systems

Credits: 1-2. Contact Hours: Laboratory 4.
Repeatable.

Prereq: Instructor Permission for Course

Specialized training in evaluation of livestock/domesticated animal production management plans. Development and advancement of decision-making skills, comparative techniques, and presentation of analyses. Emphasis placed on the impact of management decisions on marketability and profitability. Graduation Restriction: Maximum of 6 credits may be applied toward graduation. (Typically Offered: Fall, Spring)

ANS 4800A: Animal Industry Leadership Fellows: Beef

Credits: 1. Repeatable.

Prereq: ANS 2260; Instructor Permission

Students broaden their perspective of the livestock industry through site visits, case-study (Fellows) projects, and cooperative learning experiences that capitalize on interaction skills in the context of studying the structure of the U.S. livestock industry. This for-credit offering represents the central academic focus of the Iowa State University Animal Industry Leadership Fellows Program. Study is species specific, and enrollment is limited. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

ANS 4800C: Animal Industry Leadership Fellows: Pork

Credits: 1. Repeatable.

Prereq: ANS 2250; Instructor Permission

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

ANS 4800G: Animal Industry Leadership Fellows: Poultry

Credits: 1. Repeatable.

Prereq: ANS 2230; Instructor Permission

Students broaden their perspective of the livestock industry through site visits, case-study (Fellows) projects, and cooperative learning experiences that capitalize on interaction skills in the context of studying the structure of the U.S. livestock industry. Central academic focus of the Iowa State University Animal Industry Leadership Fellows Program. Study is species specific, and enrollment is limited. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

ANS 4900A: Independent Study: Animal Science

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

Open to undergraduate students in animal science, dairy science and general pre-veterinary medicine showing satisfactory preparation for project chosen. Individual projects involving faculty supervision, including mentoring and preparation of report. Graduation Restriction: A maximum of 6 credits of ANS 4900 may be applied toward the total credits required for graduation. (Typically Offered: Fall, Spring, Summer)

ANS 4900B: Independent Study: Dairy Science

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

Open to undergraduate students in animal science, dairy science and general pre-veterinary medicine showing satisfactory preparation for project chosen. Individual projects involving faculty supervision, including mentoring and preparation of report. Graduation Restriction: A maximum of 6 credits of ANS 4900 may be applied toward the total credits required for graduation. (Typically Offered: Fall, Spring, Summer)

ANS 4900C: Independent Study: Meat Science

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

Open to undergraduate students in animal science, dairy science and general pre-veterinary medicine showing satisfactory preparation for project chosen. Individual projects involving faculty supervision, including mentoring and preparation of report. Graduation Restriction: A maximum of 6 credits of ANS 4900 may be applied toward the total credits required for graduation. (Typically Offered: Fall, Spring, Summer)

ANS 4900D: Independent Study: Companion Animal Science

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

Open to undergraduate students in animal science, dairy science and general pre-veterinary medicine showing satisfactory preparation for project chosen. Individual projects involving faculty supervision, including mentoring and preparation of report. Graduation Restriction: A maximum of 6 credits of ANS 4900 may be applied toward the total credits required for graduation. (Typically Offered: Fall, Spring, Summer)

ANS 4900E: Independent Study: Equine Science

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

Open to undergraduate students in animal science, dairy science and general pre-veterinary medicine showing satisfactory preparation for project chosen. Individual projects involving faculty supervision, including mentoring and preparation of report. Graduation Restriction: A maximum of 6 credits of ANS 4900 may be applied toward the total credits required for graduation. (Typically Offered: Fall, Spring, Summer)

ANS 4900G: Independent Study: Poultry Science

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

Open to undergraduate students in animal science, dairy science and general pre-veterinary medicine showing satisfactory preparation for project chosen. Individual projects involving faculty supervision, including mentoring and preparation of report. Graduation Restriction: A maximum of 6 credits of ANS 4900 may be applied toward the total credits required for graduation. (Typically Offered: Fall, Spring, Summer)

ANS 4900H: Independent Study: Honors

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: Permission of Instructor; Membership in the University Honors Program

Open to undergraduate students in animal science, dairy science and general pre-veterinary medicine showing satisfactory preparation for project chosen. Individual projects involving faculty supervision, including mentoring and preparation of report. Graduation Restriction: A maximum of 6 credits of ANS 4900 may be applied toward the total credits required for graduation. (Typically Offered: Fall, Spring, Summer)

ANS 4900I: Independent Study: Entrepreneurship

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

Open to undergraduate students in animal science, dairy science and general pre-veterinary medicine showing satisfactory preparation for project chosen. Individual projects involving faculty supervision, including mentoring and preparation of report. Graduation Restriction: A maximum of 6 credits of ANS 4900 may be applied toward the total credits required for graduation. (Typically Offered: Fall, Spring, Summer)

ANS 4930: Workshop in Animal Science

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Workshop in livestock production. Includes current concepts in breeding, nutrition, reproduction, meats, and technologies that impact the animal industry.

ANS 4950: Agricultural Travel Course Preparation

Credits: Required. Repeatable.

Prereq: Instructor Permission for Course

Limited enrollment. Students enrolled in this course will also register for AGRON 4950 and intend to register in AGRON 4960 and ANS 4960 the following term. Topics will include the agricultural industries, climate, crops, culture, history, livestock, marketing, soils, and preparation for travel to locations to be visited. Information normally available 9 months before departure. (Typically Offered: Fall, Spring)

ANS 4960A: Agricultural Travel Course: International Tour

Credits: 1-30. Repeatable.

Limited enrollment. International tour and study of livestock production systems and impacts of animals on society and the ecosystem. Influence of climate, economics, geography, landscapes, markets, and other factors on both livestock and other domesticated animals. Locations and duration of tours will vary. Information usually available 9 months before departure. Tour expenses paid by students. Meets International Perspectives Requirement.

ANS 4960B: Agricultural Travel Course: Domestic tour

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Limited enrollment. Domestic tour and study of livestock production systems and impacts of animals on society and the ecosystem. Influence of climate, economics, geography, landscapes, markets, and other factors on both livestock and other domesticated animals. Locations and duration of tours will vary. Information usually available 9 months before departure. Tour expenses paid by students.

ANS 4970: Undergraduate Teaching Experiences in Animal Science

Credits: 1-2. Repeatable, maximum of 4 credits.

Prereq: Instructor Permission for Course

Development of oral and written communication skills of technical concepts in animal science. Emphasis on organizational skills, conducting activities and interpersonal communication skills. Responsibilities in a class under direct supervision of a faculty member. Graduation Restriction: A maximum of 4 credits of ANS 4970 may be applied toward graduation. (Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

ANS 5000A: Applied Data Science and Statistics using Statistical Software in Animal Sciences: SAS

Credits: 1. Contact Hours: Lecture 2.

Prereq: Credit or enrollment in STAT 5870 or Graduate Classification

First half semester course. Introduction to using SAS for solving research problems, including organization of data files, transfer of files between different formats, data editing, identifying confounded data, developing statistical models, and techniques for analysis of designed experiments. (Typically Offered: Fall)

ANS 5000B: Applied Data Science and Statistics using Statistical Software in Animal Sciences: R

Credits: 1. Contact Hours: Lecture 2.

Prereq: Credit or enrollment in STAT 5870 or Graduate Classification

Second half semester course. Introduction to using R for data science and statistics to solve research problems, including data entry, data management, merging files, outputting new datasets and reports, data visualization, developing statistical models, and techniques for analysis of designed experiments. (Typically Offered: Fall)

ANS 5010: Survey of Animal Disciplines

Credits: 1. Contact Hours: Lecture 1.

Prereq: Graduate Standing or Permission of Instructor

Required for Animal Science graduate students. Orientation to departmental and graduate school policies and procedures. Discussion of programs of research and outreach in Animal Science. Issues impacting the animal industry. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

ANS 5110X: Contemporary Issues in Reproductive Biology

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Current reproductive biology issues and research literature. Physiological, molecular and cellular processes in reproduction. Formulate hypotheses in existing and emerging areas of reproductive biology, including central nervous system control of reproduction, gametogenesis, stem cell biology, ovarian physiology, embryogenesis, uterine function, placental biology, fetal development, infertility and reproductive immunity. (Typically Offered: Fall)

ANS 5150: Integrated Crop and Livestock Production Systems

(Cross-listed with ABE 5150/ AGRON 5150/ SUSAG 5150).

Credits: 3. Contact Hours: Lecture 3.

Prereq: SUSAG 5090 or Graduate Classification

Methods to maintain productivity and minimize the negative ecological effects of agricultural systems by understanding nutrient cycles, managing manure and crop residue, and utilizing multispecies interactions. Crop and livestock production within landscapes and watersheds is also considered. Course includes a significant field component, with student teams analyzing Iowa farms. Offered odd-numbered years. (Typically Offered: Fall)

ANS 5170: Gut Microbiome: Implications for Health and Diseases

(Cross-listed with FSHN 5170/ MICRO 5170/ VMPPM 5170).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 2-3 credits in microbiology and/or immunology.

Explore current research on gut microbiome including modern tools used to study the gut microbiome. Examine the linkages between gut microbiome and health status, diseases, and manipulation of gut microbiome to improve health. (Typically Offered: Fall)

ANS 5180: Digestive Physiology and Metabolism of Non Ruminants

(Cross-listed with NUTRS 5180).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ANS 4190 or NUTRS 5010 or Graduate Classification

Digestion and metabolism of nutrients. Nutritional requirements and current research and feeding programs for poultry and swine. Offered odd-numbered years. (Typically Offered: Spring)

ANS 5200: Digestive Physiology and Metabolism of Ruminants

(Cross-listed with NUTRS 5200).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: ANS 4190 or NUTRS 5010 or Graduate Classification

Digestive physiology and nutrient metabolism in ruminant and preruminant animals. Offered even-numbered years. (Typically Offered: Spring)

ANS 5330: Physiology and Endocrinology of Animal Reproduction

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Development of structure and function of the reproductive system. Physiologic and endocrine aspects including puberty, gametogenesis, estrous cycle, pregnancy, maternal recognition, fertilization and early embryonic development. Offered odd-numbered years. (Typically Offered: Spring)

ANS 5360: Perinatology

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Regulation of metabolism and development in the mammalian fetus and neonate is explored in a comparative manner. Emphasis will be on the dynamic changes in these relationships occurring at birth. (Typically Offered: Spring)

ANS 5370A: Topics in Animal Behavior, Welfare: Animal Behavior

Credits: 3. Contact Hours: Lecture 3.

Prereq: Enrollment in M.S. or Ph.D.; Permission of Instructor

Each semester, the students' focus is on different topics related to animal behavior, animal welfare and contemporary issues related to animal behavior and welfare. Each topic is separate and distinct, and students may enroll in multiple topics. This is an on-line course only. Each topic may be taken only one time for credit. Offered odd-numbered years. (Typically Offered: Spring)

ANS 5400: Livestock Immunogenetics

(Cross-listed with MICRO 5400/ VMPPM 5400).

Credits: 2. Contact Hours: Lecture 2.

Prereq: ANS 5610 or MICRO 5750 or VMPPM 5200 or Graduate Classification

Basic concepts and contemporary topics in genetic regulation of livestock immune response and disease resistance. Offered odd-numbered years. (Typically Offered: Spring)

ANS 5490: Advanced Vertebrate Physiology I

(Cross-listed with KIN 5490/ NUTRS 5490).

Credits: 4. Contact Hours: Lecture 4.

Prereq: Undergraduate course in Physiology and Biochemistry

Overview of mammalian physiology. Cell biology, endocrinology, cardiovascular, respiratory, immune, digestive, skeletal muscle and reproductive systems. (Typically Offered: Fall)

ANS 5560: Current Topics in Genome Analysis

Credits: 3. Contact Hours: Lecture 3.

Prereq: BBMB 4050 or GDCB 5100 or Graduate Classification

Introduction to principles and methodology of molecular genetics useful in analyzing and modifying large genomes. Offered even-numbered years. (Typically Offered: Fall)

ANS 5600: Science and Technology of Value Added Meat Products

(Dual-listed with ANS 4600).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: ANS 2700 or Graduate standing

Physical, chemical and biological properties of meat important to achieving value-added meat product characteristics. Ingredients, technology and equipment used for processing, preservation and safety of cured meats, loaf products and fresh, cooked, dry and semi-dry sausage products. (Typically Offered: Spring)

ANS 5610: Population and Quantitative Genetics for Breeding

(Cross-listed with AGRON 5610).

Credits: 4. Contact Hours: Lecture 4.

Prereq: STAT 5870 or Graduate Classification

Population and quantitative genetics for plant and animal genetics. Study of the genetic basis and analysis of variation in quantitative traits in domestic or experimental populations using phenotypic and molecular marker data, including estimation of heritability and other genetic parameters, linkage analysis and mapping of quantitative trait loci, and the impact of inbreeding, heterosis, and genotype-by-environment interaction. (Typically Offered: Fall)

ANS 5620A: Methodologies for Population/Quantitative Genetics: Linear Models and Genetic Prediction

Credits: 2. Contact Hours: Lecture 2.

Prereq: ANS 5610 or Graduate Classification

Basic theory for genetic analysis of animal breeding data. Course A (1st half semester) covers linear models, selection index methods, and basic theory for best linear unbiased prediction. Course B (2nd half semester) best linear unbiased prediction, including genetic groups, environmental adjustment, repeated records, multiple trait models, maternal effects models, and theory for maximum likelihood estimation of genetic parameters. (Typically Offered: Spring)

ANS 5620B: Methodologies for Population/Quantitative Genetics: Advanced Genetic Prediction&Parameter Estimation

Credits: 2. Contact Hours: Lecture 2.

Prereq: ANS 5610 or Graduate Classification

Basic theory for genetic analysis of animal breeding data. Course A (1st half semester) covers linear models, selection index methods, and basic theory for best linear unbiased prediction. Course B (2nd half semester) best linear unbiased prediction, including genetic groups, environmental adjustment, repeated records, multiple trait models, maternal effects models, and theory for maximum likelihood estimation of genetic parameters. (Typically Offered: Spring)

ANS 5630: Advanced Processed Meats Technology

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Physical, chemical and biological properties of meat important to processed meat product characteristics. Ingredients, technology and equipment used for fresh and cured meat products. Packaging, preservation and food safety issues critical to processed meat products are emphasized. (Typically Offered: Spring)

ANS 5690: Reproductive and Developmental Toxicology

(Cross-listed with TOX 5690).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Chemical agents that target developmental and reproductive systems in animals and humans, both male and female. The influence that timeline of developmental in utero and what part of reproductive organ have on outcome of environmental exposures will be developed. The physiological changes due to exposure, and mechanistic pathways activated by xenobiotics will be defined and the consequences of these changes will be explored. Offered even-numbered years. (Typically Offered: Fall)

ANS 5700: Advanced Meat Science and Applied Muscle Biology

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Ante and postmortem factors impacting composition, structure, and chemistry of red meat and poultry muscle/meat, the conversion of muscle to meat, and the sensory and nutritional attributes of fresh meats. Oral reports and a written project. Graduation Restriction: Students cannot receive credit for both ANS 5700 and ANS 5730. Offered even-numbered years. (Typically Offered: Spring)

ANS 5710: Advanced Meat Processing Principles and Technology

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: ANS 4600 or ANS 5700 or Graduate Classification

Physical/chemical relationships during processing. Effects of modern technology, non-meat additives and preservation techniques on quality and safety of processed meat. Laboratory demonstration of principles and technology. Offered even-numbered years. (Typically Offered: Fall)

ANS 5730: Fresh Meat Science and Technology

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Quality, and sensory attributes of fresh meats and how they develop and how they are evaluated. The study of ante and postmortem factors impacting quantity, composition, structure, and chemistry of red meat and poultry muscle/meat. Graduation Restriction: Students cannot receive credit for both ANS 5700 and ANS 5730. (Typically Offered: Fall)

ANS 5900A: Special Topics: Animal Breeding

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Special topics in the animal sciences, offered on demand and may be conducted by guest professors. (Typically Offered: Fall, Spring, Summer)

ANS 5900B: Special Topics: Animal Nutrition

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Special topics in the animal sciences, offered on demand and may be conducted by guest professors. (Typically Offered: Fall, Spring, Summer)

ANS 5900C: Special Topics: Meat Animal Production

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Special topics in the animal sciences, offered on demand and may be conducted by guest professors. (Typically Offered: Fall, Spring, Summer)

ANS 5900D: Special Topics: Dairy Production

Credits: 1-3. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Special topics in the animal sciences, offered on demand and may be conducted by guest professors. (Typically Offered: Fall, Spring, Summer)

ANS 5900E: Special Topics: Meat Science

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Special topics in the animal sciences, offered on demand and may be conducted by guest professors. (Typically Offered: Fall, Spring, Summer)

ANS 5900F: Special Topics: Physiology of Reproduction

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Special topics in the animal sciences, offered on demand and may be conducted by guest professors. (Typically Offered: Fall, Spring, Summer)

ANS 5900G: Special Topics: Muscle Biology

Credits: 1-3. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Special topics in the animal sciences, offered on demand and may be conducted by guest professors. (Typically Offered: Fall, Spring, Summer)

ANS 5900H: Special Topics: Poultry Nutrition

Credits: 1-3. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Special topics in the animal sciences, offered on demand and may be conducted by guest professors. (Typically Offered: Fall, Spring, Summer)

ANS 5900I: Special Topics: Poultry Products

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Special topics in the animal sciences, offered on demand and may be conducted by guest professors. (Typically Offered: Fall, Spring, Summer)

ANS 5900J: Special Topics: Experimental Surgery

Credits: 1-3. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Special topics in the animal sciences, offered on demand and may be conducted by guest professors. (Typically Offered: Fall, Spring, Summer)

ANS 5900K: Special Topics: Professional Topics

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Special topics in the animal sciences, offered on demand and may be conducted by guest professors. (Typically Offered: Fall, Spring, Summer)

ANS 5900L: Special Topics: Teaching

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Special topics in the animal sciences, offered on demand and may be conducted by guest professors. (Typically Offered: Fall, Spring, Summer)

ANS 5900M: Special Topics: Molecular Biology

Credits: 1-3. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Special topics in the animal sciences, offered on demand and may be conducted by guest professors. (Typically Offered: Fall, Spring, Summer)

ANS 5900N: Special Topics: Ethology

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Special topics in the animal sciences, offered on demand and may be conducted by guest professors. (Typically Offered: Fall, Spring, Summer)

ANS 5990A: Creative Component: Animal Breeding and Genetics

Credits: 1-8. Repeatable.

Prereq: Instructor Permission for Course

A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee. (Typically Offered: Fall, Spring, Summer)

ANS 5990B: Creative Component: Animal Nutrition

Credits: 1-8. Repeatable.

Prereq: Instructor Permission for Course

A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee. (Typically Offered: Fall, Spring, Summer)

ANS 5990C: Creative Component: Animal Physiology

Credits: 1-8. Repeatable.

Prereq: Instructor Permission for Course

A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee. (Typically Offered: Fall, Spring, Summer)

ANS 5990D: Creative Component: Animal Science

Credits: 1-8. Repeatable.

Prereq: Instructor Permission for Course

A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee. (Typically Offered: Fall, Spring, Summer)

ANS 5990E: Creative Component: Meat Science

Credits: 1-8. Repeatable.

Prereq: Instructor Permission for Course

A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee. (Typically Offered: Fall, Spring, Summer)

Courses for graduate students:**ANS 6030: Seminar in Animal Nutrition**

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Discussion of current literature; preparation and submission of abstracts. (Typically Offered: Fall, Spring)

ANS 6180: Vitamins and Minerals

(Cross-listed with NUTRS 6180).

Credits: 2. Contact Hours: Lecture 2.

Understanding molecular aspects of vitamin and mineral metabolism and homeostasis in humans and animals. An in-depth examination of the chemistry of vitamins and minerals, including genetic mutations, proteins involved in absorption and excretion, and their necessity in biological processes. Offered even-numbered years. (Typically Offered: Spring)

ANS 6190: Advanced Nutrition and Metabolism - Protein

(Cross-listed with NUTRS 6190).

Credits: 2. Contact Hours: Lecture 2.

Prereq: BBMB 4050

Digestion, absorption, and intermediary metabolism of amino acids and protein. Regulation of protein synthesis and degradation. Integration of cellular biochemistry and physiology of mammalian protein metabolism. Offered odd-numbered years. (Typically Offered: Fall)

ANS 6200: Advanced Nutrition and Metabolism - Energy

(Cross-listed with NUTRS 6200).

Credits: 2. Contact Hours: Lecture 2.

Prereq: BBMB 4050

Energy constituents of feedstuffs and energy needs of animals as related to cellular biochemistry and physiology. Interpretations of classical and current research. Offered odd-numbered years. (Typically Offered: Fall)

ANS 6330: Seminar in Animal Reproduction

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Discussion of current literature and preparation of reports and seminars on selected topics concerning animal physiology. (Typically Offered: Fall)

ANS 6520A: Animal Breeding Strategies: Breeding Goals and Response to Selection

Credits: 2. Contact Hours: Lecture 2.

Prereq: ANS 5610 or Graduate Classification

Basic concepts and methods for design and evaluation of genetic improvement programs for livestock. Topic A. (1st half semester) Prediction of response to selection, selection index theory, multiple trait selection, inbreeding, crossbreeding, and marker-assisted selection. Topic B. (2nd half semester) Advanced concepts in design and evaluation of animal breeding programs, including modeling and optimization, derivation of economic values, gene-flow, and predicting rates of inbreeding. Graduation Restriction: Each topic may be taken only one time for academic credit.

ANS 6520B: Animal Breeding Strategies: Design and Evaluation of Animal Breeding Programs

Credits: 2. Contact Hours: Lecture 2.

Prereq: ANS 5610 or Graduate Classification

Basic concepts and methods for design and evaluation of genetic improvement programs for livestock. Topic A. (1st half semester) Prediction of response to selection, selection index theory, multiple trait selection, inbreeding, crossbreeding, and marker-assisted selection. Topic B. (2nd half semester) Advanced concepts in design and evaluation of animal breeding programs, including modeling and optimization, derivation of economic values, gene-flow, and predicting rates of inbreeding. Graduation Restriction: Each topic may be taken only one time for academic credit.

ANS 6530: Applied Animal Breeding Strategies

Credits: 3. Contact Hours: Lecture 3.

Industrial applications of breeding systems, selection methods, and new genetic technologies. One or more field trips to an industry breeding company. (Typically Offered: Fall)

ANS 6550A: Computational Strategies for Predicting Breeding Values

Credits: 2. Contact Hours: Lecture 3, Laboratory 1.

Prereq: ANS 5000; ANS 5620; or Graduate Classification

Computational methods and strategies for analysis of large data sets with animal breeding data for use in research and industry applications. Strategies for handling large sets and for prediction using best linear unbiased prediction using a formal language and utility programs. Offered odd-numbered years. (Typically Offered: Fall)

ANS 6550B: Computational Strategies for Genetic Parameter Estimation

Credits: 2. Contact Hours: Lecture 3, Laboratory 1.

Prereq: ANS 5000; ANS 5620; or Graduate Classification

Computational methods and strategies for analysis of large data sets with animal breeding data for use in research and industry applications. Strategies for estimation of genetic parameters and for use of non-linear models for genetic analysis of categorical and survival type data. Offered odd-numbered years. (Typically Offered: Fall)

ANS 6560: Statistical Methods for Mapping Quantitative Trait Loci

Credits: 2. Contact Hours: Lecture 2.

Prereq: ANS 5620 or Graduate Classification

Statistical methods for mapping quantitative trait loci in out-bred populations. Methods based on modeling covariances between relatives. Likelihood based methods using half-sib and full-sib families and extended pedigrees. Bayesian methods applied. Offered even-numbered years. (Typically Offered: Spring)

ANS 6580: Seminar in Animal Breeding and Genetics

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Presentation of current research related to animal breeding and genetics. (Typically Offered: Fall, Spring)

ANS 6700: Molecular Biology of Muscle

(Cross-listed with KIN 6700).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BBMB 4050, BBMB 4200

Ultrastructure of muscle; chemistry, structure, function, and molecular biology of muscle proteins. Molecular aspects of muscle contraction, development and turnover. Cytoskeletal proteins and dynamics. Offered odd-numbered years. (Typically Offered: Spring)

ANS 6840: Seminar in Meat Science

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Discussion and evaluation of current topics in research publications in meat science. (Typically Offered: Spring)

ANS 6850: Seminar in Muscle Biology

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Reports and discussion of recent literature and current investigations. (Typically Offered: Spring)

ANS 6950: Seminar in Animal Science

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Reports and discussion of current issues and research in animal science. One credit is required for all M.S. degree candidates with graduate majors in the Department of Animal Science, and two credits are required for all Ph.D. candidates with graduate majors in the Department of Animal Science. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

ANS 6990A: Research: Animal Breeding

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

ANS 6990B: Research: Animal Nutrition

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

ANS 6990C: Research: Meat Animal Production

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

ANS 6990D: Research: Dairy Production

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

ANS 6990E: Research: Meat Science

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

ANS 6990F: Research: Physiology of Reproduction

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

ANS 6990G: Research: Muscle Biology

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

ANS 6990H: Research: Poultry Nutrition

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

ANS 6990I: Research: Poultry Products

Credits: 1-30. Repeatable.

ANS 6990J: Research: Animal Ethology

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Anthropology (ANTHR)

Courses primarily for undergraduates:

ANTHR 2010: Introduction to Cultural Anthropology

Credits: 3. Contact Hours: Discussion 1, Lecture 2.

Introduction to the core concepts, theories, and methods of cultural anthropology with an emphasis on understanding human cultural diversity in global society from an anthropological perspective. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

ANTHR 2020: Human Origins

Credits: 3. Contact Hours: Discussion 1, Lecture 2.

Human biological and cultural evolution; survey of the evidence from fossil primates, the human fossil record and the archaeological record, as well as living primates; introduction to research methods in archaeology and biological anthropology. (Typically Offered: Fall, Spring)

ANTHR 2100: Introduction to Asian American Studies

(Cross-listed with WLC 2100).

Credits: 3. Contact Hours: Lecture 3.

An interdisciplinary and chronological examination of Asian American immigration experiences from the early 19th century to the 21st century. Focus on how these immigration histories are accompanied by changing racial constructions. Discussion of racial stereotyping, the model minority myth, identity development, and efforts for social justice. Meets U.S. Cultures and Communities Requirement.

ANTHR 2200: Globalization and Sustainability

(Cross-listed with SOC 2200/ ENVS 2200/ GLOBE 2200/ ME 2200/ MATE 2200).

Credits: 3. Contact Hours: Lecture 3.

An introduction to understanding the key global issues in sustainability. Focuses on interconnected roles of energy, materials, human resources, economics, and technology in building and maintaining sustainable systems. Applications discussed will include challenges in both the developed and developing world and will examine the role of technology in a resource-constrained world. Graduation Restriction: Cannot be used for technical elective credit in any engineering department. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

ANTHR 2250: American Indians of Iowa

(Cross-listed with AMIN 2250).

Credits: 3. Contact Hours: Lecture 3.

Cultures and histories of Native people who have called the present state of Iowa home; primary focus on the period between 1700 CE and the present; Native interactions with Spanish, French, British, and American people. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall)

ANTHR 2300: Globalization and the Human Condition

Credits: 3. Contact Hours: Lecture 3.

An introduction to understanding key global issues in the contemporary world. Focuses on social relations, cultural practices and political-economic linkages among Africa, the Americas, Asia, Europe and the Pacific. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

ANTHR 3060: Culture and Interpretation

Credits: 3. Contact Hours: Lecture 3.

Prereq: ANTHR 2010

Disciplinary and interdisciplinary approaches to the interpretation of contemporary and historical cultures, their contexts, and meanings. Meets International Perspectives Requirement. (Typically Offered: Spring)

ANTHR 3070: Biological Anthropology

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: ANTHR 2020

Human evolution as known from fossil evidence, comparative primate studies, and genetic variations in living populations. Laboratory-tutorial sessions include study and discussion of human osteology, fossil hominids, simple Mendelian traits, and bio-ethics in applied biological anthropology. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Spring)

ANTHR 3080: Archaeology

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: ANTHR 2020

Methods and techniques for the recovery and interpretation of archaeological evidence, its role in reconstructing human behavior and past environments. Laboratory sessions include experience in the interpretation of archaeological evidence, the use of classification systems, and prehistoric technologies such as ceramics and stone tools. (Typically Offered: Fall)

ANTHR 3090: Introduction to Culture and Language

(Cross-listed with LING 3090).

Credits: 3. Contact Hours: Lecture 3.

Introduction to study of language, culture and society from an anthropological perspective. Focus on language and thought, ethnography of speaking, discourse and narrative, writing and literacy, and media communication. Discussion of key theories and methods of linguistic anthropology. ANTHR 2010 recommended. Meets International Perspectives Requirement.

ANTHR 3100: Environmental Anthropology

Credits: 3. Contact Hours: Lecture 3.

Prereq: ANTHR 2010

Exploration of contemporary theories and methods in environmental anthropology with a focus on anthropological approaches to the global climate crisis. Meets International Perspectives Requirement.

ANTHR 3130: Kinship and Marriage in a Global Perspective

(Dual-listed with ANTHR 5130).

Credits: 3. Contact Hours: Lecture 3.

Comparative and historical overview of the family, marriage and kinship. Examination of cross-cultural differences in the construction and functioning of family and kin relations; role of kinship in structuring individual and collective activities; current critical and theoretical issues in kinship studies, especially integrating work on gender and sexuality. ANTHR 2010 recommended. Meets International Perspectives Requirement. (Typically Offered: Spring)

ANTHR 3150: Archaeology of North America

(Dual-listed with ANTHR 5150). (Cross-listed with AMIN 3150).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ANTHR 2020

Prehistory and early history of North America as reconstructed from archaeological evidence; peopling of the New World; culture- historical sequences of major culture areas; linkages of archaeological traditions with selected ethnohistorically known Native American groups. (Typically Offered: Spring)

ANTHR 3160X: Anthropology and Artificial Intelligence (AI)

Credits: 3. Contact Hours: Lecture 3.

A holistic introduction to anthropological and social scientific writing on artificial intelligence (AI) over the past several decades focusing on how the creation of humanlike machines involves making claims about human nature through their design. Includes a hands-on experimental component in which students develop AI applications that further anthropological and social-scientific goals. (Typically Offered: Fall, Spring)

ANTHR 3170: Primate Behavior, Ecology, and Evolution

Credits: 3. Contact Hours: Lecture 3.

An overview of the primates (prosimians, monkeys, and apes) with a focus on their behavior from an ecological and evolutionary perspective. Topics include: methods in primatological research; survey of the living primates; biological and social adaptations of primates; interactions between primates and their environment; and primate conservation. ANTHR 2020 and/or basic biology course recommended. (Typically Offered: Fall)

ANTHR 3190: Skeletal Biology

(Dual-listed with ANTHR 5190).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: ANTHR 3070 or 3 credits BIOL

Comprehensive study of the skeletal anatomy, physiology, genetics, growth, development and population variation of the human skeleton. Applications to forensic anthropology, paleopathology and bioarchaeology are introduced. (Typically Offered: Spring)

ANTHR 3200: Great Plains Archaeology

(Dual-listed with ANTHR 5200). (Cross-listed with AMIN 3200).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ANTHR 2020

Prehistoric societies of the Great Plains region of North America, from initial occupation to European contact; emphasis on sociocultural changes, continuities, and adaptations to changing environments using archaeological, ecological, ethnographic information. (Typically Offered: Fall)

ANTHR 3210: World Prehistory

(Dual-listed with ANTHR 5210).

Credits: 3. Contact Hours: Lecture 3.

An introduction to archaeological sites from around the world including the Near East, Africa, Europe, Mesoamerica, and North and South America. Emphasis is on the interpretation of material cultural remains in reconstructing past societies. ANTHR 2020 recommended. (Typically Offered: Spring)

ANTHR 3220: Peoples and Cultures of Native North America

(Dual-listed with ANTHR 5220). (Cross-listed with AMIN 3220).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ANTHR 2010 or AMIN 2100

Origin, distribution, and pre-contact life of the indigenous peoples of North America. Survey of culture areas; language families, social and political systems, ecological and economic adaptations, religion and spirituality; impact of European contact; cultural resilience and revitalization in contemporary American Indian life. Meets U.S. Cultures and Communities Requirement.

ANTHR 3230A: Latin American Anthropology: Violence and Memory

(Dual-listed with ANTHR 5230A). (Cross-listed with USLS 3230A).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Exploration of key contemporary and historical issues in Latin American Anthropology; discussion of current anthropological approaches to studying Latin American social issues in a global context. Topics vary each time offered. ANTHR 2010 or ANTHR 3060 recommended. Meets International Perspectives Requirement. (Typically Offered: Spring)

ANTHR 3230B: Latin American Anthropology: Social movements and Democracy

(Dual-listed with ANTHR 5230B). (Cross-listed with USLS 3230B).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Exploration of key contemporary and historical issues in Latin American Anthropology; discussion of current anthropological approaches to studying Latin American social issues in a global context. Topics vary each time offered. ANTHR 2010 or ANTHR 3060 recommended. Meets International Perspectives Requirement. (Typically Offered: Spring)

ANTHR 3230C: Latin American Anthropology: Race, Class and Gender

(Dual-listed with ANTHR 5230C). (Cross-listed with USLS 3230C).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Exploration of key contemporary and historical issues in Latin American Anthropology; discussion of current anthropological approaches to studying Latin American social issues in a global context. Topics vary each time offered. ANTHR 2010 or ANTHR 3060 recommended. Meets International Perspectives Requirement. (Typically Offered: Spring)

ANTHR 3230D: Latin American Anthropology: Regional Focus

(Dual-listed with ANTHR 5230D). (Cross-listed with USLS 3230D).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Exploration of key contemporary and historical issues in Latin American Anthropology; discussion of current anthropological approaches to studying Latin American social issues in a global context. Topics vary each time offered. ANTHR 2010 or ANTHR 3060 recommended. Meets International Perspectives Requirement. (Typically Offered: Spring)

ANTHR 3230E: Latin American Anthropology: Culture and Sport

(Dual-listed with ANTHR 5230E). (Cross-listed with USLS 3230E).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Exploration of key contemporary and historical issues in Latin American Anthropology; discussion of current anthropological approaches to studying Latin American social issues in a global context. Topics vary each time offered. ANTHR 2010 or ANTHR 3060 recommended. Meets International Perspectives Requirement.

ANTHR 3240: Health and Native American Communities

(Cross-listed with AMIN 3240/ POLS 3240).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500

Overview of historic and contemporary health and health care in Native Communities. Indian Health Service and specific regulations. Consideration of both cultural and scientific approaches to medicine. Specific health issues (e.g., diabetes, alcoholism, depression, etc.) in American Indian communities. Meets U.S. Cultures and Communities Requirement.

ANTHR 3280: Archaeological Discovery and Analysis

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Repeatable, maximum of 9 credits.

Prereq: ANTHR 3080

Identification, analysis, and interpretation of animal bones recovered from archaeological sites, emphasizing taphonomy, paleoecology, and faunal exploitation. (Typically Offered: Spring)

ANTHR 3320A: Current Issues in Native North America: Gender and Family

(Dual-listed with AMIN 5320A/ ANTHR 5320A). (Cross-listed with AMIN 3320A).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ANTHR 2010 or ANTHR 3060

Exploration of key contemporary and historical issues in Native North America; discussion of current anthropological approaches to studying Native North America in a global context. Topics vary each time offered. ANTHR 3220 or AMIN 2100 recommended. Graduation Restriction: Only 9 credits of ANTHR/AMIN 3320A, 3320B, 3320C, 3320D may count toward graduation.

ANTHR 3320B: Current Issues in Native North America: Indigenous Ecologies and Geographies

(Dual-listed with AMIN 5320B/ ANTHR 5320B). (Cross-listed with AMIN 3320B).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ANTHR 2010 or ANTHR 3060

Exploration of key contemporary and historical issues in Native North America; discussion of current anthropological approaches to studying Native North America in a global context. Topics vary each time offered. ANTHR 3220 or AMIN 2100 recommended. Graduation Restriction: Only 9 credits of ANTHR/AMIN 3320A, 3320B, 3320C, 3320D may count toward graduation.

ANTHR 3320C: Current Issues in Native North America: Cultural and Political Movements

(Dual-listed with AMIN 5320C/ ANTHR 5320C). (Cross-listed with AMIN 3320C).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ANTHR 2010 or ANTHR 3060

Exploration of key contemporary and historical issues in Native North America; discussion of current anthropological approaches to studying Native North America in a global context. Topics vary each time offered. ANTHR 3220 or AMIN 2100 recommended. Graduation Restriction: Only 9 credits of ANTHR/AMIN 3320A, 3320B, 3320C, 3320D may count toward graduation.

ANTHR 3320D: Current Issues in Native North America: Regional Focus

(Dual-listed with AMIN 5320D/ ANTHR 5320D). (Cross-listed with AMIN 3320D).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ANTHR 2010 or ANTHR 3060

Exploration of key contemporary and historical issues in Native North America; discussion of current anthropological approaches to studying Native North America in a global context. Topics vary each time offered. ANTHR 3220 or AMIN 2100 recommended. Graduation Restriction: Only 9 credits of ANTHR/AMIN 3320A, 3320B, 3320C, 3320D may count toward graduation.

ANTHR 3350: Anthropology of the Middle East

Credits: 3. Contact Hours: Lecture 3.

Introduction to ethnographic studies of the Middle East by drawing primarily on the lens of anthropologists who use anthropological methods to investigate issues of social, historical, and political relevance in the Middle East. The course will enable students to develop critical tools for studying diverse aspects of Middle Eastern experiences. Potential topics include: gender, religion and sectarianism, state and infrastructure, health, humanitarianism and displacement, popular culture. ANTHR 2010 or ANTHR 3060 recommended. Meets International Perspectives Requirement.

ANTHR 3360: Culture and Capitalism

(Dual-listed with ANTHR 5360).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ANTHR 2010 or ANTHR 3060

Cross-cultural analysis of current development practices from an anthropological perspective; focus on international aid, development institutions, agrarian reform, indigenous knowledge, humanitarianism and human rights; introduction to main theories of political and economic anthropology. Offered odd-numbered years. Meets International Perspectives Requirement. (Typically Offered: Fall)

ANTHR 3400: Magic, Witchcraft, and Religion

(Dual-listed with ANTHR 5400/ RELIG 5400). (Cross-listed with RELIG 3400).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ANTHR 2010 or ANTHR 3060

Survey of global religious belief and practice from an anthropological perspective. Emphasis on myth and ritual, shamanism, magic, witchcraft, beliefs in spirits, conceptions of the soul, mind and body relationships, and healing and therapeutic practices. Discussion of religious response to dramatic political and social change; effects of globalization on religious practice. Meets International Perspectives Requirement. (Typically Offered: Spring)

ANTHR 3420: Culture, Sex, and Gender

(Cross-listed with WGS 3420).

Credits: 3. Contact Hours: Lecture 3.

Cross-cultural examination of gender and sexuality. Emphasis on global and transnational perspectives. Topics will include varied gender and sexual expressions, status and roles, intersectionality in global or transnational contexts, and the examination of systems of oppression cross-culturally. ANTHR 2010 or WGS 2010 recommended. Meets International Perspectives Requirement. (Typically Offered: Spring)

ANTHR 3520: Migration and Refugees in the 21st Century

(Cross-listed with POLS 3520).

Credits: 0-99. Contact Hours: Lecture 3.

Repeatable.

The historical, economic, social, political, and environmental factors that explain human mobility in the 21st century. The definition of a 'migrant' with special emphasis on refugees (people who have been forcibly displaced across national borders). Ethnographic accounts of current refugee crises and of host state policy toward refugees.

ANTHR 3540: War and the Politics of Humanitarianism

(Cross-listed with POLS 3540).

Credits: 3. Contact Hours: Lecture 3.

Humanitarianism as a system of thought and a system of intervention in conflict and post-conflict situations. Role of humanitarian organizations and actors in addressing human suffering caused by conflict or war. Military action as a form of humanitarian intervention. Meets International Perspectives Requirement.

ANTHR 3550: Understanding Sub-Saharan Africa

(Cross-listed with AFAM 3550).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Survey of economic, social, political and historical processes that have shaped representations of Africa and Africans. Topics include colonialism, globalization, gender and LGBTQ rights, conflict and representations in Western media. Offered even-numbered years. Meets International Perspectives Requirement. (Typically Offered: Spring)

ANTHR 3690: Ancient Egypt

(Cross-listed with CLST 3690).

Credits: 3. Contact Hours: Lecture 3.

Archaeology and culture of Ancient Egypt from prehistory to Late Antiquity. Exploration of literature, religion, social history, government, and architecture. Discussion of major archaeological sites and methods; examination of interaction with other ancient near eastern and Mediterranean civilizations. Meets International Perspectives Requirement.

ANTHR 3760A: Classical Archeology: Bronze Age and Early Iron Age Greece

(Cross-listed with CLST 3760A).

Credits: 3. Contact Hours: Lecture 3.

An examination of the material culture of Bronze Age and Early Iron Age Greece (ca 3000-700 BCE) and the role of archaeological context in understanding the varied aspects of the cultures that flourished in the region. Primary focus on the urbanized palatial centers that emerged on the island of Crete (Minoan) and in mainland Greece (Mycenaean). Topics include the emergence of social complexity, cultural and technological changes, religious systems, and methods of interpretation. Meets International Perspectives Requirement.

ANTHR 3760B: Classical Archeology: Archaic through Hellenistic Greece (ca 700-30 BCE)

(Cross-listed with CLST 3760B).

Credits: 3. Contact Hours: Lecture 3.

An examination of the material culture of ancient Greece from ca. 700-30 BCE and the role of archaeological context in understanding the varied aspects of Greek culture found in cities, rural areas, and sanctuaries during the Archaic, Classical, and Hellenistic periods. Topics include urbanization and the rise of the polis, sanctuaries and their offerings, engagement with the wider Mediterranean, and developments in the ways that the Greeks conceptualized and represented their world. Meets International Perspectives Requirement.

ANTHR 3760C: Classical Archaeology: Roman Archaeology (ca 1000 BCE-400 CE)

(Cross-listed with CLST 3760C).

Credits: 3. Contact Hours: Lecture 3.

An examination of major developments in architecture, sculpture, painting, and other arts of the ancient Roman world and the role of archaeological context in understanding various aspects of Roman culture. Topics include art in the service of social ideology and political propaganda; interactions between the Etruscans, Greeks, and Romans; and the relationship between Rome and its provinces. Meets International Perspectives Requirement.

ANTHR 3890: Exhibiting Religion

(Cross-listed with RELIG 3890).

Credits: 3. Contact Hours: Lecture 3.

Display of religion in museums, fairs, and exhibitions. History and ethics of museum collecting, storage, display, public engagement, and repatriation. Visit local museums and explore digital galleries.

ANTHR 4110: Anthropology in Professional Applications

(Dual-listed with ANTHR 5110).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ANTHR 2010 or ANTHR 3060

An introduction to the diverse professional applications of Anthropology beyond academic careers. Explores professional opportunities for anthropologists. Introduces special skills needed for these applications. Prepares students for diverse opportunities after graduation. Meets International Perspectives Requirement. (Typically Offered: Fall)

ANTHR 4190A: Topics in Cultural Anthropology: Theory

Credits: 3. Contact Hours: Lecture 3.

Prereq: ANTHR 3060

In-depth study of current topics in cultural anthropology, such as recent theoretical trends, new methodologies, or new research on a specific region. Topics vary each time offered. Graduation Restriction: No more than 9 credits of ANTHR 4190 courses may be applied towards graduation.

ANTHR 4190B: Topics in Cultural Anthropology: Methods

Credits: 3. Contact Hours: Lecture 3.

Prereq: ANTHR 3060

In-depth study of current topics in cultural anthropology, such as recent theoretical trends, new methodologies, or new research on a specific region. Topics vary each time offered. Graduation Restriction: No more than 9 credits of ANTHR 4190 courses may be applied towards graduation.

ANTHR 4190C: Topics in Cultural Anthropology: Regional Focus

Credits: 3. Contact Hours: Lecture 3.

Prereq: ANTHR 3060

In-depth study of current topics in cultural anthropology, such as recent theoretical trends, new methodologies, or new research on a specific region. Topics vary each time offered. Graduation Restriction: No more than 9 credits of ANTHR 4190 courses may be applied towards graduation.

ANTHR 4190D: Topics in Cultural Anthropology: Others

Credits: 3. Contact Hours: Lecture 3.

Prereq: ANTHR 3060

In-depth study of current topics in cultural anthropology, such as recent theoretical trends, new methodologies, or new research on a specific region. Topics vary each time offered. Graduation Restriction: No more than 9 credits of ANTHR 4190 courses may be applied towards graduation.

ANTHR 4240: Forensic Anthropology

(Dual-listed with ANTHR 5240).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: ANTHR 2020 or ANTHR 3070

Comprehensive study of forensic anthropology, a specialized subfield of biological anthropology. Emphasis is placed on personal identifications from extremely fragmentary, comingled, burnt, cremated and incomplete skeletal remains. All parameters of forensic study are included as they pertain to anthropology, including human variation, taphonomy, entomology, archaeology, pathology, epidemiology; genetics and the non-biological forensic disciplines. An appreciation for the wide range of medicolegal and bioethical issues will also be gained. ANTHR 3190 recommended. Offered irregularly. (Typically Offered: Spring)

ANTHR 4250: Professional Preparation in Anthropology

Credits: 1. Contact Hours: Lecture 1.

Instruction and guidance in the development of professional skills needed for success in academic and non-academic anthropological careers. Topics will include strategies for internship and job searches, creating resumes and CVs, composing personal statements and cover letters, and developing contacts and sources. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

ANTHR 4290: Topics in Archaeological Laboratory Methods and Techniques: Archaeological Field School

(Dual-listed with ANTHR 5290).

Credits: 4-6.

Prereq: ANTHR 2020 or ANTHR 3080

Summer field school for training in archaeological reconnaissance and excavation techniques; documentation and interpretation of archaeological evidence. (Typically Offered: Summer)

ANTHR 4310: Ethnographic Methods

(Dual-listed with ANTHR 5310).

Credits: 3. Contact Hours: Lecture 3.

Hands-on training in ethnographic field methods; students will carry out research projects in socio-cultural anthropology, learning a variety of investigative research techniques commonly used in social sciences.

ANTHR 4340A: Internship: Archaeology

Credits: 1-6. Repeatable, maximum of 6 credits.

Prereq: Junior or Senior classification; Department Permission

Supervised practice in government agencies, museums, and business organizations. Graduation Restriction: Not more than 6 credits of internship experience may count towards the major. No credits in ANTHR 4340 may be used to satisfy Anthropology core courses for majors or for the Anthropology minor. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

ANTHR 4340B: Internship: Cultural Anthropology

Credits: 1-6. Repeatable, maximum of 6 credits.

Prereq: Junior or Senior classification; Department Permission

Supervised practice in government agencies, museums, and business organizations. Graduation Restriction: Not more than 6 credits of internship experience may count towards the major. No credits in ANTHR 4340 may be used to satisfy Anthropology core courses for majors or for the Anthropology minor. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

ANTHR 4340C: Internship: Biological Anthropology

Credits: 1-6. Repeatable, maximum of 6 credits.

Prereq: Junior or Senior classification; Department Permission

Supervised practice in government agencies, museums, and business organizations. Graduation Restriction: Not more than 6 credits of internship experience may count towards the major. No credits in ANTHR 4340 may be used to satisfy Anthropology core courses for majors or for the Anthropology minor. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

ANTHR 4340D: Internship: Linguistic Anthropology

Credits: 1-6. Repeatable, maximum of 6 credits.

Prereq: Junior or Senior classification; Department Permission

Supervised practice in government agencies, museums, and business organizations. Graduation Restriction: Not more than 6 credits of internship experience may count towards the major. No credits in ANTHR 4340 may be used to satisfy Anthropology core courses for majors or for the Anthropology minor. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

ANTHR 4450: Biological Field School

(Dual-listed with ANTHR 5450).

Credits: 4-6.

Summer field school for training in behavioral and ecological methods for primatologists. Proposal, data collection and analyses, and presentation of research topic in primatology. (Typically Offered: Summer)

ANTHR 4500: Approaches in Anthropology

Credits: 3. Contact Hours: Lecture 3.

Examination of key approaches to anthropology and its interrelated sub-fields with a focus on major theoretical and analytical contributions. (Typically Offered: Fall)

ANTHR 4510A: Practicum in Anthropology: Archaeology

Credits: 1-3. Repeatable, maximum of 9 credits.

Prereq: ANTHR 2010 or ANTHR 2020 or ANTHR 3080; Permission of Instructor

Application of methods under actual laboratory and field conditions, including basic data management, synthesis, and analysis. (Typically Offered: Fall, Spring, Summer)

ANTHR 4510B: Practicum in Anthropology: Cultural Anthropology

Credits: 1-3. Repeatable, maximum of 9 credits.

Prereq: ANTHR 2010 or ANTHR 2020 or ANTHR 3080; Permission of Instructor

Application of methods under actual laboratory and field conditions, including basic data management, synthesis, and analysis. (Typically Offered: Fall, Spring, Summer)

ANTHR 4510C: Practicum in Anthropology: Biological Anthropology

Credits: 1-3. Repeatable, maximum of 9 credits.

Prereq: ANTHR 2010 or ANTHR 2020 or ANTHR 3080; Permission of Instructor

Application of methods under actual laboratory and field conditions, including basic data management, synthesis, and analysis. (Typically Offered: Fall, Spring, Summer)

ANTHR 4510D: Practicum in Anthropology: Linguistic Anthropology

Credits: 1-3. Repeatable, maximum of 9 credits.

Prereq: ANTHR 2010 or ANTHR 2020 or ANTHR 3080; Permission of Instructor

Application of methods under actual laboratory and field conditions, including basic data management, synthesis, and analysis. (Typically Offered: Fall, Spring, Summer)

ANTHR 4820A: Topics in Biological Anthropology: Paleoanthropology

(Dual-listed with ANTHR 5820A).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Prereq: ANTHR 3070

In-depth study of current topics in biological anthropology, such as new fossil specimens, research on the evolution of cognition, the emergence of applied primatology, and the dynamic field of population genetics as each relates to the Order Primates. (Typically Offered: Fall)

ANTHR 4820B: Topics in Biological Anthropology: Primate Cognition

(Dual-listed with ANTHR 5820B).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Prereq: ANTHR 3070

In-depth study of current topics in biological anthropology, such as new fossil specimens, research on the evolution of cognition, the emergence of applied primatology, and the dynamic field of population genetics as each relates to the Order Primates. (Typically Offered: Fall)

ANTHR 4820C: Topics in Biological Anthropology: Primate Conservation

(Dual-listed with ANTHR 5820C).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Prereq: ANTHR 3070

In-depth study of current topics in biological anthropology, such as new fossil specimens, research on the evolution of cognition, the emergence of applied primatology, and the dynamic field of population genetics as each relates to the Order Primates. (Typically Offered: Fall)

ANTHR 4820D: Topics in Biological Anthropology: Population Genetics and Human Evolution

(Dual-listed with ANTHR 5820D).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Prereq: ANTHR 3070

In-depth study of current topics in biological anthropology, such as new fossil specimens, research on the evolution of cognition, the emergence of applied primatology, and the dynamic field of population genetics as each relates to the Order Primates. (Typically Offered: Fall)

ANTHR 4900A: Independent Study: Archaeology

Credits: 1-5. Repeatable, maximum of 9 credits.

Prereq: 9 credits in ANTHR; Permission of Instructor

ANTHR 4900B: Independent Study: Cultural Anthropology

Credits: 1-5. Repeatable, maximum of 9 credits.

Prereq: 9 credits in ANTHR; Permission of Instructor

ANTHR 4900C: Independent Study: Biological Anthropology

Credits: 1-5. Repeatable, maximum of 9 credits.

Prereq: 9 credits in ANTHR; Permission of Instructor

ANTHR 4900D: Independent Study: Linguistic Anthropology

(Cross-listed with LING 4900D).

Credits: 1-5. Repeatable, maximum of 9 credits.

Prereq: 9 credits in ANTHR; Permission of Instructor

Graduation Restriction: No more than 9 credits of ANTHR 4900 may be counted toward graduation.

ANTHR 4900H: Independent Study: Honors

Credits: 1-5. Repeatable, maximum of 9 credits.

Prereq: 9 credits in ANTHR; Permission of Instructor; Membership in the University Honors Program

Graduation Restriction: No more than 9 credits of ANTHR 4900 may be counted toward graduation.

Courses primarily for graduate students, open to qualified undergraduates:

ANTHR 5030: Biological Anthropology and Archaeology

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

History of biological anthropology and archaeology, current developments and theoretical issues related to major events in human biocultural evolution and world prehistory.

ANTHR 5100: Theoretical Dimensions of Cultural Anthropology

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Survey of historical and current developments in topical and theoretical approaches to sociocultural anthropology. Examination and assessment of controversies; new research directions and theoretical approaches. (Typically Offered: Fall)

ANTHR 5110: Anthropology in Professional Applications

(Dual-listed with ANTHR 4110).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

An introduction to the diverse professional applications of Anthropology beyond academic careers. Explores professional opportunities for anthropologists. Introduces special skills needed for these applications. Prepares students for diverse opportunities after graduation. Meets International Perspectives Requirement. (Typically Offered: Fall)

ANTHR 5130: Kinship and Marriage in a Global Perspective

(Dual-listed with ANTHR 3130).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Comparative and historical overview of the family, marriage and kinship. Examination of cross-cultural differences in the construction and functioning of family and kin relations; role of kinship in structuring individual and collective activities; current critical and theoretical issues in kinship studies, especially integrating work on gender and sexuality. ANTHR 2010 recommended. Meets International Perspectives Requirement. (Typically Offered: Spring)

ANTHR 5150: Archaeology of North America

(Dual-listed with AMIN 3150/ ANTHR 3150).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Prehistory and early history of North America as reconstructed from archaeological evidence; peopling of the New World; culture- historical sequences of major culture areas; linkages of archaeological traditions with selected ethnohistorically known Native American groups. (Typically Offered: Spring)

ANTHR 5190: Skeletal Biology

(Dual-listed with ANTHR 3190).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Comprehensive study of the skeletal anatomy, physiology, genetics, growth, development and population variation of the human skeleton. Applications to forensic anthropology, paleopathology and bioarchaeology are introduced. (Typically Offered: Spring)

ANTHR 5200: Great Plains Archaeology

(Dual-listed with AMIN 3200/ ANTHR 3200).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Prehistoric societies of the Great Plains region of North America, from initial occupation to European contact; emphasis on sociocultural changes, continuities, and adaptations to changing environments using archaeological, ecological, ethnographic information. (Typically Offered: Fall)

ANTHR 5210: World Prehistory

(Dual-listed with ANTHR 3210).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

An introduction to archaeological sites from around the world including the Near East, Africa, Europe, Mesoamerica, and North and South America. Emphasis is on the interpretation of material cultural remains in reconstructing past societies. ANTHR 2020 recommended. (Typically Offered: Spring)

ANTHR 5220: Peoples and Cultures of Native North America

(Dual-listed with AMIN 3220/ ANTHR 3220).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Origin, distribution, and pre-contact life of the indigenous peoples of North America. Survey of culture areas; language families, social and political systems, ecological and economic adaptations, religion and spirituality; impact of European contact; cultural resilience and revitalization in contemporary American Indian life.

ANTHR 5230A: Latin American Anthropology: Violence and Memory

(Dual-listed with ANTHR 3230A/ USLS 3230A).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Prereq: Graduate Standing or Permission of Instructor

Exploration of key contemporary and historical issues in Latin American Anthropology; discussion of current anthropological approaches to studying Latin American social issues in a global context. Topics vary each time offered. ANTHR 2010 or ANTHR 3060 recommended. Meets International Perspectives Requirement. (Typically Offered: Spring)

ANTHR 5230B: Latin American Anthropology: Social movements and Democracy

(Dual-listed with ANTHR 3230B/ USLS 3230B).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Prereq: Graduate Standing or Permission of Instructor

Exploration of key contemporary and historical issues in Latin American Anthropology; discussion of current anthropological approaches to studying Latin American social issues in a global context. Topics vary each time offered. ANTHR 2010 or ANTHR 3060 recommended. Meets International Perspectives Requirement. (Typically Offered: Spring)

ANTHR 5230C: Latin American Anthropology: Race, Class and Gender

(Dual-listed with ANTHR 3230C/ US LS 3230C).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Prereq: Graduate Standing or Permission of Instructor

Exploration of key contemporary and historical issues in Latin American Anthropology; discussion of current anthropological approaches to studying Latin American social issues in a global context. Topics vary each time offered. ANTHR 2010 or ANTHR 3060 recommended. Meets International Perspectives Requirement. (Typically Offered: Spring)

ANTHR 5230D: Latin American Anthropology: Regional Focus

(Dual-listed with ANTHR 3230D/ USLS 3230D).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Prereq: Graduate Standing or Permission of Instructor

Exploration of key contemporary and historical issues in Latin American Anthropology; discussion of current anthropological approaches to studying Latin American social issues in a global context. Topics vary each time offered. ANTHR 2010 or ANTHR 3060 recommended. Meets International Perspectives Requirement. (Typically Offered: Spring)

ANTHR 5230E: Latin American Anthropology: Culture and Sport

(Dual-listed with ANTHR 3230E/ USLS 3230E).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Prereq: Graduate Standing or Permission of Instructor

Exploration of key contemporary and historical issues in Latin American Anthropology; discussion of current anthropological approaches to studying Latin American social issues in a global context. Topics vary each time offered. ANTHR 2010 or ANTHR 3060 recommended.

ANTHR 5240: Forensic Anthropology

(Dual-listed with ANTHR 4240).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Comprehensive study of forensic anthropology, a specialized subfield of biological anthropology. Emphasis is placed on personal identifications from extremely fragmentary, comingled, burnt, cremated and incomplete skeletal remains. All parameters of forensic study are included as they pertain to anthropology, including human variation, taphonomy, entomology, archaeology, pathology, epidemiology; genetics and the non-biological forensic disciplines. An appreciation for the wide range of medicolegal and bioethical issues will also be gained. ANTHR 3190 recommend Offered irregularly. (Typically Offered: Spring)

ANTHR 5260: Design Ethnography

(Cross-listed with HCI 5260).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

A hands-on introduction to ethnographic methods with a focus on their application in design, human computer interaction, user research, and other applied domains. Assumes no background in cross-cultural study or social science. Trains students to use ethnographic methods to conceptualize, design, build, and evaluate interactive systems and other design-oriented projects (e.g., architecture). . (Typically Offered: Fall)

ANTHR 5290: Archaeological Field School

(Dual-listed with ANTHR 4290).

Credits: 4-6.

Prereq: Graduate Standing or Permission of Instructor

Summer field school for training in archaeological reconnaissance and excavation techniques; documentation and interpretation of archaeological evidence. (Typically Offered: Summer)

ANTHR 5310: Ethnographic Methods

(Dual-listed with ANTHR 4310).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Hands-on training in ethnographic field methods; students will carry out research projects in socio-cultural anthropology, learning a variety of investigative research techniques commonly used in social sciences.

ANTHR 5320A: Current Issues in Native North America: Gender and Family

(Dual-listed with AMIN 3320A/ ANTHR 3320A). (Cross-listed with AMIN 5320A).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Exploration of key contemporary and historical issues in Native North America; discussion of current anthropological approaches to studying Native North America in a global context. Topics vary each time offered. ANTHR 3220 or AMIN 2100 recommended. Graduation Restriction: Only 9 credits of ANTHR/AMIN 3320A, 3320B, 3320C, 3320D may count toward graduation.

ANTHR 5320B: Current Issues in Native North America: Indigenous Ecologies and Geographies

(Dual-listed with AMIN 3320B/ ANTHR 3320B). (Cross-listed with AMIN 5320B).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Exploration of key contemporary and historical issues in Native North America; discussion of current anthropological approaches to studying Native North America in a global context. Topics vary each time offered. ANTHR 3220 or AMIN 2100 recommended. Graduation Restriction: Only 9 credits of ANTHR/AMIN 3320A, 3320B, 3320C, 3320D may count toward graduation.

ANTHR 5320C: Current Issues in Native North America: Cultural and Political Movements

(Dual-listed with AMIN 3320C/ ANTHR 3320C). (Cross-listed with AMIN 5320C).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Exploration of key contemporary and historical issues in Native North America; discussion of current anthropological approaches to studying Native North America in a global context. Topics vary each time offered. ANTHR 3220 or AMIN 2100 recommended. Graduation Restriction: Only 9 credits of ANTHR/AMIN 3320A, 3320B, 3320C, 3320D may count toward graduation.

ANTHR 5320D: Current Issues in Native North America: Regional Focus

(Dual-listed with AMIN 3320D/ ANTHR 3320D). (Cross-listed with AMIN 5320D).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Exploration of key contemporary and historical issues in Native North America; discussion of current anthropological approaches to studying Native North America in a global context. Topics vary each time offered. ANTHR 3220 or AMIN 2100 recommended. Graduation Restriction: Only 9 credits of ANTHR/AMIN 3320A, 3320B, 3320C, 3320D may count toward graduation.

ANTHR 5360: Culture and Capitalism

(Dual-listed with ANTHR 3360).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Cross-cultural analysis of current development practices from an anthropological perspective; focus on international aid, development institutions, agrarian reform, indigenous knowledge, humanitarianism and human rights; introduction to main theories of political and economic anthropology. Offered odd-numbered years. (Typically Offered: Fall)

ANTHR 5400: Magic, Witchcraft, and Religion

(Dual-listed with ANTHR 3400/ RELIG 3400). (Cross-listed with RELIG 5400).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Survey of global religious belief and practice from an anthropological perspective. Emphasis on myth and ritual, shamanism, magic, witchcraft, beliefs in spirits, conceptions of the soul, mind and body relationships, and healing and therapeutic practices. Discussion of religious response to dramatic political and social change; effects of globalization on religious practice. Meets International Perspectives Requirement. (Typically Offered: Spring)

ANTHR 5410: Seminar in Forensic Sciences

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Seminars by professional criminalists, research scientists, Certificate students, and educators. Emphasis on opportunities for research and development, citizen involvement, and educational outreach related to forensic science. Weekly report required. (Typically Offered: Spring)

ANTHR 5420: Independent Research and Presentation in Forensic Science

Credits: 1.

Prereq: Graduate Standing or Permission of Instructor

Research topic approved by course instructor. Written and oral reports required. Oral report given in forensics seminar, CHEM 5400. (Typically Offered: Spring)

ANTHR 5450: Biological Field School

(Dual-listed with ANTHR 4450).

Credits: 4-6.

Prereq: Graduate Standing or Permission of Instructor

Summer field school for training in behavioral and ecological methods for primatologists. Proposal, data collection and analyses, and presentation of research topic in primatology. (Typically Offered: Summer)

ANTHR 5820A: Topics in Biological Anthropology: Paleoanthropology

(Dual-listed with ANTHR 4820A).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Prereq: Graduate Standing or Permission of Instructor

In-depth study of current topics in biological anthropology, such as new fossil specimens, research on the evolution of cognition, the emergence of applied primatology, and the dynamic field of population genetics as each relates to the Order Primates. (Typically Offered: Fall)

ANTHR 5820B: Topics in Biological Anthropology: Primate Cognition

(Dual-listed with ANTHR 4820B).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Prereq: Graduate Standing or Permission of Instructor

In-depth study of current topics in biological anthropology, such as new fossil specimens, research on the evolution of cognition, the emergence of applied primatology, and the dynamic field of population genetics as each relates to the Order Primates. (Typically Offered: Fall)

ANTHR 5820C: Topics in Biological Anthropology: Primate Conservation

(Dual-listed with ANTHR 4820C).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Prereq: Graduate Standing or Permission of Instructor

In-depth study of current topics in biological anthropology, such as new fossil specimens, research on the evolution of cognition, the emergence of applied primatology, and the dynamic field of population genetics as each relates to the Order Primates. (Typically Offered: Fall)

ANTHR 5820D: Topics in Biological Anthropology: Population Genetics and Human Evolution

(Dual-listed with ANTHR 4820D).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Prereq: Graduate Standing or Permission of Instructor

In-depth study of current topics in biological anthropology, such as new fossil specimens, research on the evolution of cognition, the emergence of applied primatology, and the dynamic field of population genetics as each relates to the Order Primates. (Typically Offered: Fall)

ANTHR 5900: Graduate Independent Study

Credits: 1-4. Repeatable.

Prereq: Graduate classification and Permission of Instructor

ANTHR 5910: Orientation to Anthropology

Credits: 1. Contact Hours: Lecture 1.

Prereq: Graduate Standing or Permission of Instructor

Introduction to the Anthropology program, including the requirements for successful degree completion, department administrative procedures, ethics in anthropology and current trends in the four subfields of anthropology. Required of graduate students. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

ANTHR 5990: Creative Component

Credits: 1-5. Repeatable, maximum of 5 credits.

Prereq: Instructor Permission for Course

Individually directed study applying anthropological methods and theory to a practical research problem; for students electing the nonthesis degree option. (Typically Offered: Fall, Spring, Summer)

Courses for graduate students:**ANTHR 6100: Foundations of Sustainable Agriculture**

(Cross-listed with ABE 6100/ AGRON 6100/ SUSAG 6100/ SOC 6100).

Credits: 3. Contact Hours: Lecture 3.

Historical, biophysical, socioeconomic, and ethical dimensions of agricultural sustainability. Strategies for evaluating existing and emerging agricultural systems in terms of the core concepts of sustainability and their theoretical contexts. (Typically Offered: Fall)

ANTHR 6990: Research

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

Apparel, Events, and Hospitality Management (AESHM)

Courses primarily for undergraduates:

AESHM 1110: Professional Development for AESHM

Credits: 1. Contact Hours: Lecture 1.

Introduction to professional experiences within AESHM and CHS Career Services including CyHire. Coursework includes resume development, daily habits for success including stress management, intrapersonal skills with a wellness focus, interpersonal skills and leadership, business etiquette, and professional ethics. (Typically Offered: Fall, Spring)

AESHM 1110L: AESHM Program Orientation and Learning Community

Credits: 1. Contact Hours: Laboratory 2.

Orientation to policies and procedures of department and program. Overview of major and minor options, including entrepreneurship. Exploration of undergraduate research, independent studies, study abroad, and field studies. Coverage of goal setting, curriculum planning, degree audits, and registration. Peer mentor interaction in academic, extracurricular, and service learning arranged component. (Typically Offered: Fall, Spring)

AESHM 1700D: Supervised Work Experience I: Hospitality

Credits: 1. Repeatable, maximum of 2 times.

Supervised work experience with a cooperating firm or organization. Employer/experience for AESHM 4700 or HSPM 4700 should be different from employer/experience used for AESHM 1700 and AESHM 2700. Graduation Restriction: No more than 12 credits total from AESHM 1700, 2700, and 4700 may be applied toward graduation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

AESHM 1700F: Supervised Work Experience I: Event Management

Credits: 1. Repeatable, maximum of 2 times.

Supervised work experience with a cooperating firm or organization. Employer/experience for AESHM 4700 or HSPM 4700 should be different from employer/experience used for AESHM 1700 and AESHM 2700. Graduation Restriction: No more than 12 credits total from AESHM 1700, 2700, and 4700 may be applied toward graduation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

AESHM 1700N: Supervised Work Experience I: Apparel

Credits: 1. Repeatable, maximum of 2 times.

Supervised work experience with a cooperating firm or organization. Employer/experience for AESHM 4700 or HSPM 4700 should be different from employer/experience used for AESHM 1700 and AESHM 2700. Graduation Restriction: No more than 12 credits total from AESHM 1700, 2700, and 4700 may be applied toward graduation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

AESHM 1750D: Financial Applications for Retail and Hospitality**Industries: Hospitality Management**

Credits: 2. Contact Hours: Lecture 2.

Using an online delivery method, students will learn basic mathematical concepts, calculations and formulas commonly used in the apparel and hospitality industries. Emphasis on problem solving, critical/creative thinking, and mathematical interpretation of calculations and formulas used within the hospitality industries. (Typically Offered: Spring)

AESHM 1750N: Financial Applications for Retail and Hospitality**Industries: Retail Merchandising**

Credits: 2. Repeatable.

Using an online delivery method, students will learn basic mathematical concepts, calculations and formulas commonly used in the apparel and hospitality industries. Emphasis on problem solving, critical/creative thinking, and mathematical interpretation of calculations and formulas used within the apparel industries. (Typically Offered: Fall, Spring, Summer)

AESHM 1800E: First Year Student Field Study: Hospitality and Event Management

Credits: 1-2. Contact Hours: Lecture 2.5, Laboratory 0.

Repeatable, maximum of 2 times.

Prereq: Instructor Permission for Course

Study of and tours of regional areas of interest to majors in the HSPM and EVENT majors. Trip to regional location under supervision of faculty member. Locations vary. Journal entries and final report/analysis are required. Cost associated with trip. (Typically Offered: Fall, Spring)

AESHM 1800N: First Year Student Field Study: Apparel, Merchandising, and Design

Credits: 1-2. Contact Hours: Lecture 2.

Repeatable, maximum of 2 times.

Prereq: Instructor Permission for Course

Study of and tours of regional areas of interest to AMD majors. Trip to regional location under supervision of faculty member. Locations vary. Journal entries and final report/analysis are required. Cost associated with trip. (Typically Offered: Fall, Spring)

AESHM 2110: Leadership Experiences and Development (LEAD)

Credits: 3. Contact Hours: Lecture 3.

Introduction to leadership behaviors. Development and utilization of leadership behaviors to positively impact school life, community life, and work life. (Typically Offered: Fall, Spring)

AESHM 2220: Creativity on Demand

Credits: 3. Contact Hours: Lecture 3.

Learn to use creativity strategies to solve everyday problems related to personal and professional lives. Application of creative thinking techniques to view things from different perspectives; identify unique opportunities; and generate and evaluate original ideas. Offered even-numbered years. (Typically Offered: Spring)

AESHM 2380: Human Resource Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Principles and practices of human resource management relevant to human science-related organizations. Emphasis on the entry-level manager's role. (Typically Offered: Fall, Spring)

AESHM 2700D: Supervised Work Experience II: Hospitality

Credits: 1-2. Repeatable, maximum of 2 times.

Supervised work experience with a cooperating firm or organization. Employer/experience for AESHM 4700 or HSPM 4700 should be different from employer/experience used for AESHM 1700 and AESHM 2700. Graduation Restriction: No more than 12 credits total from AESHM 1700, 2700, and 4700 may be applied toward graduation. (Typically Offered: Fall, Spring, Summer)

AESHM 2700F: Supervised Work Experience II: Event Management

Credits: 1-2. Repeatable, maximum of 2 times.

Supervised work experience with a cooperating firm or organization. Employer/experience for AESHM 4700 or HSPM 4700 should be different from employer/experience used for AESHM 1700 and AESHM 2700. Graduation Restriction: No more than 12 credits total from AESHM 1700, 2700, and 4700 may be applied toward graduation. (Typically Offered: Fall, Spring, Summer)

AESHM 2700N: Supervised Work Experience II: Apparel

Credits: 1-2. Repeatable, maximum of 2 times.

Supervised work experience with a cooperating firm or organization. Employer/experience for AESHM 4700 or HSPM 4700 should be different from employer/experience used for AESHM 1700 and AESHM 2700. Graduation Restriction: No more than 12 credits total from AESHM 1700, 2700, and 4700 may be applied toward graduation. (Typically Offered: Fall, Spring, Summer)

AESHM 2720: Fashion Show Production and Promotion

Credits: 2-3. Contact Hours: Lecture 3, Laboratory 2.

Prereq: Instructor Permission for Course

Planning and production of fashion show including developing budgets, public relations, advertising, fund-raising, choreography, staging, lighting, and food. Promotion of fashion show and similar events. Permission by application. Graduation Restriction: Maximum of 5 credits can be applied to graduation. (Typically Offered: Fall, Spring)

AESHM 2800: Orientation to U.S. Field Study

Credits: Required. Contact Hours: Lecture 1.

Repeatable, maximum of 2 times.

Orientation to the field study location during the semester preceding the trip. (Typically Offered: Fall, Spring)

AESHM 2810: Orientation to International Field Study

Credits: 1. Contact Hours: Lecture 1.

Repeatable, maximum of 2 times.

Orientation to the field study location during the semester preceding the trip. (Typically Offered: Fall, Spring, Summer)

AESHM 2870: Principles of Management in Human Sciences

Credits: 3. Contact Hours: Lecture 3.

Introduction to management concepts and principles with application to human sciences-related businesses and organizations. Includes service quality management, professionalism, and social responsibility. (Typically Offered: Fall, Spring)

AESHM 3110E: Seminar on Careers and Internships: Event Management and Hospitality Management

Credits: 1. Contact Hours: Lecture 1.

Prereq: AESHM 1110; Sophomore classification

Internship and career planning, professional expectations and responsibilities. Resume development, business letters/professional correspondence, interviewing techniques, and business etiquette. (Typically Offered: Fall, Spring)

AESHM 3110N: Seminar on Careers and Internships: Apparel, Merchandising, and Design

Credits: 1. Contact Hours: Lecture 1.

Prereq: AESHM 1110; Sophomore classification

Internship and career planning, professional expectations and responsibilities. Resume development, cover letters, interviewing techniques, and business etiquette. (Typically Offered: Fall, Spring)

AESHM 3400: Hospitality and Apparel Marketing Strategies

Credits: 3. Contact Hours: Lecture 3.

Application of marketing principles to the hospitality-, events-, and apparel-related industries. Emphasis on the role of marketing in an organization's overall strategic planning. Development and evaluation techniques available to hospitality, events, apparel, and related businesses, including advertising, sales promotion, packaging, and public relations. (Typically Offered: Fall, Spring)

AESHM 3420: Aesthetics of Consumer Experience

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Design principles, aesthetic concepts, and research applied to consumer experiences, with an emphasis on hospitality and retail environments and events. Influence of individual differences and cultural patterns on aesthetic preferences. (Typically Offered: Fall, Spring)

AESHM 3450X: Retail/Hospitality Experiences & Events

Credits: 1-3. Contact Hours: Lecture 3.

Survey course of retail and hospitality events. Production and execution of retail and hospitality events in the Student Innovation Center.

AESHM 3650: Event, Hospitality, and Retail Risk Management

Credits: 3. Contact Hours: Lecture 3.

Overview and management of hazards and risks in the planning, design, operation, and evaluation stages of events, hospitality organizations, and apparel/retail environments. (Typically Offered: Summer)

AESHM 3800D: U.S. Field Study: Hospitality Management

(Dual-listed with AESHM 5800D).

Credits: 1-3. Repeatable, maximum of 3 times.

Study and tours of areas of interest to majors in the Hospitality Management program. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 2800. Permission by application. (Typically Offered: Fall, Spring, Summer)

AESHM 3800F: U.S. Field Study: Event Management

(Dual-listed with AESHM 5800F).

Credits: 1-3. Repeatable, maximum of 3 times.

Study and tours of areas of interest to majors in the majors in the Event Management program. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 2800. Permission by application. (Typically Offered: Fall, Spring, Summer)

AESHM 3800N: U.S. Field Study: Apparel, Merchandising, and Design

(Dual-listed with AESHM 5800N).

Credits: 1-3. Repeatable, maximum of 3 times.

Prereq: AESHM 2800 or concurrent enrollment; permission of instructor
Study and tours of areas of interest to majors in the Apparel, Merchandising, and Design program. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 2800. Permission by application. (Typically Offered: Fall, Spring, Summer)

AESHM 3810D: International Field Study: Hospitality Management

(Dual-listed with AESHM 5810D).

Credits: 1-3. Repeatable.

Study and tours of areas of interest to majors in the Hospitality Management program. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 2810. Permission by application. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

AESHM 3810F: International Field Study: Event Management

(Dual-listed with AESHM 5810F).

Credits: 1-3. Repeatable.

Prereq: AESHM 2810 or concurrent enrollment; Instructor permission
Study and tours of areas of interest to majors in the Event Management major. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 2810. Permission by application. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

AESHM 3810N: International Field Study: Apparel, Merchandising, and Design

(Dual-listed with AESHM 5810N).

Credits: 1-3. Repeatable, maximum of 3 times.

Prereq: AESHM 2810 or concurrent enrollment; Instructor permission
Study and tours of areas of interest to majors in the Apparel, Merchandising, and Design major. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 2810. Permission by application. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

AESHM 3980: Cooperative Education

Credits: Required. Repeatable.

Prereq: Permission of Advisor; Junior classification

Required of all cooperative education students seeking full-time status. Students register for this course prior to commencing each work period. (Typically Offered: Fall, Spring, Summer)

AESHM 4210: Developing Global Leadership: Maximizing Human Potential

Credits: 3. Contact Hours: Lecture 3.

Development of leadership in a global environment. Focus on global concerns that impact on the well-being of individuals, families, and communities. Strategies for working with individuals, families and communities in other countries and cultures. Taking local action on global issues. Participation in a service activity. Meets International Perspectives Requirement. (Typically Offered: Spring)

AESHM 4620X: Black Lives Matter: Fashion, Politics, and Resistance Movements

Credits: 3. Contact Hours: Lecture 3.

Prereq: AMD 1650 or Permission of Instructor

Use historical and cultural methods to examine the history of the Black Lives Matter movement its relationship to past resistance/activist movements and fashion and appearance. Summarize and evaluate literature on Black activism and Black identity. Plan and develop a public exhibition and opening event. Offered even-numbered years. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Spring)

AESHM 4700F: Supervised Professional Internship: Event Management

Credits: 3-6. Repeatable.

Supervised and structured practical industry work experience with a cooperating firm or organization. Employer/experience for AESHM 4700 or HSPM 4700 should be different from employer/experience used for AESHM 1700 and AESHM 2700. This course if offered for a grade. Graduation Restriction: Maximum number of credits given in a semester is 6. No more than 12 credits from AESHM 1700, 2700, and 4700 may be applied toward graduation. (Typically Offered: Fall, Spring, Summer)

AESHM 4700MX: Supervised Professional Internship: Apparel (Out-of-state)

Credits: 3-6. Repeatable, maximum of 12 credits.

Prereq: Department Permission for Course

Supervised work experience with a cooperating firm or organization. Graduation Restrictions: No more than 12 credits from AESHM 1700, 2700, and 4700 may be applied toward graduation. (Typically Offered: Fall, Spring, Summer)

AESHM 4700N: Supervised Professional Internship: Apparel

Credits: 3-6. Repeatable.

Supervised work experience with a cooperating firm or organization. Employer/experience for AESHM 4700 or HSPM 4700 should be different from employer/experience used for AESHM 1700 and AESHM 2700. Graduation Restriction: No more than 12 credits total from AESHM 1700, 2700, and 4700 may be applied toward graduation. (Typically Offered: Fall, Spring, Summer)

AESHM 4720: Fashion Show Management

Credits: 2-3.

Prereq: Instructor Permission for Course

Provide leadership and communicate direction for planning and production of fashion show, including developing budgets, publicity, advertising, fundraising, choreography, staging, lighting, and food. Graduation Restriction: Maximum of 5 credits can be applied to graduation. (Typically Offered: Fall, Spring)

AESHM 4740: Entrepreneurship in Human Sciences

Credits: 3. Contact Hours: Lecture 3.

Prereq: AMD 2750 or AESHM 2870 or ACCT 2840 or 3 cr in MKT or permission of instructor

Comprehensive approach to entrepreneurship including concepts of innovation, creativity, opportunity assessment, and business planning. Focus on human sciences-related businesses: retail, service, hospitality, event, food-related, family-owned, rural, and community businesses. Interaction with entrepreneurs, market research, feasibility analysis, business proposals, and business/community outreach and consulting. (Typically Offered: Fall, Spring)

AESHM 4790: Data Analytics for Apparel, Events, and Hospitality Management

Credits: 3. Contact Hours: Lecture 3.

Introduction to business analytics concepts and techniques in retail business including fashion, hospitality, and event. Offers opportunities to learn basic hands-on data analytics methods for data summarization, analysis, visualization, and interpretation. (Typically Offered: Fall)

AESHM 4900H: Independent Study: Honors

Credits: 2-4.

Prereq: Permission of Instructor; Membership in the University Honors Program

Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

AESHM 4970: Cooperative Education

Credits: Required. Contact Hours: Lecture 1.

Repeatable.

Prereq: Permission of advisor; Senior or Graduate classification

Required of cooperative education students. Students must register for this course prior to commencing each work period. (Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

AESHM 5010: Introduction to Scholarly Research for Graduate Students

Credits: 1.

Prereq: Graduate Standing or Permission of Instructor

Focus on the basics of developing scholarly research, including definition and purpose of research and the components of research reporting. Emphasis on standards for each section of research reports. Tips for research reporting and processes of research development. An introduction to ethical standards. Required of all new AESHM graduate students. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

AESHM 5020: Research Methods in Apparel, Events, and Hospitality

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate classification

Overview of research methods for qualitative, quantitative, and mixed methods. Topics include philosophical worldviews, the use of theory, and different research approach, design, methodologies, and procedures. (Typically Offered: Summer)

AESHM 5100: Quantitative Research Methods in Apparel, Events, and Hospitality

Credits: 3. Contact Hours: Lecture 3.

Prereq: STAT 5870 or equivalent; Graduate standing in the Department; Permission of Instructor

Overview of quantitative research methods in apparel and hospitality fields. Topics include types of quantitative research design, sampling design, measurement, validity issues, power and precision analysis, methods of data gathering and analysis techniques, and interpretation of statistical results. Use of statistical packages. Development of research plan. Offered odd-numbered years. (Typically Offered: Spring, Summer)

AESHM 5110: Seminar

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 times.

Prereq: 6 graduate credits in AMD, AESHM, or HSPM. Permission of Instructor

Discussion of scholarship and current issues. Topics vary.

AESHM 5120: Qualitative Research Methods in Apparel, Events, and Hospitality

Credits: 3. Contact Hours: Lecture 3.5.

Prereq: Graduate standing

Introduction to and hands-on experiences with a variety of qualitative research methods specific to apparel, events and hospitality research. Students will develop skills at research design, data, collection, analysis, and write-up for qualitative inquiry. Offered even-numbered years. (Typically Offered: Summer)

AESHM 5550: Strategic Management for Service Industries

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Strategic management process as a planning and decision-making framework: integration of human resources, operations, marketing, and financial management concepts. Emphasis on strategic management tools for researchers and partitioners. Offered even-numbered years. (Typically Offered: Spring)

AESHM 5700A: Apparel Merchandising and Design

Credits: 1-3. Repeatable, maximum of 2 times.

Prereq: 6 graduate credits in AMD, AESHM, or HSPM. Permission of Instructor

Supervised experience related to career objective. Proposal must be approved semester before placement. (Typically Offered: Fall, Spring, Summer)

AESHM 5700B: Hospitality Management

Credits: 1-3. Repeatable, maximum of 2 times.

Prereq: 6 graduate credits in AMD, AESHM, or HSPM. Permission of Instructor

Supervised experience related to career objective. Proposal must be approved semester before placement. (Typically Offered: Fall, Spring, Summer)

AESHM 5740: Entrepreneurship in Human Sciences

Credits: 3. Contact Hours: Lecture 3.

Prereq: AMD 2750 or AESHM 2870 or ACCT 2840 or 3 cr in MKT or permission of instructor

Comprehensive approach to entrepreneurship including concepts of innovation, creativity, opportunity assessment, and business planning. Focus on human sciences-related businesses: retail, service, hospitality, event, food-related, family-owned, rural, and community businesses. Interaction with entrepreneurs, market research, feasibility analysis, business proposals, and business/community outreach and consulting. (Typically Offered: Fall, Spring)

AESHM 5790: Data Analytics for Apparel, Event, and Hospitality Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: STAT 5870 or equivalent; (AESHM 5100 and HDFS 5030) or instructor permission

Business analytics is a process of transforming data into meaningful insights and actionable results in the context of decision making and problem solving. Review of the data-related challenges apparel, event, and hospitality organizations confront and the importance of data analytics in making critical management decisions. Basic analytic techniques including data management, analysis, interpretation, and visualization and analyze case studies that successfully deployed these techniques. Typically Offered: Fall (even-numbered years), Summer (odd-numbered years).

AESHM 5800D: U.S. Field Study: Hospitality Management

(Dual-listed with AESHM 3800D).

Credits: 1-3. Repeatable, maximum of 3 times.

Prereq: AESHM 2800 or concurrent enrollment; permission of instructor

Study and tours of areas of interest to majors in the Hospitality Management program. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 2800. Permission by application. (Typically Offered: Fall, Spring, Summer)

AESHM 5800F: U.S. Field Study: Event Management

(Dual-listed with AESHM 3800F).

Credits: 1-3. Repeatable, maximum of 3 times.

Prereq: AESHM 2800 or concurrent enrollment; permission of instructor

Study and tours of areas of interest to majors in the majors in the Event Management program. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 2800. Permission by application. (Typically Offered: Fall, Spring, Summer)

AESHM 5800N: U.S. Field Study: Apparel, Merchandising, and Design

(Dual-listed with AESHM 3800N).

Credits: 1-3. Repeatable, maximum of 3 times.

Prereq: AESHM 2800 or concurrent enrollment; permission of instructor

Study and tours of areas of interest to majors in the Apparel, Merchandising, and Design program. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 2800. Permission by application. (Typically Offered: Fall, Spring, Summer)

AESHM 5810D: International Field Study: Hospitality Management

(Dual-listed with AESHM 3810D).

Credits: 1-3. Repeatable.

Prereq: AESHM 2810 or concurrent enrollment; Instructor permission

Study and tours of areas of interest to majors in the Hospitality Management program. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 2810. Permission by application. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

AESHM 5810F: International Field Study: Event Management

(Dual-listed with AESHM 3810F).

Credits: 1-3. Repeatable.

Prereq: AESHM 2810 or concurrent enrollment; Instructor permission

Study and tours of areas of interest to majors in the Event Management major. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 2810. Permission by application. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

AESHM 5810N: International Field Study: Apparel, Merchandising, and Design

(Dual-listed with AESHM 3810N).

Credits: 1-3. Repeatable, maximum of 3 times.

Prereq: AESHM 2810 or concurrent enrollment; Instructor permission

Study and tours of areas of interest to majors in the Apparel, Merchandising, and Design major. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 2810. Permission by application. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

Courses for graduate students:**AESHM 6110: Seminar**

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: 6 graduate credits in AMD, AESHM, or HSPM. Permission of Instructor

Scholarship and current issues. Topics vary.

AESHM 6700A: Teaching Practicum: Apparel Merchandising and Design

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Supervised experience in the university classroom. Proposal must be approved semester before placement. (Typically Offered: Fall, Spring, Summer)

AESHM 6700B: Teaching Practicum: Hospitality Management

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Supervised experience in the university classroom. Proposal must be approved semester before placement. (Typically Offered: Fall, Spring, Summer)

AESHM 6700C: Teaching Practicum: Event Management

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

This practicum is designed to provide event management graduate students (the graduate instructor) with experience in instructional planning, management, and systematic delivery of designed instruction for event undergraduate courses. Proposal must be approved semester before placement. (Typically Offered: Fall, Spring, Summer)

Apparel, Merchandising and Design (AMD)

Courses primarily for graduate students, open to qualified undergraduates:

AMD 5040: Innovative Textiles

(Dual-listed with AMD 4040).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Instructor Permission for Course

Theories and principles of textile science. Textile product serviceability. Effect of fiber structure on properties and performance. New developments in textiles. Previous coursework in textile science and chemistry recommended.

AMD 5050: Quality Assurance of Textiles and Apparel

(Dual-listed with AMD 3050).

Credits: 3.

Prereq: Instructor Permission for Course

Principles of product and materials evaluation and quality assurance. Developing specifications and using standard practices for evaluating materials, product characteristics, performance, and quality. Previous coursework in natural science and statistics recommended. (Typically Offered: Fall)

AMD 5100: Foundation of Scholarship in Apparel, Merchandising, and Design

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Overview of scholarship in apparel, merchandising, and design with emphasis on current and future directions. Fundamentals of writing literature reviews. Examination of ethical issues in scholarship and academic life. Introduction to creativity, sustainability, and entrepreneurship. (Typically Offered: Fall)

AMD 5210: Digital Technologies in Textile and Apparel

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Digital technologies in textile and apparel design. Theories and practices connected to technology in apparel fields. Technologies explored in this class may include digital textile design and printing, 3D body scanning, avatar development for digital fitting or other advanced technologies used in the textile and apparel industries. Previous coursework in research methods recommended. Offered odd-numbered years. (Typically Offered: Fall)

AMD 5250: Experimental Patternmaking

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or enrollment in AMD 5100

Research, analyze, and apply experimental patternmaking techniques to original garments suitable for entry into a juried competition/exhibitions. Compare, contrast, and organize a framework of research patternmaking principles through content analysis or other appropriate research techniques. Documentation of learning and design process. Previous coursework in apparel construction and patternmaking recommended. Offered odd-numbered years. (Typically Offered: Spring)

AMD 5390: Digital Textile Design and Theory

Credits: 3. Contact Hours: Studio 6.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Focus on artisanal textile, apparel, or surface and structural design techniques. Design processes for specialty fabrics and markets. Topics vary by term. Offered even-numbered years. (Typically Offered: Spring)

AMD 5450: Consumer Experience and Retail Branding

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Examination of hedonic nature of consumer experience and its application to experiential design and branding of retail/hospitality establishments. Emphasis on consumer behavior, environmental psychology, and marketing literature. Previous coursework in psychology, consumer behavior, or marketing recommended. Offered even-numbered years. (Typically Offered: Spring)

AMD 5540: Dress History Research Methods

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Using a variety of sources and methods of analysis, students will develop their ability to read and interpret primary and secondary sources and to understand the methodology underpinnings and process of constructing dress history. Anticipated Semesters Offered: Spring - Alternate offered odd-numbered years. (Typically Offered: Spring)

AMD 5580: Queer Fashions: History, Culture, and the Industry

(Dual-listed with AMD 4580/ WGS 4580). (Cross-listed with WGS 5580).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Focus on analyzing the dressed and undressed body of individuals in the queer and trans communities in various cultural contexts with a focus on material culture. Examine concepts related to gender and sexuality and the changing definitions and representations of individuals who identify in the queer and trans communities focusing on appearance, fashion, and the body. Historic and current representations of fashion, styles, and appearances will be analyzed and discussed. Attention to how sexuality and gender intersect with and shape other identities including race, ability, body size, and class. Examine the complex structures, systems, and ideologies that uphold discrimination and inequitable distribution of power and resources as related to the course material. Attention will mostly be given to North American perspectives. We will use material culture to explore how objects related to fashioning the body reveal lived experiences about the owners and consumers. Offered even-numbered years. (Typically Offered: Spring)

AMD 5620X: Fashion Studies, Culture, Industry, and Social Justice

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Analysis of fashion and cultural practices of historically marginalized communities with a focus on power, privilege, and social justice. Heightened attention towards the 20th and 21st centuries. Examination of the way the global fashion industry intersects with and is related to the communities and their dress practices under study. Emphasis on ethnographic research methods. Offered even-numbered years. (Typically Offered: Fall)

AMD 5650: Sustainability: Theory and Practical Application

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Overview of current sustainability theory, research, and methodology. Emphasis on the evaluation and discussion of current sustainability literature and sustainable practice of apparel, textiles, and related products and services through people, processes, and the environment. Development and presentation of original scholarly and creative design work under various sustainability frameworks. Previous knowledge in apparel industry and product development recommended. Offered even-numbered years. (Typically Offered: Fall)

AMD 5670: Consumer Behavior and Apparel

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Application of concepts and theories from the social sciences to the study of consumer behavior. Experience in conducting research; manuscript writing. Previous coursework in consumer behavior and statistics recommended. Offered odd-numbered years. (Typically Offered: Fall)

AMD 5720: Sourcing and Global Issues

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Evaluation of textile and apparel industries in global markets considering ethical, economic, political, social, and professional implications. Sourcing strategies in a global environment. Corporate and consumer social responsibility and sustainability. Experience in conducting research using secondary data. Previous coursework in merchandising, marketing, or economics recommended. Offered odd-numbered years. Meets International Perspectives Requirement. (Typically Offered: Spring)

AMD 5760: Industry Applications in Merchandising and Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: Instructor Permission for Course

Using the case study method, students apply merchandising theory, principles, and practices to industry scenarios. Emphasis on problem solving, creative thinking, data analysis, and data interpretation involved in business operations. Focus on the development of leadership skills while functioning in small and large groups. (Typically Offered: Spring)

AMD 5770: E-Commerce for Apparel and Hospitality Companies

Credits: 3. Contact Hours: Lecture 3.

Prereq: Instructor Permission for Course

Analysis of technology and consumer trends, industry practices, and marketing strategies for e-commerce including big data, data mining, and social media. Evaluation and development of apparel or hospitality company websites. Theory application to the development of multi-channel business strategies. Previous coursework in marketing recommended. Offered even-numbered years. (Typically Offered: Fall)

AMD 5780: Social Network Analysis

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to social network related theories, practices and analyses. Visualize and analyze social structures, formed from social relationships, interactions, communications, and social media activities. Explore methods for social network data collection and data management, including application on big data. Practical guidelines on conducting S research in social science contexts, including applying S with big data. Previous coursework in statistics recommended. Offered odd-numbered years. (Typically Offered: Spring)

AMD 5900A: Special Topics: Textile Science

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Individually designed AMD-related projects that reflect the special interests of the student.

AMD 5900B: Special Topics: Historical, Cultural, and Museum Studies of Dress and Textiles

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Individually designed AMD-related projects that reflect the special interests of the student.

AMD 5900C: Special Topics: Textile and Apparel Design

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Individually designed AMD-related projects that reflect the special interests of the student.

AMD 5900E: Special Topics: Merchandising, Aesthetics, and Entrepreneurship

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Individually designed AMD-related projects that reflect the special interests of the student.

AMD 5900F: Special Topics: Sociological, Psychological, and Consumer Behavioral Aspects of Dress

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Individually designed AMD-related projects that reflect the special interests of the student.

AMD 5900J: Special Topics: Product Development, Innovation, and Sourcing

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Individually designed AMD-related projects that reflect the special interests of the student. (Typically Offered: Fall, Spring, Summer)

AMD 5900S: Special Topics: Production and Quality Assurance

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Individually designed AMD-related projects that reflect the special interests of the student. (Typically Offered: Fall, Spring, Summer)

AMD 5900W: Special Topics: Fashion Show, Fashion Public Relations and Marketing

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Individually designed AMD-related projects that reflect the special interests of the student. (Typically Offered: Fall, Spring, Summer)

AMD 5950: Senior Design Studio

(Dual-listed with AMD 4950).

Credits: 3. Contact Hours: Studio 6.

Prereq: Graduate Standing or Permission of Instructor

Creation of an apparel line from target market research to prototypes through the use of manual techniques and CAD technologies. The line is to be included in a professional portfolio and pieces submitted to a juried exhibition. Previous coursework in apparel construction and design recommended. (Typically Offered: Fall)

AMD 5990: Creative Component

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Creative Component.

Courses for graduate students:

AMD 6110: Seminar

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Discussion of scholarship and current issues. Topics vary.

AMD 6250: Design Theory and Process

Credits: 4. Contact Hours: Lecture 2, Laboratory 4.

Analysis and application of design theory and creative processes, including strategies for solving aesthetic, functional, and/or technology-focused design problems. Creation and dissemination of design scholarship. Offered even-numbered years. (Typically Offered: Spring, Summer)

AMD 6650: Critical Social Science Theories in Fashion Studies

Credits: 3. Contact Hours: Lecture 3.

Analysis of cultural and social science theories, concepts, frameworks, and epistemologies applicable to how fashion products, management, and media are produced, distributed, consumed, regulated, and represented. Emphasis on qualitative research, theoretical interpretation, and theory development while centering justice and decolonizing theories. Example theories examined include Black feminist thought, critical race theory, feminist queer crip, tribalcrit, symbolic interaction, and semiotics. Collection, analysis, and interpretation of qualitative data. Offered odd-numbered years. (Typically Offered: Spring)

AMD 6760: Merchandising Theory and Research Applications

Credits: 3. Contact Hours: Lecture 3.

Prereq: Instructor Permission for Course

Review of current merchandising theory, research, and methodology. Emphasis on the evaluation and discussion of current and seminal merchandising literature, understanding research processes, interpretation of findings, assessing implications of research for future directions in merchandising, and the development and presentation of original scholarly work. Previous coursework in statistics recommended. Offered even-numbered years. (Typically Offered: Fall)

AMD 6900: Advanced Topics

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Advanced Topics.

AMD 6990: Research

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Arabic (ARABC)

Courses primarily for undergraduates:**ARABC 1010: Elementary Arabic I**

Credits: 4. Contact Hours: Lecture 5.

Beginning level development of reading, writing, listening comprehension, and speaking in Arabic, within the context of Arabic culture. Attention to the use of the Arabic alphabet. (Typically Offered: Fall)

ARABC 1020: Elementary Arabic II

Credits: 4. Contact Hours: Lecture 5.

Prereq: ARABC 1010 or placement by department exam

Continuation of ARABC 1010. Beginning level development of reading, writing, listening comprehension, and speaking in Arabic, within the context of Arabic culture. Meets International Perspectives Requirement. (Typically Offered: Spring)

ARABC 1950: Study Abroad

Credits: 1-30.

Supervised instruction in Arabic language and culture, formal class instruction at level appropriate to student's training, augmented by practical living experience. Taught in Arabic. (Typically Offered: Summer)

ARABC 2010: Intermediate Arabic I

Credits: 4. Contact Hours: Lecture 4.

Prereq: ARABC 1020 or placement by department exam

Intermediate level development of reading, writing, listening comprehension, and speaking in Arabic, within the context of Arabic culture. Meets International Perspectives Requirement. (Typically Offered: Fall)

ARABC 2020: Intermediate Arabic II

Credits: 4. Contact Hours: Lecture 4.

Prereq: ARABC 2010 or placement by department exam

Continuation of ARABC 2010. Intermediate level development of reading, writing, listening comprehension, and speaking in Arabic, within the context of Arabic culture. Meets International Perspectives Requirement.

ARABC 2950: Study Abroad

Credits: 1-30.

Prereq: ARABC 1020

Supervised instruction in Arabic language and culture, formal class instruction at level appropriate to student's training, augmented by practical living experience. Taught in Arabic. (Typically Offered: Summer)

ARABC 3200X: Taste of the Middle East and North Africa

(Cross-listed with FSHN 3200X).

Credits: 3. Contact Hours: Lecture 3.

Exploration of Middle Eastern and North African food cultures through historical, religious, and social lenses. Students will engage in discussions, presentations, and cooking demonstrations and tastings. Taught in English. (Typically Offered: Fall, Spring)

ARABC 3710: The Arabian Nights

(Cross-listed with WLC 3710).

Credits: 3. Contact Hours: Lecture 3.

Focus on the tales of the famous '1001 Arabian Nights' book.

Discussions of the narrative tools, supernatural elements, and the culture of the Medieval Middle East. Readings, discussions, and papers in English. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

ARABC 3750: Arab Culture

Credits: 3. Contact Hours: Lecture 3.

Survey of contemporary Arab culture in the Middle East and North Africa as reflected in history, language, the arts, and social institutions with attention to the Arab Diaspora. Taught in English. Meets International Perspectives Requirement. (Typically Offered: Spring)

ARABC 4900: Independent Study

Credits: 1-6. Repeatable.

Prereq: Instructor Permission for Course

Architecture (ARCH)

Courses primarily for undergraduates:

ARCH 2010: Architectural Design I

Credits: 6. Contact Hours: Lecture 1, Studio 12.

Prereq: Admission into the Professional program in Architecture

Introduction to architectural design including design process, drawing conventions, methods of design analysis, and model making using both analog and digital tools. Studio projects focus on formal and volumetric principles of pattern and composition, investigations of site conditions, and understanding of scale. Field trips to relevant architectural sites. (Typically Offered: Fall)

ARCH 2010H: Architectural Design I: Honors

Credits: 6-7. Contact Hours: Studio 13.5, Lecture 1.5.

Prereq: Admission into the Professional program in Architecture; Membership in the University Honors Program

Introduction to architectural design including design process, drawing conventions, methods of design analysis, and model making using both analog and digital tools. Studio projects focus on formal and volumetric principles of pattern and composition, investigations of site conditions, and understanding of scale. Field trips to relevant architectural sites. (Typically Offered: Fall)

ARCH 2020: Architectural Design II

Credits: 6. Contact Hours: Lecture 1, Studio 12.

Continuation of fundamental architectural design exploration. Studio projects focus on the generation of ideas based on experience and systematic analysis of tectonics. Emphasis on design development through detail, materiality, and spatial relationships. Students work in groups and individually. Representational methods expand on architectural conventions through experimentation. Field trips to relevant architectural sites. (Typically Offered: Spring)

ARCH 2020H: Architectural Design II: Honors

Credits: 6-7. Contact Hours: Lecture 1, Studio 12.

Prereq: Membership in the University Honors Program

Continuation of fundamental architectural design exploration. Studio projects focus on the generation of ideas based on experience and systematic analysis of tectonics. Emphasis on design development through detail, materiality, and spatial relationships. Students work in groups and individually. Representational methods expand on architectural conventions through experimentation. Field trips to relevant architectural sites. (Typically Offered: Spring)

ARCH 2200: Contemporary Architecture

Credits: 3. Contact Hours: Lecture 3.

Survey of global architectural ideas and practices from 1990 to the present. Emphasis will be given to recent movements and architectural manifestations, as well as close examinations of socio-cultural conditions for contemporary practice. (Typically Offered: Fall)

ARCH 2210: Histories and Theories of Architecture to 1750

Credits: 3. Contact Hours: Lecture 3.

Survey of architectural ideas, theories, and practices before 1750. Emphasis on the mutually formative relationship between architecture and the social, cultural, economic, and political forces, nationally and globally, in which it is produced. (Typically Offered: Fall)

ARCH 2300: Design Communications I

Credits: 3. Contact Hours: Lecture 2, Studio 2.

Prereq: Admission into the Professional program in Architecture

Investigations of various design media and their applications to design. Exercises to develop representational skills and perceptual sensitivity. (Typically Offered: Fall)

ARCH 2310: Advanced Design Representation

Credits: 3. Contact Hours: Studio 2, Lecture 2.

Prereq: ARCH 2300; Junior, Senior or graduate standing

Advanced investigations of various design media and their applications to design. Emphasis on careful consideration of media, mixed-media strategies and development of craft. Offered irregularly. (Typically Offered: Fall)

ARCH 3010: Architectural Design III

Credits: 6. Contact Hours: Lecture 1, Studio 12.

Prereq: ARCH 2020

Consideration of landscape as a constructed, cultural artifact. Projects address the perceptual aspects and strategies of situation and location; examination of environmental phenomena and patterns of use and settlement as revealed and affected by the architectural artifact. Development of a critical design process is stressed. (Typically Offered: Fall)

ARCH 3010H: Architectural Design III: Honors

Credits: 6-7. Contact Hours: Studio 13.5, Lecture 1.5.

Prereq: ARCH 2020; Membership in the University Honors Program

Consideration of landscape as a constructed, cultural artifact. Projects address the perceptual aspects and strategies of situation and location; examination of environmental phenomena and patterns of use and settlement as revealed and affected by the architectural artifact. Development of a critical design process is stressed. (Typically Offered: Fall)

ARCH 3020: Architectural Design IV

Credits: 6. Contact Hours: Lecture 1, Studio 12.

Prereq: Minimum grade of C in ARCH 3010

Design for housing in an urban context that demonstrates a synthetic understanding of diverse scales of use and occupation as shaped by user requirements, site conditions, and principles for inclusive design. Consideration of regulatory requirements and measurable environmental impacts of the proposal on its site. (Typically Offered: Spring)

ARCH 3020H: Architectural Design IV: Honors

Credits: 6-7. Contact Hours: Lecture 1, Studio 12.

Prereq: Minimum grade of C in ARCH 3010; Membership in the University Honors Program

Design for housing in an urban context that demonstrates a synthetic understanding of diverse scales of use and occupation as shaped by user requirements, site conditions, and principles for inclusive design. Consideration of regulatory requirements and measurable environmental impacts of the proposal on its site. (Typically Offered: Spring)

ARCH 3210: History of the American City

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Study of the development of the built environment and urban condition in the United States from the colonial period to today. Primary attention is given to urban spatial organization, built form, technological change, regulatory and funding patterns, and social categories such as class, race, and gender. Credit counts toward fulfillment of History, Theory, Culture requirements. Meets U.S. Cultures and Communities Requirement.

ARCH 3220: Histories and Theories of Architecture after 1750

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Survey of architectural ideas, theories and practices from 1750 to 1990. Emphasis on the mutually formative relationship between architecture and the social, cultural, economic, and political forces, nationally and globally, in which it is produced. (Typically Offered: Spring)

ARCH 3340: Computer-aided Architectural Design

Credits: 3.

Exploration of current and potential applications of computing in architectural design. Projects engage digital design methods, data and media workflows.

ARCH 3350: Three-Dimensional Studio

Credits: 3. Repeatable, maximum of 6 credits.

This course deals with three dimensional problems in visual invention, organization, and expression emphasizing creative manipulation of tools, materials, and techniques as means for three-dimensional thinking. Projects cover the additive (modeling), subtractive (carving), substitutional (casting) as well as constructive techniques.

ARCH 3450: Building Science and Technology I

Credits: 2. Contact Hours: Lecture 2.

Prereq: Admission to the professional program in architecture AND concurrent enrollment in ARCH 3450L

First course in a sequence focused on architectural building technologies. Lectures and labs cover: environmental forces and systems (solar orientation, climate, daylighting, natural ventilation, human comfort and occupancy patterns), materials and assemblies (drawing conventions, building codes, and physical properties of materials) and fundamental structural principles (forces/loads, equilibrium, and stability) to understand impact of the built environment on human health, safety, and welfare at building scales. (Typically Offered: Fall)

ARCH 3450L: Building Science and Technology I Lab

Credits: 1. Contact Hours: Laboratory 2.

Prereq: Admission to the professional program in architecture AND concurrent enrollment in ARCH 3450

Laboratory to accompany ARCH 3450 and must be taken concurrently. Integrating building technologies into architectural designs through experiments and exercises in laboratory format. (Typically Offered: Fall)

ARCH 3460: Building Science and Technology II

Credits: 3. Contact Hours: Lecture 3.

Prereq: ARCH 3450, ARCH 3450L, PHYS 1310 and PHYS 1310L; (MATH 1450 or satisfactory score of 79+ on math placement exam or MATH 1650); concurrent enrollment in ARCH 3460L

Second course in a sequence focused on architectural building technologies. Lectures and labs cover: environmental systems (heat transfer in the building envelope, passive heating and cooling, daylighting, thermal comfort, analytical guidelines and building energy calculation methods), materials & assemblies (building envelope systems, accessibility, egress, and material properties), and structural systems (structural system selection/comparison, and design and analysis of 'form-active' compression and tension structures) to understand impact of the built environment on human health, safety, and welfare at building scales. (Typically Offered: Spring)

ARCH 3460L: Building Science and Technology II Lab

Credits: 2. Contact Hours: Laboratory 4.

Prereq: ARCH 3450, ARCH 3450L, PHYS 1310 and PHYS 1310L; (MATH 1450 or satisfactory score of 79+ on math placement exam or MATH 1650); concurrent enrollment in ARCH 3460

Laboratory to accompany ARCH 3460 and must be taken concurrently. Integrating building technologies into architectural designs through experiments and exercises in laboratory format. (Typically Offered: Spring)

ARCH 3470: Building Science and Technology III

Credits: 3. Contact Hours: Lecture 3.

Prereq: ARCH 3460, ARCH 3460L AND (concurrent enrollment in ARCH 3470L)

Third course in a sequence focused on architectural building technologies. Lectures and labs cover: multistory building framing, assembly, and enclosure systems, sizing and selecting structural framing components (foundations, columns, beams, etc.), and an environmental design process that demonstrates the ability to integrate climate into the control of thermal, luminous, ventilative and acoustic environments. Introduction to plumbing and rain water collection systems to understand the impact of the built environment on human health, safety, and welfare at building scales and to assess those technologies against performance objectives of projects. (Typically Offered: Fall)

ARCH 3470L: Building Science and Technology III Lab

Credits: 2. Contact Hours: Laboratory 4.

Prereq: ARCH 3460 AND ARCH 3460L AND (concurrent enrollment in ARCH 3470)

Laboratory to accompany ARCH 3470 and must be taken concurrently. Integrating building technologies into architectural designs through experiments and exercises in laboratory format.

ARCH 3480: Building Science and Technology IV

Credits: 3. Contact Hours: Lecture 3.

Prereq: ARCH 3470, ARCH 3470L; concurrent enrollment in ARCH 3480L

Fourth course in a sequence focused on architectural building technologies. Lectures and labs cover: ability to demonstrate active environmental HVAC control systems design, use and design of mechanical, electrical, plumbing, fire safety, transportation, and conveying systems and subsystems, constructed building assemblies and details (building envelope details for waterproofing and enclosure, advanced material properties, costs, and serviceability), and structural design for multi-story structures (design and documenting various framing patterns, integration with other building systems, and lateral stability strategies for wind and seismic) to understand the impact of the built environment on human health, safety, and welfare at building scales and to assess those technologies against performance objectives of projects. (Typically Offered: Spring)

ARCH 3480L: Building Science and Technology IV Lab

Credits: 2. Contact Hours: Laboratory 4.

Prereq: ARCH 3470, ARCH 3470L; concurrent enrollment in ARCH 3480

Laboratory to accompany ARCH 3480 and must be taken concurrently. Integrating building technologies into architectural designs through experiments and exercises in laboratory format. (Typically Offered: Spring)

ARCH 3710: Human Behavior and Environmental Theory

Credits: 3. Contact Hours: Discussion 1, Lecture 2.

Prereq: Admission into the Professional program in Architecture

Exploration of theories that describe social structure and order and the manner in which individuals and societies organize themselves and structure their environment.

ARCH 4010: Architectural Design V

Credits: 6.

Prereq: Minimum grade of C in ARCH 3020

Projects showing students' ability to integrate knowledge of sound building design into a comprehensive architectural proposal that reflects sustainable design principles. Consideration of site, structure, building envelope, environmental controls, life safety, and methods to measure building performance. Projects typically are closely connected to the physical, environmental, and social context of their sites. (Typically Offered: Fall)

ARCH 4010H: Architectural Design V: Honors

Credits: 6-7.

Prereq: Minimum grade of C in ARCH 3020; Membership in the University Honors Program

Projects showing students' ability to integrate knowledge of sound building design into a comprehensive architectural proposal that reflects sustainable design principles. Consideration of site, structure, building envelope, environmental controls, life safety, and methods to measure building performance. Projects typically are closely connected to the physical, environmental, and social context of their sites. (Typically Offered: Fall)

ARCH 4020: Architectural Design VI

Credits: 6.

Prereq: Minimum grade of C in ARCH 4010

An examination of the relationship between architecture and the city. Studio projects stress analysis and interpretation of the diverse forces and conditions that impact and inform architecture in the urban environment. Urban design project. Study abroad option. (Typically Offered: Spring)

ARCH 4020H: Architectural Design VI: Honors

Credits: 6-7.

Prereq: Minimum grade of C in ARCH 4010; Membership in the University Honors Program

An examination of the relationship between architecture and the city. Studio projects stress analysis and interpretation of the diverse forces and conditions that impact and inform architecture in the urban environment. Urban design project. Study abroad option. (Typically Offered: Spring)

ARCH 4030: Architectural Design VII

Credits: 6.

Prereq: ARCH 4020

Advanced studio as incubator for examining progressive agendas within or beyond the discipline of architecture. Innovative research that is academically rigorous, critically informed, speculative, and design-led is encouraged. Projects and creative outputs vary per studio instructor. (Typically Offered: Fall)

ARCH 4030H: Architectural Design VII: Honors

Credits: 6-7.

Prereq: ARCH 4020; Membership in the University Honors Program

Advanced studio as incubator for examining progressive agendas within or beyond the discipline of architecture. Innovative research that is academically rigorous, critically informed, speculative, and design-led is encouraged. Projects and creative outputs vary per studio instructor. (Typically Offered: Fall)

ARCH 4040: Architectural Design VIII

Credits: 6. Contact Hours: Lecture 1.5, Studio 13.5.

Prereq: ARCH 4030

Advanced forum for architectural research and/or design. Choice of thematic studios or student initiated research and design. Experimentation and innovation are encouraged. DSNS 4460 or DSNS 5460, for 6 cr. each time taken, can be substituted for this class and be taken up to a maximum of 12 credits. (Typically Offered: Spring)

ARCH 4040H: Architectural Design VIII: Honors

Credits: 6-7.

Prereq: ARCH 4030; Membership in the University Honors Program

Advanced forum for architectural research and/or design. Choice of thematic studios or student initiated research and design. Experimentation and innovation are encouraged. DSNS 4460 or DSNS 5460, for 6 cr. each time taken, can be substituted for this class and be taken up to a maximum of 12 credits. (Typically Offered: Spring)

ARCH 4170: Big and Tall: A History of Construction

(Dual-listed with ARCH 5170).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: Junior or Senior Classification

History, theory, and principles of construction from ancient times through today. Analytic project or term paper and weekly readings with discussion questions. Credit counts toward fulfillment of History, Theory, Culture requirements.

ARCH 4200: Topics in American Architecture

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: Junior classification

History, theory, and principles of American architecture and urban design considering relationships to the culture, visual arts, site, and surroundings. Credit counts toward fulfillment of History, Theory, Culture requirements. Graduation Restriction: A maximum of 6 credits of ARCH 4200 may be applied to degree program.

ARCH 4220: Topics in Medieval Architecture

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: Junior classification

History, theory, and principles of American architecture and urban design considering relationships to the culture, visual arts, site, and surroundings. Credit counts toward fulfillment of History, Theory, Culture requirements. Graduation Restriction: A maximum of 6 credits of ARCH 4200 may be applied to degree program. Meets International Perspectives Requirement.

ARCH 4230: Topics in Renaissance to Mid-Eighteenth Century Architecture

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: Junior classification

History, theory, and principles of renaissance to mid-eighteenth century architecture and urban design considering relationships to the culture, visual arts, site, and surroundings. Credit counts toward fulfillment of History, Theory, Culture requirements.

ARCH 4240: Topics in Nineteenth Century Architecture

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: Junior classification

History, theory, and principles of nineteenth century architecture and urban design considering relationships to the culture, visual arts, site, and surroundings. Credit counts toward fulfillment History, Theory, Culture requirements. Graduation Restriction: A maximum of 6 credits of ARCH 4240 may be applied to degree program.

ARCH 4250: Topics in Twentieth Century and Contemporary Architecture

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: Junior classification

History, theory, and principles of twentieth century architecture and urban design considering relationships to the culture, visual arts, site, and surroundings. Credit counts toward fulfillment History, Theory, Culture requirements. Graduation Restriction: A maximum of 6 credits of ARCH 4250 may be applied to degree program.

ARCH 4260: Topics in Native American Architecture

(Cross-listed with AMIN 4260).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: Junior classification

History, theory, and principles of Native American/American Indian architecture, landscape architecture and planning considering relationships to the culture, visual arts, site, and surroundings. Credit counts toward fulfillment History, Theory, Culture. Graduation Restriction: A maximum of 6 credits of ARCH/AMIN 4260 may be applied to degree program.

ARCH 4270: History, Theory, and Criticism of Chinese Architecture

(Dual-listed with ARCH 5270).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Senior classification

The history and theoretical concept of Chinese built environment with emphasis on the morphology of built form and its relationship to art, landscape design, and urban structure. Credit counts toward fulfillment History, Theory, Culture. Meets International Perspectives Requirement. (Typically Offered: Fall)

ARCH 4290: Topics in Italian Architecture

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior classification

History, theory and principles of Italian architecture considering relationships to the culture, visual arts, site, and surroundings. Credit counts toward fulfillment of History, Theory, Culture requirements. (Typically Offered: Spring)

ARCH 4310: Analytical Drawing

Credits: 3. Contact Hours: Lecture 1, Studio 6.

Repeatable, maximum of 12 credits.

Exploration of 2- and 3-dimensional representations. Emphasis on on-site freehand sketching, perspective and orthographic drawing, rendering of shadows and textures, and use of diverse media. (Typically Offered: Fall, Spring)

ARCH 4320: Advanced Computer Lighting and Rendering

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Exploration of the computer as a design and communication tool. Emphasis on lighting and rendering techniques.

ARCH 4330: Digital Fabrication

(Dual-listed with ARCH 5330).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: ARCH 2310 and ARCH 3010

Exploration of the computer as a design and manufacturing tool. Emphasis on developing digital fabrication technologies and workflows. (Typically Offered: Fall, Spring)

ARCH 4340: Advanced Computer-aided Architectural Design

Credits: 3. Contact Hours: Lecture 1, Studio 4.

Specialized investigations of the computer as a design tool. Development of computer software and workflows for architectural and environmental problem solving.

ARCH 4360: Advanced Design Media

(Dual-listed with ARCH 5360).

Credits: 3. Repeatable, maximum of 6 credits.

Special topics in design media applications. (Typically Offered: Fall, Spring)

ARCH 4370: Architectural Photography

Credits: 3. Contact Hours: Lecture 3.

Emphasis on use of the camera and lighting in photographing drawings and interior and exterior building environments.

ARCH 4380: Architectural Robotics

(Dual-listed with ARCH 5380).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: ARCH 2310; ARCH 3010; or instructor permission. Junior, senior, or graduate standing

Exploration of robots as design and manufacturing tools for architects. Emphasis on developing robotic technologies and workflows with relevance to architectural design.

ARCH 4390: Computational Design Theory

(Dual-listed with ARCH 5390).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ARCH 2200, ARCH 2210, and ARCH 3220 or senior classification or graduate standing.

Seminar discussion of critical readings and theories surrounding computational design; This course surveys the history and development of digital computing and its use in design from early thought experiments, to computer-aided design systems, to present day artificial intelligences and robotics. The potentials and consequences of emerging computational design systems are discussed.

ARCH 4450: Building Science and Technology V

Credits: 2. Contact Hours: Lecture 2.

Prereq: ARCH 3480 AND ARCH 3480L AND (concurrent enrollment in ARCH 4450L)

Final course in a sequence of architectural building technology courses comprising environmental systems, materials/assembly, and building structures topics. Using both lectures and labs, the three interrelated modules each emphasize a particular building technology subject with an overall focus on synthesizing and integrating building technologies together in sustainable design strategies. Topics include: integration of active environmental control and service systems into the design of larger scale buildings, the development of construction details for building shell and interiors, and the design and analysis of various long-span structural systems. Environmental modeling and simulation to develop the ability to integrate measurable outcomes of building performance. (Typically Offered: Fall)

ARCH 4450L: Building Science and Technology V Lab

Credits: 1. Contact Hours: Laboratory 2.

Prereq: Credit or concurrent enrollment in ARCH 4450

Laboratory to accompany ARCH 4450 and must be taken concurrently. Integrating building technologies into architectural designs through experiments and exercises in laboratory format. (Typically Offered: Fall)

ARCH 4510: Whole Building Energy Performance Modeling

(Dual-listed with ARCH 5510).

Credits: 3. Contact Hours: Lecture 2, Studio 2.

Prereq: ARCH 2020; ARCH 3460; ARCH 3460L; or permission of instructor
Architectural design, design evaluation and technical analysis using energy, daylighting, and natural ventilation performance modeling tools. Emphasis will be given to whole building energy efficiency including passive and active systems integration. (Typically Offered: Spring)

ARCH 4820: Professional Practice

(Dual-listed with ARCH 5820).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior classification and ARCH 3710

Emphasis on the circumstances and opportunities of the professional practice of architecture: practice as profession, process, organization, business, and evolving models of practice. (Typically Offered: Fall)

ARCH 4860: Urban Design Explorations

Credits: 3. Contact Hours: Lecture 3.

An investigation of urban design realities in its contemporary form as part of International study abroad program in Rome. Credit counts toward fulfillment of History, Theory, Culture requirements. (Typically Offered: Spring)

ARCH 4900A: Independent Study: Design Communications.

Credits: 1-9. Repeatable.

Independent investigation.

ARCH 4900B: Independent Study: Design

Credits: 1-9. Repeatable.

Independent investigation.

ARCH 4900C: Independent Study: Building Science and Technology

Credits: 1-9. Repeatable.

Independent investigation.

ARCH 4900D: Independent Study: Architectural History

Credits: 1-9. Repeatable.

Independent investigation.

ARCH 4900E: Independent Study: Behavioral Studies

Credits: 1-9. Repeatable.

Independent investigation.

ARCH 4900F: Independent Study: Practice

Credits: 1-9. Repeatable.

Independent investigation.

ARCH 4900H: Independent Study: Honors

Credits: 1-9. Repeatable, maximum of 9 times.

Prereq: Membership in the University Honors Program

Independent investigation.

Courses primarily for graduate students, open to qualified undergraduates:

ARCH 5050: Architectural Design and Media I: Mapping, Programming, Building

Credits: 6. Contact Hours: Studio 12.

Prereq: Graduate Standing or Permission of Instructor

An introduction to comprehensive architectural design projects that focuses on three interrelated design skills: mapping, programming and building. Projects establish a framework for designing buildings that considers multiple factors such as environmental forces, construction methods, building codes, urban regulations, social relationships, and cultural values. (Typically Offered: Fall)

ARCH 5060: Architectural Design and Media II: Materiality and Representation

Credits: 6. Contact Hours: Studio 12.

Prereq: Graduate Standing or Permission of Instructor

Small-scale architectural design projects that investigate design representation through analogue and digital means. The projects explore different representation strategies to help students develop an understanding of the particular modes of architectural representation that advance the designer's knowledge of space as a complex interaction between materials with inherent physical characteristics, mobile socializing bodies, and changing environmental cycles. (Typically Offered: Spring)

ARCH 5070: Architectural Design and Media III: Design in Detail

Credits: 5. Contact Hours: Studio 10.

Prereq: Graduate Standing or Permission of Instructor

Design projects that emphasize the multi-faceted role of the architectural detail in the design process through first, understanding the historical specificity of building construction and detailing; second, utilizing working drawing as a mode of communication; and third, designing with details. (Typically Offered: Summer)

ARCH 5160: Exhibiting Architecture

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

History and theory of architectural exhibitions from the 19th century until today. Weekly readings with in-class discussions and a small curatorial project. Credit counts toward fulfillment of History, Theory, Culture requirements.

ARCH 5170: Big and Tall: A History of Construction

(Dual-listed with ARCH 4170).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: Graduate Standing or Permission of Instructor

History, theory, and principles of construction from ancient times through today. Analytic project or term paper and weekly readings with discussion questions. Credit counts toward fulfillment of History, Theory, Culture requirements.

ARCH 5180: Balkans to Baltics: Architecture and Innovation in Europe's Middle

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate or senior level status or Permission of Instructor

History and theory of 20th century architecture in East-Central Europe. Analytic project or term paper and weekly readings with in-class discussion. Credit counts toward fulfillment of History, Theory, Culture requirements.

ARCH 5210: Celluloid Cities, Urbanism in Film

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate or senior level status or Permission of Instructor

Urban theory and history as manifested in popular films and videos, both fiction and documentary. Term projects require students to make short videos. (Experience with video-making not necessary.) Credits counts towards fulfillment of History, Theory, Culture requirement.

ARCH 5220: Complex Adaptive Systems Theory for the Design of Built Environments

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

The principles of complex adaptive systems theory are studied and then applied towards the design of resilient and responsive built environments. Topics cover a broad spectrum, including urban informalities, tactical approaches, the capacity of digital infrastructures to coordinate distributed human practices, and emergent phenomena. Credit counts toward fulfillment of History, Theory, Culture requirements.

ARCH 5250: Meaning and Form in Architecture

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Seminar on critical analysis of meaning and form in architecture and human-made environment in various cultural contexts examined from historical and theoretical perspectives. Analytic term paper and weekly readings with discussion questions. Credit counts toward fulfillment of History, Theory, Culture requirements. Meets International Perspectives Requirement.

ARCH 5270: History, Theory, and Criticism of Chinese Architecture

(Dual-listed with ARCH 4270).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

The history and theoretical concept of Chinese built environment with emphasis on the morphology of built form and its relationship to art, landscape design, and urban structure. Credit counts toward fulfillment History, Theory, Culture. Meets International Perspectives Requirement. (Typically Offered: Fall)

ARCH 5280A: Studies in Architecture: Culture

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 times.

Prereq: ARCH 2200, ARCH 2210, and ARCH 3220 or senior classification or graduate standing.

Topical offerings change by semester. Credit counts toward fulfillment of History, Theory, Culture requirements.

ARCH 5280B: Studies in Architecture: Technology

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 times.

Prereq: Graduate or senior level status or Permission of Instructor

Studies in Architecture: Technology.

ARCH 5280C: Studies in Architecture: Communications

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 times.

Prereq: Graduate or senior level status or Permission of Instructor

Studies in Architecture: Communications.

ARCH 5280E: Studies in Architecture: Practice

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 times.

Prereq: Graduate or senior level status or Permission of Instructor

Studies in Architecture: Practice.

ARCH 5300: Formworks

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate or senior level status or Permission of Instructor

Studies and activities showing fabrication as a means of speculation and discourse about materiality. Focus is given to the concepts and values embedded in materials and how we build at various scales. (Typically Offered: Fall, Spring)

ARCH 5310: Drawing Culture

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate or senior level status or Permission of Instructor

Exploration of theories and practices that center on drawing as a fundamental means of knowing.

ARCH 5330: Digital Fabrication

(Dual-listed with ARCH 4330).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: Graduate Standing or Permission of Instructor

Exploration of the computer as a design and manufacturing tool.

Emphasis on developing digital fabrication technologies and workflows.

(Typically Offered: Fall, Spring)

ARCH 5340: Topics in Computer-aided Architectural Design

Credits: 3. Repeatable, maximum of 6 credits.

Prereq: Graduate or senior level status or Permission of Instructor

Emphasis on advanced, exploratory approaches to design computing.

Projects highlight experimentation and integration of multiple media types. (Typically Offered: Fall)

ARCH 5350: Advanced Three-Dimensional Studio

Credits: 3. Repeatable, maximum of 6 credits.

Prereq: Graduate Standing or Permission of Instructor

Advanced investigation of sculptural expression with emphasis on individual projects.

ARCH 5360: Advanced Design Media

(Dual-listed with ARCH 4360).

Credits: 3. Repeatable, maximum of 6 credits.

Prereq: Graduate Standing or Permission of Instructor

Special topics in design media applications. (Typically Offered: Fall, Spring)

ARCH 5380: Architectural Robotics

(Dual-listed with ARCH 4380).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: Graduate Standing or Permission of Instructor

Exploration of robots as design and manufacturing tools for architects.

Emphasis on developing robotic technologies and workflows with relevance to architectural design.

ARCH 5390: Computational Design Theory

(Dual-listed with ARCH 4390).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

What is the role of the human designer when automation, simulation, and other computationally-driven processes enter into the picture?

This seminar approaches such questions from the perspective of architecture and design, supplemented with multidisciplinary readings from mathematics, cognitive science, computer science, evolutionary biology, and philosophy. Students will cultivate a sense of what is possible with new technologies, and to begin to articulate a position -- a theory or theories -- of how humans and computers will design together in the future. Participation required in class discussions and constructive debates. Final project is a research paper.

ARCH 5400: Regimes of Perception

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate or senior level status or Permission of Instructor

Exploration of theories, methodologies, and apparatuses of projection as a spatial and material practice. Readings and discussions

accompany assignments for projection through drawing, fabrication, and performance. (Typically Offered: Fall, Spring)

ARCH 5430: Building Science and Technology I

Credits: 6.

Prereq: Graduate Standing or Permission of Instructor

Introduction to analytical, experimental, and computational methods to understand the impacts of building physics and mechanics of the built environment on human health, safety, and welfare at building scales. Lectures and labs cover environmental forces and systems, materials & assemblies, fundamental structural principles, and digital modeling.

ARCH 5440: Building Science and Technology II

Credits: 3.

Prereq: Graduate Standing or Permission of Instructor

Extension to the understanding of fundamental building technologies and their impacts. Lectures and labs cover building assemblies, enclosure systems, structural framing components, water management, and measurable indoor environment, to further understand the impact of the built environment on human health, safety, and welfare.

ARCH 5510: Whole Building Energy Performance Modeling

(Dual-listed with ARCH 4510).

Credits: 3. Contact Hours: Lecture 2, Studio 2.

Prereq: Graduate Standing or Permission of Instructor

Architectural design, design evaluation and technical analysis using energy, daylighting, and natural ventilation performance modeling tools. Emphasis will be given to whole building energy efficiency including passive and active systems integration. (Typically Offered: Spring)

ARCH 5580: Sustainability and Green Architecture

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate or senior level status or Permission of Instructor

Issues of sustainability as related to living patterns and city design, population, pollution and use and availability of natural resources for the built environment. Issues of green and sustainable architecture as related to critical thinking about methods of building material selection and systems, the environment of the United States and the world, and examples of green or sustainable building designs.

ARCH 5670: Preservation, Restoration, Rehabilitation, Cultural Heritage, and Technology

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate or senior level status or Permission of Instructor

Standards and procedures-including the use of current digital technologies-for preserving, restoring, reconstructing, and rehabilitating existing buildings following the guidelines of the National Park Service and the National Trust for Historic Preservation. Credit counts toward fulfillment of History, Theory, Culture requirements.

ARCH 5680: Historic Preservation

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate or senior level status or Permission of Instructor

The history and theory of the Historic Preservation movement including an overview of the National Trust for Historic Preservation; the National Register of the Historic Places; the National Park Service; federal programs, funding sources, preservation law, national landmarks, and historic districts. Credit counts toward fulfillment of History, Theory, Culture requirements. (Typically Offered: Fall)

ARCH 5710: Design for All People

(Cross-listed with GERON 5710).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Principles and procedures of inclusive design in response to the varying ability level of users. Assessment and analysis of existing buildings and sites with respect to standards and details of accessibility for all people, including visually impaired, mentally impaired, and mobility restricted users. Design is neither a prerequisite nor a required part of the course. Enrollment open to students majoring in related disciplines. Credit counts toward fulfillment of History, Theory, Culture requirements. (Typically Offered: Spring)

ARCH 5750: Contemporary Urban Design Theory

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Current urban design theory and its application to urban problems. Credit counts toward fulfillment of History, Theory, Culture requirements.

ARCH 5760: Study Abroad Options

Credits: 1-12. Contact Hours: Lecture 12.

Repeatable, maximum of 12 credits.

Prereq: Graduate Standing or Permission of Instructor

Special topics in environmental design, architectural history and contemporary practice. Travel to relevant countries. General cultural and historical studies, topical projects and individual inquiry. Courses may be taught by departmental faculty or faculty from approved Iowa State Study Abroad programs. See current offerings for detailed syllabus. Meets International Perspectives Requirement. (Typically Offered: Summer)

ARCH 5790X: Methods for Interdisciplinary Research

(Cross-listed with HCI 5790X).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to qualitative, quantitative, and experimental methods for interdisciplinary research. Themes drawn from architectural history, design fields, human computer interaction, and applied social sciences; guest speakers attend to present their research methodologies. Students develop a research paper on a topic of their choice.

ARCH 5810: Making and Material Practice

Credits: 5. Contact Hours: Lecture 1, Studio 12.

Prereq: Graduate Standing or Permission of Instructor

Planning and execution of a project serving a community need. Learning occurs through both theory and active involvement in on-site work. Projects connect previous coursework to practical applications and community involvement. (Typically Offered: Summer)

ARCH 5820: Professional Practice

(Dual-listed with ARCH 4820).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Emphasis on the circumstances and opportunities of the professional practice of architecture: practice as profession, process, organization, business, and evolving models of practice. (Typically Offered: Fall)

ARCH 5900: Special Topics

Credits: 1-5. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Investigation of architectural issues having a specialized nature.

ARCH 5950: Seminar on the Built Environment I: History

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to historical canons and traditions of architecture and urbanism. Discussion of the relationship between historical inquiry and contemporary practice. Students learn skills in critical thinking, visual analysis, and research methods. Course sessions develop thematically with interdisciplinary readings, group discussions, student presentations, and research projects. (Typically Offered: Fall)

ARCH 5960: Seminar on the Built Environment II: Landscape and Society

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to landscape as artifact and multi-disciplinary knowledge-base for design thinking. Literatures and methods of environmental psychology, cultural geography, landscape and architectural history and theory, site and circulation design as intersection of built infrastructural, natural, and social systems. Emphasis on sensory perception, and human movement; investigations of climate, environmental conditions, and values toward consumption and sustainability in everyday experience of the built environment. (Typically Offered: Spring)

ARCH 5970: Seminar on the Built Environment III: Theory

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Multidisciplinary overview of contemporary theories concerned with the production of the built environment. Particular attention to urbanism as a discourse that relates social interactions and power structures to material space. Credit counts toward fulfillment of History, Theory, Culture requirements. (Typically Offered: Fall)

ARCH 5980: Seminar on the Built Environment IV: Topical Study

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

A research seminar which considers a topic within contemporary discourses on the built environment outside of Europe and North America. The topic will be studied from multiple perspectives highlighting the historical and theoretical relationships between architecture, global cultures, geography, landscape, and urban planning. Credit counts toward fulfillment History, Theory, Culture requirements. (Typically Offered: Spring)

Courses for graduate students:**ARCH 6010: Sustainable Building Design**

Credits: 6. Contact Hours: Studio 12.

Design projects that are developed through integrative design strategies that explore the relationship between buildings and environmental forces to maximize non-wasteful, efficient use of resources such as energy, water and building materials. Projects will include investigations of the impact of solar energy, airflow, building materials, passive and active systems and wall sections on spatial quality and form making while demonstrating synthesis of user requirements, regulatory requirements, site conditions, and accessible design. Design decisions will be quantitatively validated through energy modeling and performance simulation. (Typically Offered: Fall)

ARCH 6020: Communities, Architecture and the Environment

Credits: 6. Contact Hours: Studio 12.

Design projects that explore the relationships between architectural, cultural, and environmental landscapes. Emphasis on regional sites, socio-economic conditions, and sustainable design and planning practices at multiple scales. Projects stress engagement with local circumstances and stakeholders; systemic interconnections and strategies; and the application of interdisciplinary research. (Typically Offered: Spring)

ARCH 6030: Integrative Design

Credits: 6. Contact Hours: Studio 12.

Repeatable.

Rigorous examination of architecture's relationship with culture and technology. Studio projects stress the interpretation of contextual and historical considerations while demonstrating broad integration and consideration of environmental stewardship, technical documentation, accessibility, site conditions, life safety, environmental systems, structural systems, and building envelope systems and assemblies. This course fulfills the Graduate College Creative Component Requirement. (Typically Offered: Fall)

ARCH 6040: Design Studio Options

Credits: 6. Contact Hours: Studio 12.

Repeatable, maximum of 12 credits.

Design studio selected by the students, which may include but is not limited to: independent design study, interdisciplinary design studio, study abroad, and design build. DSNS 5460 for 6 cr. may be substituted for this course. (Typically Offered: Spring)

ARCH 6410: Building Science and Technology III

Credits: 3.

Synthesis of building technologies and design process to understand the impacts of building technologies on occupants and the natural/urban environment. Lectures and labs cover active environmental control systems, fire safety, transportation, constructed building assemblies and details, multi-story structural design, and the utilization of computational simulations.

ARCH 6420: Building Science and Technology IV

Credits: 3.

Explorations of emerging building technologies and their impacts on the environment and society. A view into emerging technologies in architecture with an emphasis on adaptability through experimentation and inquiries. Topics include novel materials, assembly techniques, long-span structural systems, renewable energy production, and smart systems.

ARCH 6900: Independent Design Study

Credits: 6. Repeatable.

Independent architectural design projects commensurate with student interests requiring approval of Architecture Graduate Committee.

ARCH 6980: Graduate Seminar

Credits: Required. Contact Hours: Lecture 1.

Repeatable.

Special topics and guest speakers. (Typically Offered: Fall, Spring)

ARCH 6990: Research

Credits: 1-9. Repeatable.

Prereq: Instructor Permission for Course
Research.

Art Education (ARTED)

Courses primarily for undergraduates:

ARTED 2090: Methods of Teaching in and Through Art

Credits: 2. Contact Hours: Studio 4.

Prereq: Sophomore classification

Methods of teaching in and through visual art are experienced and applied in this course. Art-centered and interdisciplinary art education methods for K-8 teaching are designed to develop creativity, authentic expression, collaboration, aesthetic sensitivity and pluralistic, global perspectives. (Typically Offered: Fall, Spring)

ARTED 2110: Introduction to Art Education

Credits: 3. Contact Hours: Studio 6.

Prereq: Sophomore classification

Teaching methods for K-12 art education. Hands-on discipline-specific and integrated art activities are experienced and designed; emphasis is on creativity, artistic and human diversity, community building, and development of thinking skills in holistic, pluralistic art education. (Typically Offered: Fall, Spring)

ARTED 4900: Independent Study

Credits: 1-30.

Prereq: Instructor Permission for Course
(Typically Offered: Fall)

Art History (ARTH)

Courses primarily for undergraduates:

ARTH 2370X: French and Francophone Animation

(Cross-listed with FRNCH 2370X/ WFS 2370X).

Credits: 3. Contact Hours: Lecture 3.

Survey of French and Francophone cinematic animation and introduction to the principles of motion and French and Francophone decorative arts. Emphasis on interdisciplinary practices. (Typically Offered: Fall, Spring)

ARTH 2800: History of Art I

Credits: 3. Contact Hours: Lecture 3.

Development of the visual arts including painting, sculpture, architecture, and crafts, from the prehistoric through Gothic periods. Meets International Perspectives Requirement. (Typically Offered: Fall)

ARTH 2810: History of Art II

Credits: 3. Contact Hours: Lecture 3.

Development of the visual arts of western civilization including painting, sculpture, architecture, and crafts; from the Renaissance to the twentieth century. Meets International Perspectives Requirement. (Typically Offered: Spring)

ARTH 2810H: History of Art II: Honors

Credits: 4. Contact Hours: Lecture 3, Discussion 1.

Prereq: Membership in the University Honors Program

Development of the visual arts of western civilization including painting, sculpture, architecture, and crafts; from the Renaissance to the twentieth century. Meets International Perspectives Requirement. (Typically Offered: Spring)

ARTH 2920: Introduction to Visual Culture Studies

Credits: 3. Contact Hours: Lecture 2, Discussion 1.

An introduction to various topics in visual culture studies, including significant trends in the visual arts, mass media, scientific imagery, visual communications, and other areas related to visual literacy and visual representation in local and global contexts. Cross cultural viewpoints and issues of diversity will be presented in relation to visual culture.

ARTH 2930: Origins and Evolution of Modern Design

Credits: 3. Contact Hours: Lecture 3.

History of designed artifacts, their creators, and their cultural environments in Europe and America from the beginning of the Industrial Revolution to the present.

ARTH 3710X: Chinese Calligraphy: History, Appreciation and Practice

(Cross-listed with CHIN 3710X).

Credits: 3. Repeatable, maximum of 6 credits.

Chinese calligraphy is a unique form of visual art. Combining theoretical and experiential learning, this course offers a comprehensive introduction to Chinese calligraphy, including its history, theory and criticism, social functions, and cultural significance. It also provides students with opportunities to cultivate their artistic creativity and skills through hands-on practices. Taught in English, no knowledge of Chinese language required. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

ARTH 3820: Art and Architecture of Asia

Credits: 3. Contact Hours: Lecture 3.

Introduction to histories of art and architecture in Asia before the modern era. Cultures may include China, Korea, Japan, and India. Art traditions of Asia are explored in relation to their cultural, historical, and religious contexts. Meets International Perspectives Requirement.

ARTH 3830: Greek and Roman Art

(Cross-listed with CLST 3830).

Credits: 3. Contact Hours: Lecture 3.

Greek art from Neolithic to Hellenistic periods. Roman art from the traditional founding to the end of the empire in the West.

ARTH 3830H: Greek and Roman Art: Honors

(Cross-listed with CLST 3830H).

Credits: 3-4. Contact Hours: Lecture 3.

Prereq: Membership in the University Honors Program

Greek art from Neolithic to Hellenistic periods. Roman art from the traditional founding to the end of the empire in the West.

ARTH 3840: Art of Islam

Credits: 3. Contact Hours: Lecture 3.

Historical survey of the painting, sculpture, crafts, and architecture of the various civilizations of the Islamic world. Meets International Perspectives Requirement.

ARTH 3840H: Art of Islam: Honors

Credits: 3-4. Contact Hours: Lecture 3.

Prereq: Membership in the University Honors Program

Historical survey of the painting, sculpture, crafts, and architecture of the various civilizations of the Islamic world. Meets International Perspectives Requirement.

ARTH 3850: Renaissance Art

Credits: 3. Contact Hours: Lecture 3.

Italian and Northern European art including painting, sculpture, architecture, and craft from 1300 to 1600. Emphasis on techniques and cultural contexts. Focus on circulation, exchange, and production of art in an age of global discovery and exploration.

ARTH 3850H: Renaissance Art: Honors

Credits: 3-4. Contact Hours: Lecture 3.

Prereq: Membership in the University Honors Program

Italian and Northern European art including painting, sculpture, architecture, and craft from 1300 to 1600. Emphasis on techniques and cultural contexts. Focus on circulation, exchange, and production of art in an age of global discovery and exploration.

ARTH 3860: American Art to 1945

Credits: 3. Contact Hours: Lecture 3.

Survey of American art from the early colonial period to 1945, with emphasis on historical and cultural issues that underlie art production in the United States. Meets U.S. Cultures and Communities Requirement.

ARTH 3880: Modern Art and Theory

Credits: 3. Contact Hours: Lecture 3.

Visual arts and critical theory of the late 19th and early 20th centuries, including Expressionism, Cubism, Futurism, Suprematism, Dada, and Surrealism.

ARTH 3950: Art and Theory Since 1945

Credits: 3. Contact Hours: Lecture 3.

Visual arts and critical theory after 1945, including Abstract Expressionism, Pop Art, and Performance Art. Meets U.S. Cultures and Communities Requirement.

ARTH 3960: History of Photography

Credits: 3. Contact Hours: Lecture 3.

Survey of the evolution of photography and photojournalism from the 1830s to the present, seen from an art historical perspective, emphasizing causative factors, cultural influences, and major masters and schools.

ARTH 4600: The World on Display

Credits: 3. Contact Hours: Lecture 3.

Survey of world's fairs and other international exhibitions, focusing on their displays of art, manufacturing, luxury goods and industrial products, and relating to overarching discourses of nationalism, colonialism, and political supremacy as they were articulated within the exhibitions.

ARTH 4860: Art History Field Study

Credits: Required. Repeatable.

Prereq: Concurrent Enrollment in an ARTH course; Permission of Instructor
Study and tours of museums, galleries, artist and/or designer studios and other areas of interest within art history. Offered on a satisfactory-fail basis only.

ARTH 4870: Nineteenth-Century Art

Credits: 3. Contact Hours: Lecture 3.

European and American art and architecture from 1780 to 1900 focusing on the major movements of western Europe, including Neoclassicism, Romanticism, Realism, Impressionism, and Post-Impressionism.

ARTH 4890: History of Comics

(Dual-listed with ARTH 5890).

Credits: 3. Contact Hours: Lecture 3.

An art-historical survey of comic strips, comic books, and graphic novels from their origins in the 19th century to present.

ARTH 4890H: History of Comics

Credits: 3-4. Contact Hours: Lecture 3.

Prereq: Membership in the University Honors Program

An art-historical survey of comic strips, comic books, and graphic novels from their origins in the 19th century to present.

ARTH 4900: Independent Study

Credits: 1-6. Repeatable.

Prereq: Permission of Instructor; Permission of Department Chair

Student must have completed art history coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis.

ARTH 4900H: Independent Study: Honors

Credits: 1-6. Repeatable.

Prereq: Permission of Instructor; Permission of Department Chair; Membership in the University Honors Program

Student must have completed art history coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis.

ARTH 4910: Art History in Europe Seminar

Credits: 1. Contact Hours: Lecture 1.

Prereq: Permission of instructor; credit or enrollment in ARTH 4920

Cultural and historical aspects of art and design in Western Europe in preparation for study abroad. Area of study varies each time offered. Meets International Perspectives Requirement. Offered on a satisfactory-fail basis only.

ARTH 4920: Art History In Europe

(Dual-listed with ARTH 5920).

Credits: 3. Contact Hours: Lecture 3.

International study abroad program in western Europe. Visits to design studios, art museums, and educational facilities. Related activities depending on specific area of study which may vary each time offered. Meets International Perspectives Requirement.

ARTH 4940: Women/Gender in Art

(Cross-listed with WGS 4940).

Credits: 3. Contact Hours: Lecture 3.

Issues of gender related to cultural environments from the Middle Ages to contemporary times in Europe and America. Feminist movement beginning in the 1970s and specifically gender issues in art that are becoming widespread in the artistic culture.

ARTH 4970: Internship

Credits: 1-6. Repeatable, maximum of 6 credits.

Prereq: Undergraduate classification and written approval of supervising instructor on required form in advance of semester of enrollment

Supervised experience with a cooperating sponsor. Offered on a satisfactory-fail basis only. Offered on a satisfactory-fail basis only.

ARTH 4980: Selected Topics in Art History

(Dual-listed with ARTH 5980).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Specialized study in the history or criticism of art and/or design.

ARTH 4990: Visual Culture Studies Writing and Methods Seminar

Credits: 3. Contact Hours: Lecture 3.

Sustained exploration of topics related to Visual Culture Studies. Course incorporates introduction to methods central to the field of visual culture studies, writing exercises, and guided instruction in the process of conducting research and reporting results of the research process. Course will result in an original paper.

Courses primarily for graduate students, open to qualified undergraduates:

ARTH 5010: Issues in Visual and Material Culture Seminar

Credits: 3. Contact Hours: Lecture 3.

Issues and debates that pertain to the study of visual objects and material artifacts in their cultural context. Examination of the role of visual and material culture studies as both relate to allied disciplines including, but not limited to: anthropology, art history, design history, design studies, and new media studies. (Typically Offered: Fall, Spring, Summer)

ARTH 5860: Internship

Credits: 1-6. Repeatable, maximum of 6 credits.

Prereq: Graduate classification and written approval of supervising instructor on required form in advance of semester of enrollment

Supervised experience with a cooperating sponsor. Offered on a satisfactory-fail basis only. Offered on a satisfactory-fail basis only.

ARTH 5870: Nineteenth Century Art

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

European and American art and architecture from 1780 to 1900, focusing on the major movements of western Europe, including Neoclassicism, Romanticism, Realism, Impressionism, and Post-Impressionism.

ARTH 5880: Modern Art and Theory

Credits: 3. Contact Hours: Lecture 3.

Prereq: Senior or graduate classification

Visual arts and critical theory of the late 19th and early 20th centuries, including Expressionism, Cubism, Futurism, Suprematism, Dada and Surrealism.

ARTH 5890: History of Comics

(Dual-listed with ARTH 4890).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

An art-historical survey of comic strips, comic books, and graphic novels from their origins in the 19th century to present.

ARTH 5900: Special Topics

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Independent Study in Art History.

ARTH 5920: Art History In Europe

(Dual-listed with ARTH 4920).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

International study abroad program in western Europe. Visits to design studios, art museums, and educational facilities. Related activities depending on specific area of study which may vary each time offered. Meets International Perspectives Requirement.

ARTH 5940: Women/Gender in Art

(Cross-listed with WGS 5940).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Issues of gender related to cultural environments from the Middle Ages to contemporary times in Europe and America. Feminist movement beginning in the 1970s and specifically gender issues in art that are becoming widespread in the artistic culture.

ARTH 5950: Art and Theory Since 1945

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Visual arts and critical theory after 1945, including Abstract Expressionism, Pop Art, and Performance Art.

ARTH 5960: History of Photography

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Survey of the evolution of photography and photojournalism from the 1830s to the present, seen from an art historical perspective, emphasizing causative factors, cultural influences, and major masters and schools.

ARTH 5970: Green Art: Earthworks and Beyond

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Seminar covering aspects of art and design based on ecological principles, including earthworks, land-based art, recycled/reused objects, ecofeminism, ephemerality, and green design. .

ARTH 5980: Selected Topics in Art History

(Dual-listed with ARTH 4980).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Prereq: Graduate Standing or Permission of Instructor

Specialized study in the history or criticism of art and/or design.

Astronomy and Astrophysics (ASTRO)

Courses primarily for undergraduates:

ASTRO 1020: North Star Astronomy

Credits: 1. Contact Hours: Lecture 1.

An entirely web-based course covering topics in observing the sky and navigation by the stars for students with little or no previous experience.

The course combines material on common naked-eye phenomena, such as daily and seasonal variations in the sky, with information on how these helped navigators determine where they are on Earth. The course "lectures" are on-line, interactive units with built in exercises, hands-on (offline) activities and layers of help. Graded homework and quizzes are administered via Canvas. Graduation Restriction: Students who take ASTRO 1200 may count credit in only one of ASTRO 1020 or 1030 toward graduation. (Typically Offered: Fall, Spring, Summer)

ASTRO 1030: Evening Star

Credits: 1. Contact Hours: Lecture 1.

An entirely web-based course covering topics in celestial mechanics ("Rocket science!") for students with little or no previous experience. It combines the geography of the solar system with discussion of methods of traveling to the other planets. The course "lectures" are on-line, interactive units with built-in exercises, hands-on (offline) activities, and layers of help. Graded homework and quizzes are administered via Canvas. Graduation Restriction: Students who take ASTRO 1200 may count credit in only one of ASTRO 1020 or 1030 toward graduation. (Typically Offered: Fall, Spring, Summer)

ASTRO 1200: The Sky and the Solar System

Credits: 3. Contact Hours: Lecture 2, Discussion 1.

For the nonscientist. A survey of our view of the universe, and the exploration of the solar system and beyond. The sky: constellations; motions of the Sun, Moon, and planets; seasons and the calendar; eclipses. The solar system: origin and evolution; characteristics of the Sun, planets, satellites, comets, meteorites, and asteroids. The detection and characterization of other solar systems, and the search for life in the universe. Extensive use of the planetarium is included. (Typically Offered: Fall, Spring, Summer)

ASTRO 1500: Stars, Galaxies, and Cosmology

Credits: 3.

For the nonscientist. A survey of astronomy with a focus on the universe beyond our solar system. Basic observational astronomy and the history of astronomy. Stellar astronomy: motions, distances, sizes, spectra; types of stars; variability; binary systems. Stellar evolution: the birth, life, and death of stars, including supernovae, neutron stars, and black holes. The structure and evolution of the Milky Way Galaxy. Other galaxies, clusters of galaxies, quasars. Theories of the origin of the universe. (Typically Offered: Fall, Spring)

ASTRO 2500: Astronomy Bizarre

Credits: 3. Contact Hours: Lecture 3.

Prereq: ASTRO 1200 or ASTRO 1500

For the nonscientist. A small enrollment course examining new and exciting topics in modern astronomy. Galaxy and star formation. Black holes and pulsars. Colliding galaxies. Quasars. Dark Matter. Dark energy. Quasars. Cosmology, the Big Bang and the future of the universe. Prospects and searches for extraterrestrial life. (Typically Offered: Spring)

ASTRO 2900: Independent Study

Credits: 1-4. Repeatable.

Prereq: Instructor Permission for Course

Offered on a satisfactory-fail basis only.

ASTRO 3420: Introduction to Solar System Astronomy

Credits: 3. Contact Hours: Lecture 3.

Prereq: (PHYS 2320 and PHYS 2320L) or PHYS 2420

An introduction to the physics of the Solar System and the planetary systems discovered around other stars. General characteristics of planetary systems: dynamics, thermodynamics, internal and surface structure of planets and minor bodies, physics of their atmosphere. Discovery techniques and characterization of extrasolar planets, and planetary systems formation models. 'Grand tour' of the Solar System, using data and imagery from probes and telescopes that have visited these worlds. The origin and evolution of life on Earth, and the ongoing search for life in the Solar System and elsewhere in the universe. (Typically Offered: Fall)

ASTRO 3440L: Astronomy Laboratory

Credits: 3. Contact Hours: Lecture 1, Laboratory 6.

Prereq: (PHYS 2320 and PHYS 2320L) or PHYS 2420

Experiments in optical astronomy. Observational techniques, ranging from stellar photometry to CCD imaging. Data processing and analysis techniques. Astronomical software packages and online databases and resources. Available instruments include a variety of small telescopes and astronomical CCD cameras. (Typically Offered: Fall)

ASTRO 3460: Introduction to Astrophysics

Credits: 3. Contact Hours: Lecture 3.

Prereq: (PHYS 2320 and PHYS 2320L) or PHYS 2420

An exploration of the universe beyond our Solar System, with emphasis on the astrophysics of stars and galaxies. Observable properties of stars, physics of stellar atmospheres and interiors. Birth, evolution and death of stars, to understand the past and future of our Sun, the Milky Way galaxy and the other galaxies in the universe. Basic concepts of cosmology, dark matter and dark energy. Use of computer models to calculate the structure and evolution of stars and protostars, and to analyze actual astronomical data obtained by professional astronomers. (Typically Offered: Spring)

ASTRO 4050: Astrophysical Cosmology

(Dual-listed with ASTRO 5050).

Credits: 3. Contact Hours: Lecture 3.

Introduction to modern cosmology and large-scale structure; mathematical and observational fundamentals associated with the origin, structure, and evolution of the Universe. Scale of the Universe, Hubble's Law, the cosmic microwave background, Big Bang nucleosynthesis, the origin of elements, dark energy and the accelerating universe, and dark matter. For senior undergraduates and graduate students in all areas of physics. Previous coursework equivalent to ASTRO 3460 (Introduction to Astrophysics) is necessary for success in this course. (Typically Offered: Spring)

ASTRO 4500: Undergraduate Research

Credits: 1-6. Repeatable.

Prereq: Instructor Permission for Course

Research under supervision of astronomy faculty. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

ASTRO 4500L: Undergraduate Research

Credits: 1-6. Repeatable.

Prereq: ASTRO 3440L and permission of instructor

Laboratory or observational project under supervision of astronomy faculty. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

ASTRO 4900: Independent Study

Credits: 1-4. Repeatable, maximum of 9 credits.

Prereq: 6 credits ASTRO; permission of instructor

Offered on a satisfactory-fail basis only.

ASTRO 4900H: Independent Study: Honors

Credits: 1-4. Repeatable, maximum of 9 credits.

Prereq: 6 credits ASTRO; Permission of Instructor; Membership in the University Honors Program

Graduation Restriction: No more than 9 credits of ASTRO 4900 may be counted toward graduation. Offered on a satisfactory-fail basis only.

Courses primarily for graduate students, open to qualified undergraduates:

ASTRO 5050: Astrophysical Cosmology

(Dual-listed with ASTRO 4050).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to modern cosmology and large-scale structure; mathematical and observational fundamentals associated with the origin, structure, and evolution of the Universe. Scale of the Universe, Hubble's Law, the cosmic microwave background, Big Bang nucleosynthesis, the origin of elements, dark energy and the accelerating universe, and dark matter. For senior undergraduates and graduate students in all areas of physics. Previous coursework equivalent to ASTRO 3460 (Introduction to Astrophysics) is necessary for success in this course. (Typically Offered: Spring)

ASTRO 5100: Observational Astrophysics

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Techniques in optical and near-IR astronomy, including spectroscopy and CCD photometry. Emphasis on projects involving proficiency in the use of research telescopes and modern instrumentation. Project topics range from photometric studies of pulsating and binary star systems to deep CCD imaging of faint nebulae and galaxies. Offered irregularly. Previous coursework equivalent to ASTRO 4050 or ASTRO 5050 (Astrophysical Cosmology) is necessary for success in this course. (Typically Offered: Fall, Spring)

ASTRO 5800: Stellar Astrophysics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

The interior structure and atmospheric properties of stars: Stellar structure equations and constitutive relations: energy generation, energy transport by radiation and convection; equation of state, nuclear energy generation and nucleosynthesis. Numerical and analytic solutions to the equations of structure and evolution. Observational connections through the theory of radiative transfer. Line and continuum processes and sources of opacity. Non-LTE and statistical equilibrium. Line profiles. Interpretation of stellar spectra: temperature, pressure, and abundance determinations. Stellar evolution from formation to final phases. Offered irregularly. (Typically Offered: Fall, Spring)

ASTRO 5820: High Energy Astrophysics

Credits: 3. Contact Hours: Lecture 3.

Prereq: ASTRO 4050 or ASTRO 5050 or Permission of Instructor

Interactions of high-energy particles, non-thermal radiation processes, spectral evolution of non-thermal systems, cosmic rays, active galactic nuclei, pulsars, neutrinos, measurement techniques for relativistic charged particles, high energy photons, and neutrinos. Offered irregularly. (Typically Offered: Fall, Spring)

ASTRO 5840: Galactic Astronomy

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Overall structure of our Galaxy and the interstellar medium. Physical processes in the interstellar medium (e.g., heating and cooling mechanisms, turbulence). Observational techniques for studying the interstellar medium. Kinematics and chemical evolution of the Galaxy. Previous coursework equivalent to ASTRO 4050 or ASTRO 5050 (Astrophysical Cosmology) is necessary for success in this course. Offered irregularly. (Typically Offered: Fall, Spring)

ASTRO 5860: Extragalactic Astronomy

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Galaxy evolution, dynamics of external galaxies, evolution and classification of galaxies, groups and clusters of galaxies, extra-galactic radio sources, quasars, structure formation, cosmological models and their observational consequences. Offered irregularly. Previous coursework equivalent to ASTRO 4050 or ASTRO 5050 (Astrophysical Cosmology) is necessary for success in this course. (Typically Offered: Fall, Spring)

ASTRO 5900: Special topics

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Offered on a satisfactory-fail basis only.

ASTRO 5990: Creative Component

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Individually directed study of research-level problems for students electing the nonthesis M.S. option in astronomy. Offered on a satisfactory-fail basis only.

Courses for graduate students:

ASTRO 6500: Advanced Seminar

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Topics of current interest in astronomy and astrophysics. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

ASTRO 6750: Advanced Stellar Astrophysics

Credits: 3. Contact Hours: Lecture 3.

Prereq: ASTRO 5800 or Permission of Instructor

Advanced topics in stellar astrophysics. Dynamic and extended atmospheres, chromospheres, coroneae, and stellar winds. MHD, stellar activity, and dynamo theory. Radiative transfer and the transition from extended atmospheres to the interstellar medium. Diffusive processes in stellar atmospheres and interiors. Techniques for quantitative analysis of planetary and stellar spectra including detailed modeling and spectrum synthesis. Evolution in interacting binaries. Nucleosynthesis II. Variable stars. Supernovae. Neutron stars and black holes. Offered irregularly. (Typically Offered: Fall, Spring)

ASTRO 6990: Research

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Offered on a satisfactory-fail basis only.

Athletic Training (ATR)

Courses primarily for undergraduates:

ATR 2170: Clinical Practicum in Athletic Training I

Credits: 1.

Prereq: ATR 2210; Permission of Athletic Training Program Director

Athletic training clinical experiences for pre-athletic training students.

Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

ATR 2180: Orientation to Athletic Training Clinical Experience

Credits: 0.5. Contact Hours: Laboratory 2.

Repeatable, maximum of 1 credits.

Prereq: Pre-ATR Undergraduate Student

Pre-athletic training clinical experience designed to orientate students to the athletic training profession prior to enrolling in athletic training course sequence. Students will observe athletic trainers in various athletic training clinical sites. Open to pre-athletic training students only. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

ATR 2190: Anatomy Clinical Practicum

Credits: 1. Contact Hours: Laboratory 2.

Athletic training clinical experiences designed to review human anatomical structures including origin, insertion, action, innervations of muscles. Students will gain experience with palpation of these structures to help identify location of anatomical landmarks. Students will also gain experience identifying bones, ligaments, and tendons. Open to athletic training students only. (Typically Offered: Spring)

ATR 2200: Basic Athletic Training

Credits: 2. Contact Hours: Lecture 1, Laboratory 2.

Prereq: BIOL 1550 or (BIOL 2550 and BIOL 2560)

Introduction to methods of prevention and immediate care of athletic injuries. Basic information concerning health supervision of athletes, and some basic wrapping and strapping techniques for common injuries.

ATR 2210: Pre-Athletic Training Clinical Practicum

Credits: 1. Contact Hours: Laboratory 3.

Athletic training clinical observation experiences to accompany ATR 2200. Utilize knowledge to evaluate, analyze and demonstrate appropriate taping, wrapping and basic skill techniques. Open to students interested in the athletic training option. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

ATR 2230: Preseason Clinical Experience Practicum

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Permission of Clinical Coordinator

Athletic training clinical experiences for athletic training students during pre-season intercollegiate football. Clinical experiences include: Emergency care, splinting and spinal immobilization, medical record keeping and HIPPA regulations, environmental conditions, prevention of injury screening strategies, athletic training room and education program policies and procedures, review of athletic taping techniques, acute injury management, and anatomy review. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

ATR 2280: Basic Orthopedic Assessment and Evaluation Principles

Credits: 2.

Prereq: ATR 2190

Assessment procedures and evaluation techniques for upper and lower body orthopedic conditions and injuries. Includes an overview of mechanisms of injury, general musculoskeletal disorders, spine or neurological dysfunction. (Typically Offered: Fall)

ATR 2290: Clinical Practicum in Athletic Training II

Credits: 1.

Prereq: Credit or concurrent enrollment in ATR 2280

Pre-Athletic training clinical experiences designed to orientate students to the assessment and evaluation principles of upper and lower body orthopedic conditions and injuries. Pre-athletic training students will observe athletic trainers in various athletic training clinical sites. Concurrent enrollment in ATR 2280. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

ATR 3280: Athletic Injuries Clinical Practicum

Credits: 1. Contact Hours: Laboratory 2.

Prereq: ATR 2290

Athletic training clinical experiences for pre-athletic training students. Clinical experiences include: prevention of injury screening strategies, athletic training room and education program policies and procedures, review of athletic taping techniques, acute injury management, and anatomy review. Offered on a satisfactory-fail basis only.

Courses primarily for graduate students, open to qualified undergraduates:

ATR 5010: Bracing, Wrapping, and Taping Techniques

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Admission to graduate program in Athletic Training

Methods to select, fabricate, and/or customize prophylactic, assistive, and restrictive devices, material, and techniques into plan of care (durable medical equipment, orthotic devices, taping, bracing, splinting, protective padding, and casting). Methods of taping and wrapping for injury care, mitigation of injury, and return to play. Exposure to different brands of bracing, how to fit a brace, and their use as well as casting techniques. Discussions of when to refer for prosthetics and overview of gait training.

ATR 5020: Emergency Care Procedures in Athletic Training

Credits: 3. Contact Hours: Lecture 3.

Prereq: Admission to graduate program in Athletic Training

Overview of medical emergencies and other critical incidents that may occur. Evaluate and manage patients with acute conditions including triaging conditions and internal/external hemorrhage. Cardiac, respiratory, and cervical spine compromise. Conditions related to environment, fractures, dislocations, and wound care and closure. Concussion/brain injury with consideration of established protocols including: comprehensive examination, recognition, and treatment, implementation of a plan of care, referral, and return to participation. (Typically Offered: Summer)

ATR 5050: Therapeutic Modalities and Clinical Interventions

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: ATR 5020, ATR 5200, acceptance into Athletic Training program

Knowledge and skills to utilize a variety of therapeutic modalities. Detailed understanding of the psychological and physiological process of pain, healing and a problem-based approach to apply theories, principles, and techniques of thermal, electrical, mechanical, light, and alternative therapies (laser, cryotherapy). Incorporation interventions (for pre-, post-, and non-surgical conditions) designed to address a patients' identified impairments, activity limitations, injuries, and participation restrictions. Home care to include self-treatment, soft tissue techniques. (Typically Offered: Fall)

ATR 5090: Athletic Training Clinical Education I

Credits: 1.

Prereq: Acceptance into Athletic Training program

Clinical experiences under the direct supervision of a clinical preceptor. Techniques and clinical skills provided in both the clinical and classroom settings including: Special Olympics, emergency department rotation, environmental conditions, off season practice and conditioning sessions, biometrics/physiological monitoring systems and translation of data into effective preventative measures, clinical interventions, and performance enhancement. (Typically Offered: Summer)

ATR 5100: Evaluation Methods and Treatment Techniques - Lower Body

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: ATR 5020, ATR 5200, acceptance into Athletic Training program

Proper methods of musculoskeletal evaluation of the lower extremity. Evaluate and manage patient(s) with acute conditions including triaging conditions that are life threatening or otherwise emergent. Obtain a medical history, proper methods of documentation, patient overview (including ICF model), identification of comorbidities, assessment of function, selection and use of special tests and measures assessing patient's clinical presentation, clinical practice decisions, evaluation of all results to determine a plan of care, including referral when warranted. Selection and incorporations of interventions designed to address a patient's identified impairments, activity limitations, and participation restriction. (Typically Offered: Fall)

ATR 5130: Evaluation Methods and Treatment Techniques - Upper Body

Credits: 3. Contact Hours: Lecture 3.

Prereq: ATR 5100, ATR 5210, acceptance into Athletic Training program

Proper methods of musculoskeletal evaluation of the upper extremity including spine. Evaluate and manage patient(s) with acute conditions. Obtaining a medical history, methods of documentation, assessment of function, selection and use of special tests and measures assessing patient's clinical presentation, determine a plan of care, including referral when warranted. Selection and incorporations of interventions designed to address a patient's identified impairments, activity limitations, and participation restrictions, using ICF model for clinical practice decisions. Review of concussion evaluation, protocols, and return to play following a head injury/concussion. (Typically Offered: Spring)

ATR 5150: Evidence-based Practice in Athletic Training

Credits: 2. Contact Hours: Lecture 2.

Prereq: ATR 5220, ATR 5450, acceptance into Athletic Training program

Principles of evidence-based practice, search for evidence, grading and evaluating literature. Use of systems of quality assurance and improvement to enhance patient care, search, retrieve, and incorporating the use of contemporary principles and practices information from health informatics for clinical decisions and communication with patients/clients, family members, coaches, administrators, other healthcare providers, consumers, payors, and/or policy makers. Use of the International Classification of Functioning, Disability, and Health (ICF) as a framework for delivery and communication about patient care. (Typically Offered: Summer)

ATR 5190: Athletic Training Clinical Education II

Credits: 3.

Prereq: ATR 5100, ATR 5210, acceptance into Athletic Training program

Clinical experiences under the supervision of a clinical preceptor with client/patient populations in competitive, recreational, individual and team activities, with foundational behaviors of professional practice. Real client/patient interactions as well as assessment of clinical component procedures and policies. Clinical hours occur in a variety of settings with patients and the student will complete the clinical hours that may extend prior to and/or beyond the academic semester end date. Clinical opportunities provide a basis for evaluating the athletic training student's clinical progression through the program. (Typically Offered: Fall)

ATR 5200: Athletic Training Seminar A - An Introduction to Athletic Training

Credits: 1. Contact Hours: Lecture 1.

Prereq: Acceptance into Athletic Training program

Introduction to athletic training program and an overview of policies and procedures, and program handbook. History of athletic training, professional domains, electronic health records, ethics, cultural competence, social justice, HIPPA, and FERPA confidentiality, and professionalism. (Typically Offered: Summer)

ATR 5210: Athletic Training Seminar B - Diagnostic Imaging and Lab Principles

Credits: 1. Contact Hours: Lecture 1.

Prereq: ATR 5020, ATR 5200, acceptance into Athletic Training program

Procedures on obtaining via the appropriate physician and medical staff the necessary and appropriate diagnostic tests or labs to facilitate diagnosis, referral, and treatment planning. Using evidence to inform practice and utilize systems of quality assurance and improvement to enhance patient care. Communicate and collaborate with other medical interprofessionals including radiologists, x-ray technicians, medical laboratory scientists and clinical lab technicians for best patient care and outcomes. (Typically Offered: Fall)

ATR 5220: Athletic Training Seminar C - Interprofessional Collaboration and Leadership

Credits: 1. Contact Hours: Lecture 1.

Prereq: ATR 5100, ATR 5210, acceptance into Athletic Training program

Explore other allied health care professions and interprofessional collaboration for optimal patient care and referral. Total patient care and how different professions can impact the care will be explored and discussed. Participation in roundtable discussions with other interprofessional health professions and students are exposed to foundational behaviors of professional practice including but not limited to: communication, work/family balance, ethics, mentorship, leadership, professional involvement, and promotion of the profession. (Typically Offered: Spring)

ATR 5230: Athletic Training Seminar D - Advanced Topics in Athletic Training

Credits: 1. Contact Hours: Lecture 1.

Prereq: ATR 5220, ATR 5450, acceptance into Athletic Training program

Advanced clinical experiences and specialty training that includes exposure to soft tissue mobilization techniques, gait analysis and sport science technologies related to injury mitigation and sport performance. (Typically Offered: Summer)

ATR 5240: Athletic Training Seminar E - Professional Development in Athletic Training

Credits: 1. Contact Hours: Lecture 2.

Prereq: ATR 5150, ATR 5500, and permission of the Athletic Training Program Director

Assess the athletic training students' mastery of knowledge and clinical skills in athletic training, prepare students for employment, continuing education, and self-assessment. Utilizes a case study approach covering all of the domains of athletic training and demonstrates interprofessional and interdisciplinary connections. Review of all of the athletic training domains via specific exams (written, simulation and computer based) will be utilized to prepare the student to challenge the BOC examination. (Typically Offered: Spring)

ATR 5290: Athletic Training Clinical Education III

Credits: 3.

Prereq: ATR 5100, ATR 5210, ATR 5190, acceptance into Athletic Training program

Clinical experiences under the supervision of a clinical preceptor with client/patient populations in competitive, recreational, individual and team activities, high and low intensity activities with foundational behaviors of professional practice. Real client/patient interactions as well as assessment of clinical component procedures and policies. Clinical hours occur in a variety of settings with patients and the student will complete the clinical hours that may extend prior to and/or beyond the academic semester end date. Clinical opportunities provide a basis for evaluating the athletic training student's clinical progression through the program. (Typically Offered: Spring)

ATR 5390: Athletic Training Clinical Education IV

Credits: 2.

Prereq: ATR 5220, ATR 5450, ATR 5290, acceptance into Athletic Training program

General medicine clinical experiences under the direct supervision of a clinical preceptor. Advanced issues in the athletic training profession with emphasis on practical application and professional development, and collaboration with other health care professionals. Utilization of evidenced based research and approaches to clinical practice with emphasis placed on lab reports, imaging results, life-span issues, and diverse patient populations including non-sport client/patient populations, different sexes and throughout the lifespan (pediatric, adult, elderly). Foundational behaviors of professional practice and emphasis will focus on evaluation, treatment, rehabilitation, and clinical skills. (Typically Offered: Summer)

ATR 5450: Therapeutic Exercise and Rehabilitation Interventions

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: ATR 5100, ATR 5210, acceptance into Athletic Training program

Therapeutic and corrective exercise, joint mobilization, soft tissue techniques, movement training (including gait training), motor control/proprioceptive activities, task-specific functional training, home and self-care including self-treatment and exercise, cardiovascular training. Pre-, post-, and non-surgical conditions and addressing activity limitations, patient goals, participation restrictions, quality assurance and quality improvement, patient reported outcomes, and return to play guidelines. (Typically Offered: Spring)

ATR 5490A: Athletic Training Clinical Education Study Abroad: Preparing for the Experience

Credits: 1. Contact Hours: Lecture 1.

Prereq: Sophomore or junior classification, or acceptance into graduate Athletic Training Program; minimum GPA of 3.0; ATR 2200 or ATR 2290

Preparation for a study abroad experience that is focused on the discipline of athletic training in another country. Pre-travel for ATR 5490B study abroad experience. Meets International Perspectives Requirement. (Typically Offered: Spring)

ATR 5490B: Athletic Training Clinical Education Study Abroad

Credits: 1-3. Contact Hours: Lecture 3.

Prereq: ATR 5490A; Accepted to study abroad by Athletic Training Director

First-person perspective into the athletic training profession in another country as well as provide enrichment experiences related to the history and culture of that country. Follow-up course and experience of one credit ATR 5490A which was intended to prepare the student for the study abroad experience. Meets International Perspectives Requirement. (Typically Offered: Spring)

ATR 5500: Pharmacological Issues in Athletic Training

Credits: 2. Contact Hours: Lecture 2.

Prereq: ATR 5220, ATR 5450, acceptance into Athletic Training program

General medical and pharmacological issues generally found in the field of athletic training. Medications used to treat medical conditions and the ability to educate patients regarding appropriate pharmacological agents for the management of their condition, including indications, contraindications, dosing, interactions, and adverse reactions. Administration of medications by the appropriate route upon the order of a physician or other provider with legal prescribing authority. Educate clients/patients about effects, participation consequences, risks of misuse and abuse of alcohol, performance-enhancing drugs/substances; and over the counter, prescription and recreational drugs including drug testing policies and procedures. (Typically Offered: Summer)

ATR 5590: Athletic Training Clinical Education V

Credits: 4.

Prereq: ATR 5390 and ATR 5600; Acceptance into graduate Athletic Training Program

Course monitors student progression of athletic training proficiencies, acquiring clinical skills under the direct supervision of a clinical preceptor. Field experience provides additional athletic training experiences and clinical responsibilities for a minimum of two 8 week rotations under the direct supervision of a clinical preceptor. Required to complete a minimum of 25 hrs per week of field clinical experience. Clinical experience may extend beyond the academic semester end date and the clinical hours are a component of this course. (Typically Offered: Fall)

ATR 5600: General Medical and Behavioral Health Issues

Credits: 3. Contact Hours: Lecture 3.

Prereq: ATR 5220, ATR 5450, acceptance into Athletic Training program

Medical issues generally observed in the athletic training profession. Development and implementation of wellness strategies to mitigate the risk for long-term health conditions across the lifespan and in an active population. Topics including dermatology, mental illness, neurological disorders, pulmonary disease, respiratory infections, viral infections, autoimmune disorders, oncology, gastrointestinal conditions and sexually transmitted infections. Identify, refer, give support to patients with behavioral health conditions and interact with other healthcare providers. (Typically Offered: Summer)

ATR 5690: Athletic Training Immersion Clinical Education VI

Credits: 5.

Prereq: Athletic Training Program Director Permission for Course

Cumulative clinical experience to gain a more in-depth experience in the field of athletic training. Student selects a field or site experience that meets their professional goals. Field experience is designed to provide immersive and additional athletic training experiences for a minimum of 10 weeks under the direct supervision of a certified athletic trainer. Site approved by the preceptor and ATR program director prior to beginning the immersion clinical experience. Required to complete a minimum of 25 hours per week of field experience. Clinical experience may extend beyond the academic semester end date and the clinical hours are a component of this course. (Typically Offered: Spring)

ATR 5700: Injury Intervention, Rehabilitation and Patient Care

Credits: 3.

Prereq: ATR 5150, ATR 5500, ATR 5600 and acceptance into Athletic Training program

Basic understanding of injury and sport psychology and its application to the overall health and well-being of athletic and general population clients. Psychological, social, socio-economical, and environmental factors that influence a client/patient and in their injury susceptibility, reaction, immediate care, and adherence to rehabilitation will be explored. Assessment and intervention techniques to promote and facilitate rehabilitation in a variety of professional settings and with patients from different backgrounds and social issues that may impact a patient. Overview of special populations (adolescent, female, special populations of athletes/physically active patients). Foundational behaviors of professional practice and working with other allied health care professionals in the overall health and well-being of a patient will be explored. (Typically Offered: Fall)

ATR 5750: Athletic Training Organization and Administration

Credits: 3. Contact Hours: Lecture 3.

Prereq: Concurrently enrolled in ATR 5690

Knowledge and skills necessary for the administration aspect of an athletic training program. Course content includes but is not limited to: PPEs, how to manage physical, human, and financial resources in the delivery of healthcare services. Discussion of patient and insurance management, working relationships with interprofessional members of the health care team, policies and procedures for guidance in the daily operation of athletic training services including EAP or other critical incidents (concussion or other brain injuries), patients in behavioral health crisis, record keeping, athletic training facility design, resume development, and administrative/leadership skills and mentoring. (Typically Offered: Spring)

Athletics (ATH)

Courses primarily for undergraduates:

ATH 1010B: Intercollegiate Athletics: Basketball (men)

Credits: 1. Contact Hours: Laboratory 15.

Repeatable, maximum of 4 credits.

Prereq: Athletic Team Coach Permission for Course

Limited to a maximum of 4. Graduation Restriction: Credit for a sport section of ATH 1010 may not be applied toward graduation if credit is also received for KIN 1660 or any skill technique course in the same sport. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

ATH 1010C: Intercollegiate Athletics: Basketball (women)

Credits: 1. Contact Hours: Laboratory 15.

Repeatable, maximum of 4 credits.

Prereq: Athletic Team Coach Permission for Course

Limited to a maximum of 4. Graduation Restriction: Credit for a sport section of ATH 1010 may not be applied toward graduation if credit is also received for KIN 1660 or any skill technique course in the same sport. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

ATH 1010D: Intercollegiate Athletics: Cross Country (men)

Credits: 1. Contact Hours: Laboratory 15.

Repeatable, maximum of 4 credits.

Prereq: Athletic Team Coach Permission for Course

Limited to a maximum of 4. Graduation Restriction: Credit for a sport section of ATH 1010 may not be applied toward graduation if credit is also received for KIN 1660 or any skill technique course in the same sport. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

ATH 1010E: Intercollegiate Athletics: Cross Country (women)

Credits: 1. Contact Hours: Laboratory 13.

Repeatable, maximum of 4 credits.

Prereq: Athletic Team Coach Permission for Course

Limited to a maximum of 4. Graduation Restriction: Credit for a sport section of ATH 1010 may not be applied toward graduation if credit is also received for KIN 1660 or any skill technique course in the same sport. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

ATH 1010F: Intercollegiate Athletics: Football (men)

Credits: 1. Contact Hours: Laboratory 15.

Repeatable, maximum of 4 credits.

Prereq: Athletic Team Coach Permission for Course

Limited to a maximum of 4. Graduation Restriction: Credit for a sport section of ATH 1010 may not be applied toward graduation if credit is also received for KIN 1660 or any skill technique course in the same sport. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

ATH 1010G: Intercollegiate Athletics: Golf (men)

Credits: 1. Contact Hours: Laboratory 15.

Repeatable, maximum of 4 credits.

Prereq: Athletic Team Coach Permission for Course

Limited to a maximum of 4. Graduation Restriction: Credit for a sport section of ATH 1010 may not be applied toward graduation if credit is also received for KIN 1660 or any skill technique course in the same sport. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

ATH 1010J: Intercollegiate Athletics: Gymnastics (women)

Credits: 1. Contact Hours: Laboratory 13.

Repeatable, maximum of 4 credits.

Prereq: Athletic Team Coach Permission for Course

Limited to a maximum of 4. Graduation Restriction: Credit for a sport section of ATH 1010 may not be applied toward graduation if credit is also received for KIN 1660 or any skill technique course in the same sport. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

ATH 1010K: Intercollegiate Athletics: Softball (women)

Credits: 1. Contact Hours: Laboratory 13.

Repeatable, maximum of 4 credits.

Prereq: Athletic Team Coach Permission for Course

Limited to a maximum of 4. Graduation Restriction: Credit for a sport section of ATH 1010 may not be applied toward graduation if credit is also received for KIN 1660 or any skill technique course in the same sport. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

ATH 1010M: Intercollegiate Athletics: Swimming/Diving (women)

Credits: 1. Contact Hours: Laboratory 13.

Repeatable, maximum of 4 credits.

Prereq: Athletic Team Coach Permission for Course

Limited to a maximum of 4. Graduation Restriction: Credit for a sport section of ATH 1010 may not be applied toward graduation if credit is also received for KIN 1660 or any skill technique course in the same sport. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

ATH 1010O: Intercollegiate Athletics: Tennis (women)

Credits: 1. Contact Hours: Laboratory 15.

Repeatable, maximum of 4 credits.

Prereq: Athletic Team Coach Permission for Course

Limited to a maximum of 4. Graduation Restriction: Credit for a sport section of ATH 1010 may not be applied toward graduation if credit is also received for KIN 1660 or any skill technique course in the same sport. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

ATH 1010P: Intercollegiate Athletics: Track and Field (men)

Credits: 1. Contact Hours: Laboratory 15.

Repeatable, maximum of 4 credits.

Prereq: Athletic Team Coach Permission for Course

Limited to a maximum of 4. Graduation Restriction: Credit for a sport section of ATH 1010 may not be applied toward graduation if credit is also received for KIN 1660 or any skill technique course in the same sport. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

ATH 1010Q: Intercollegiate Athletics: Track and Field (women)

Credits: 1. Contact Hours: Laboratory 13.

Repeatable, maximum of 4 credits.

Prereq: Athletic Team Coach Permission for Course

Limited to a maximum of 4. Graduation Restriction: Credit for a sport section of ATH 1010 may not be applied toward graduation if credit is also received for KIN 1660 or any skill technique course in the same sport. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

ATH 1010R: Intercollegiate Athletics: Volleyball (women)

Credits: 1. Contact Hours: Laboratory 13.

Repeatable, maximum of 4 credits.

Prereq: Athletic Team Coach Permission for Course

Limited to a maximum of 4. Graduation Restriction: Credit for a sport section of ATH 1010 may not be applied toward graduation if credit is also received for KIN 1660 or any skill technique course in the same sport. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

ATH 1010S: Intercollegiate Athletics: Wrestling (men)

Credits: 1. Contact Hours: Laboratory 15.

Repeatable, maximum of 4 credits.

Prereq: Athletic Team Coach Permission for Course

Limited to a maximum of 4. Graduation Restriction: Credit for a sport section of ATH 1010 may not be applied toward graduation if credit is also received for KIN 1660 or any skill technique course in the same sport. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

ATH 1010T: Intercollegiate Athletics: Golf (women)

Credits: 1. Contact Hours: Laboratory 13.

Repeatable, maximum of 4 credits.

Prereq: Athletic Team Coach Permission for Course

Limited to a maximum of 4. Graduation Restriction: Credit for a sport section of ATH 1010 may not be applied toward graduation if credit is also received for KIN 1660 or any skill technique course in the same sport. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

ATH 1010U: Intercollegiate Athletics: Soccer (women)

Credits: 1. Contact Hours: Laboratory 13.

Repeatable, maximum of 4 credits.

Prereq: Athletic Team Coach Permission for Course

Limited to a maximum of 4. Graduation Restriction: Credit for a sport section of ATH 1010 may not be applied toward graduation if credit is also received for KIN 1660 or any skill technique course in the same sport. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

Biochemistry, Biophysics, and Molecular Biology (BBMB)

Courses primarily for undergraduates:

BBMB 1010: Introduction to Biochemistry

Credits: 2. Contact Hours: Lecture 2.

Foundational principles of the molecules and chemistry of life, including structure and function of biological molecules: protein, lipids, nucleic acids, and carbohydrates. Survey of modern biotechnology frontiers. (Typically Offered: Fall)

BBMB 1020: Introduction to Biochemistry Laboratory

Credits: 1.

Prereq: Credit or enrollment in CHEM 1770 and CHEM 1770L or CHEM 2010 and CHEM 2010L

Topics in the scientific background of biochemistry, such as macromolecules, metabolism, and catalysis. Laboratory experimentation covers biochemical concepts and the study of bio-molecules including proteins, lipids and nucleic acids. A significant component is practice in scientific communication. For students declaring or considering Biochemistry majors. (Typically Offered: Spring)

BBMB 1100: Biochemistry Learning Community I

Credits: 1. Contact Hours: Lecture 1.

Biochemistry Learning Community introducing the program of study, academic planning, and university resources. Survey of careers and research in biotechnology, medicine, and biophysics. Introduction to ISU research and faculty. Concurrent enrollment with BBMB 1010 highly recommended. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

BBMB 1110: Biochemistry Learning Community II

Credits: 1. Contact Hours: Lecture 1.

Biochemistry Learning Community serving an overview of career-development and research resources, including research opportunities, internships, lab skills, and leadership roles. Introductions to ISU research and faculty. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

BBMB 1200: The Biochemistry of Beer

(Cross-listed with FSHN 1200).

Credits: 2. Contact Hours: Lecture 2.

An introduction to the major classes of biomolecules, basic biochemical concepts, enzymology, metabolism and genetic engineering as they apply to the production and flavor of beer. All aspects of the biochemistry of beer will be covered, including the malting of barley, starch conversion, yeast fermentation and the chemical changes that occur during the aging of beer. Intended for non-majors. (Typically Offered: Fall)

BBMB 1200L: Biochemistry of Beer Laboratory

(Cross-listed with FSHN 1200L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Credit or enrollment in BBMB 1200

An introduction to biochemical methods related to the production of beer. Laboratory exercises related to water chemistry, mash enzymology, hop compound extraction and analysis, and yeast biology will be performed. Closely follows the material being taught in BBMB 1200. Graduation Restriction: Natural science majors are limited to elective credit only. (Typically Offered: Fall)

BBMB 1210: Medicines, Drugs and You

Credits: 2. Contact Hours: Lecture 2.

An introduction to how medicines treat disease, what drug molecules look like, how they function, how they can be toxic, modern therapeutics ranging from over-the-counter pain relievers, antibiotics and anti-depressants, to anti-cancer chemotherapies. The differences between drugs and supplements. Intended for students of all majors. (Typically Offered: Spring)

BBMB 2010: Chemical Principles in Biological Systems

Credits: 2. Contact Hours: Lecture 2.

Prereq: Credit or enrollment in CHEM 3320

Survey of the chemical principles of biological systems including: water, organic chemistry of functional groups in biomolecules and biochemical cofactors, weak bonds and their contribution to biomolecular structure, oxidation-reduction reactions and redox potential, thermodynamic laws and bioenergetics, chemical equilibria and kinetics, inorganic chemistry in biological systems, data presentation. The subjects will be taught using molecules from biological systems as examples. Intended for majors in biochemistry. (Typically Offered: Spring)

BBMB 2210: Structure and Reactions in Biochemical Processes

Credits: 3. Contact Hours: Lecture 3.

Prereq: CHEM 1630, CHEM 1670, CHEM 1770 or CHEM 2010

Fundamentals necessary for an understanding of biochemical processes. Primarily for students in agriculture. Graduation Restriction: Not acceptable for credit toward a major in biochemistry, biophysics, or agricultural biochemistry. Credit for both BBMB 2210 and CHEM 2310 may not be applied toward graduation. (Typically Offered: Fall, Spring)

BBMB 3010: Survey of Biochemistry

Credits: 3. Contact Hours: Lecture 3.

Prereq: CHEM 2310 or CHEM 3310

A survey of biochemistry: structure and function of amino acids, proteins, carbohydrates, lipids, and nucleic acids; enzymology; metabolism; biosynthesis; and selected topics. Graduation Restriction: Only one of BBMB 3010, 3030, or 3160 may count toward graduation; Not acceptable for credit toward a major in Biochemistry. (Typically Offered: Fall, Spring, Summer)

BBMB 3030: General Biochemistry

Credits: 3. Contact Hours: Lecture 3.

Prereq: CHEM 3310

Biochemistry for pre-health professions and biomedical engineering: structure and function of amino acids, proteins, carbohydrates, lipids and nucleic acids; enzyme activity; metabolism; DNA replication; RNA transcription; protein translation. Graduation Restriction: only one of BBMB 3010, 3030, or 3160 may count toward graduation; not acceptable for credit toward a major in Biochemistry. (Typically Offered: Spring)

BBMB 3110: Writing Scientific Reports in Biochemistry

Credits: 1.

Prereq: Credit or concurrent enrollment in BBMB 3120

Data analysis, presentation, and writing reports in biochemistry.

Concurrent enrollment in BBMB 3120 recommended. (Typically Offered: Fall, Spring)

BBMB 3120: Experimental Research Skills in Biochemistry

Credits: 2. Contact Hours: Lecture 1, Laboratory 3.

Prereq: BBMB 1020 AND (credit or concurrent enrollment in CHEM 1780 or CHEM 2010)

Inquiry-based introduction to biochemical techniques such as protein purification, enzymatic assays, solution preparation, hypothesis formation and testing, data analysis, high-throughput methodology, and research record keeping. Concurrent enrollment in BBMB 3110 recommended. (Typically Offered: Fall, Spring)

BBMB 3160: Principles of Biochemistry

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 3140; (CHEM 2310 or CHEM 3310)

Biological systems at the molecular level; chemistry of biological macromolecules, enzyme function and regulation, basic metabolic pathways; integration of metabolism in diverse living systems. For students in biology and related majors who do not require the more rigorous treatment of biochemistry found in BBMB 4040/4050. Graduation Restriction: Only one of BBMB 3010, 3030, or 3160 may count toward graduation; Not acceptable for credit toward a major in Biochemistry. (Typically Offered: Fall, Spring)

BBMB 4040: Biochemistry I

Credits: 3. Contact Hours: Lecture 3.

Prereq: CHEM 2310 or CHEM 3310

Survey of biochemistry for undergraduate majors in biochemistry and related fields. The first of a comprehensive two semester series with BBMB 4050. Chemistry of amino acids, proteins, carbohydrates, and lipids; protein structure, function, and regulation; carbohydrate metabolism. BIOL 3140 strongly recommended. Graduation Restriction: Credit for both BBMB 4200 and the BBMB 4040 - 4050 sequence may not be applied toward graduation. (Typically Offered: Fall, Spring, Summer)

BBMB 4050: Biochemistry II

Credits: 3. Contact Hours: Lecture 3.

Prereq: BBMB 4040

Survey of biochemistry for undergraduate majors in biochemistry and related fields. The second of a comprehensive two semester series after BBMB 4040. Metabolism of carbohydrates, amino acids, nucleotides and lipids; formation, turnover, and molecular relationships among DNA, RNA, and proteins; genetic code; regulation of gene expression; and selected topics in molecular physiology. Graduation Restriction: Credit For Either BBMB 420 Or The BBMB 404,405 Sequence, But Not Both, May Be Applied Toward Graduation. (Typically Offered: Fall, Spring, Summer)

BBMB 4100: Analysis of Scientific Literature

Credits: 2. Contact Hours: Lecture 2.

Repeatable, maximum of 2 times.

Prereq: Credit or enrollment in BBMB 4040 or BBMB 5040

Examination and discussion of current research reports in biochemistry, biophysics, genetics, molecular and cell biology. Critical evaluation and analysis of scientific data and experimental design in research literature. (Typically Offered: Fall, Spring)

BBMB 4110: Techniques in Biochemical Research

Credits: 4. Contact Hours: Lecture 2, Laboratory 8.

Prereq: Credit or enrollment in CHEM 3320

Capstone biochemistry laboratory grounded in inquiry-driven research methodologies. Laboratory techniques include molecular cloning, enzyme kinetics, electrophoresis, spectrophotometry, and chromatography. Emphasis on structure-function relationships, purification, characterization, and quantification of biomolecules. Multi-week projects promote collaboration, critical thinking, and advanced scientific/technical writing. (Typically Offered: Fall)

BBMB 4200: Mammalian Biochemistry

Credits: 3. Contact Hours: Lecture 3.

Prereq: CHEM 3320 and BIOL 3140

Structure and function of proteins; enzymology; biological oxidation; chemistry and metabolism of carbohydrates, lipids, amino acids and nucleic acids; protein synthesis and the genetic code; relationship of biochemistry to selected mammalian diseases. Biochemistry of mammals emphasized. Graduation Restriction: Not acceptable for credit toward a major in Biochemistry. Credit for both BBMB 4200 and the BBMB 4040 - 4050 sequence may not be applied toward graduation. (Typically Offered: Fall, Spring)

BBMB 4300: Prokaryotic Diversity and Ecology

(Dual-listed with MICRO 5300). (Cross-listed with MICRO 4300).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MICRO 3020; MICRO 3020L

Survey of the diverse groups of prokaryotes emphasizing important and distinguishing metabolic, phylogenetic, morphological, and ecological features of members of those groups. Offered odd-numbered years. (Typically Offered: Spring)

BBMB 4450: Molecular Cell Signaling

(Dual-listed with BBMB 5450).

Credits: 2. Contact Hours: Lecture 2.

Prereq: BBMB 4050 or BBMB 4200; or BBMB 5060 and BBMB 5070

Molecular mechanisms of cellular signaling including receptor activation, desensitization and cross talk, signal transduction pathways, nuclear receptors, growth factor and extracellular matrix activators, protein kinases, caspase and transcription factor downstream signals, and lipids, gases and cyclic nucleotides as regulators of cell signaling. Course content includes current literature, student and instructor presentations and, for BBMB 5450 students only, research proposal writing and review. Offered even-numbered years. (Typically Offered: Spring)

BBMB 4610: Molecular Biophysics

(Dual-listed with BBMB 5610).

Credits: 2. Contact Hours: Lecture 2.

Prereq: CHEM 1780; PHYS 2320 or PHYS 2320H

Physical methods for the study of molecular structure and organization of biological materials. X-ray diffraction, nuclear magnetic resonance, hydrodynamics and fluorescence spectroscopy. Registration for the graduate credit commits the student to graduate-level examinations, which differ from undergraduate-level examinations in the number and/or difficulty of questions. (Typically Offered: Spring)

BBMB 4900: Independent Study

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Independent study with a faculty mentor. Graduation Restriction: No more than 9 credits of BBMB 4900 may count toward graduation. (Typically Offered: Fall, Spring, Summer)

BBMB 4970X: Biochemistry Program Outcomes Assessment

Credits: 0. Contact Hours: Lecture 0.

Assessment of Biochemistry program curriculum and educational objectives to be reviewed by the BBMB Department for continuous program improvement. Assessment administered as one capstone exam offered in late Spring and exit survey for student feedback. Offered on a satisfactory-fail basis only. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

BBMB 4990: Undergraduate Research

Credits: 1-5. Repeatable.

Prereq: Instructor Permission for Course

Independent research under faculty guidance. (Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

BBMB 5040: Amino Acids and Proteins

Credits: 2. Contact Hours: Lecture 2.

Prereq: Junior, Senior, or Graduate Standing

Protein structure and chemistry including protein folding, examples of enzyme functions and mechanisms, methods of protein expression, purification, and analysis, and elementary enzyme kinetics. (Typically Offered: Fall, Spring)

BBMB 5050: Bioenergetics and Metabolism

Credits: 2. Contact Hours: Lecture 2.

Prereq: Junior, Senior, or Graduate Standing

Examination of catabolic pathways involved in the oxidation of organic and inorganic molecules, and energy metabolism involving inputs from light or other non-light sources. Central metabolism and glycolysis, fermentation, aerobic and anaerobic respiration, photosynthesis. (Typically Offered: Fall)

BBMB 5060: Membrane Biochemistry

Credits: 2. Contact Hours: Lecture 2.

Prereq: Junior, Senior, or Graduate Standing

Analysis of the structure and functions of biological lipids and membranes. Mechanisms of membrane transport, trafficking, and signaling mechanisms. Investigation of the structures, roles, and biogenesis of transmembrane proteins. (Typically Offered: Fall, Spring)

BBMB 5070: Biochemistry of Nucleic Acids

Credits: 2. Contact Hours: Lecture 2.

Prereq: Junior, Senior, or Graduate Standing

Analysis of the chemical structure, function, synthesis, and metabolism of nucleic acids. Chemical characterization of nucleotides, polynucleotides, DNA, and RNA. Analysis of transcription, translation, and the genetic code. (Typically Offered: Fall, Spring)

BBMB 5100: Molecular Biology and Biochemistry of RNA

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Biochemical processes that define structure and function of nucleic acids. Emphasis on the molecular processes that take place during synthesis, processing, and function of different RNA species; review of recent advances in RNA research. Offered odd-numbered years. (Typically Offered: Fall)

BBMB 5120: Principles of Glycobiology

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Structure, synthesis, and functions of glycans, glycoproteins, glycolipids, and glycosylated secondary metabolites in prokaryotic and eukaryotic organisms. Fundamental role of glycans in living organisms along with the most advanced techniques used for their characterization. Biotechnological applications of glycans and glycoconjugates for human needs. Offered even-numbered years. (Typically Offered: Spring)

BBMB 5300: Prokaryotic Diversity and Ecology

(Dual-listed with MICRO 4300). (Cross-listed with MICRO 5300).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (MICRO 3020 and MICRO 3020L) or Graduate Classification

Survey of the diverse groups of prokaryotes emphasizing important and distinguishing metabolic, phylogenetic, morphological, and ecological features of members of those groups. Offered odd-numbered years. (Typically Offered: Spring)

BBMB 5310: Plant Biochemistry

Credits: 2. Contact Hours: Lecture 2.

Prereq: BBMB 3010

In-depth exploration of plant biochemistry with a focus on the unique aspects of plants versus heterotrophic organisms. Analysis of unique pathways, metabolic trafficking between unique organelles and tissues, and techniques for their characterization. Offered even-numbered years. (Typically Offered: Spring)

BBMB 5320: Enzyme Kinetics and Mechanisms

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Advanced concepts of enzyme kinetics and catalysis. Experimental methods for determining kinetic and chemical reaction mechanisms. Enzyme structure/function relationships and the role of dynamics in catalysis. Offered odd-numbered years. (Typically Offered: Spring)

BBMB 5420A: Introduction to Molecular Biology Techniques: DNA Techniques

(Cross-listed with BMS 5420A/ EEOB 5420A/ FSHN 5420A/ GDCB 5420A/ HORT 5420A/ NREM 5420A/ NUTRS 5420A/ VDPAM 5420A/ VMPM 5420A).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes genetic engineering procedures, sequencing, PCR, and genotyping. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

BBMB 5420B: Introduction to Molecular Biology Techniques: Protein

(Cross-listed with BMS 5420B/ EEOB 5420B/ FSHN 5420B/ GDCB 5420B/ HORT 5420B/ NREM 5420B/ NUTRS 5420B/ VDPAM 5420B).

Credits: 1. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. Offered on a satisfactory-fail basis only. (Typically Offered: Spring, Summer)

BBMB 5420C: Introduction to Molecular Biology Techniques: Cell Techniques

(Cross-listed with BMS 5420C/ EEOB 5420C/ FSHN 5420C/ GDCB 5420C/ HORT 5420C/ NREM 5420C/ NUTRS 5420C/ VMPM 5420C/ VDPAM 5420C).

Credits: 1. Contact Hours: Laboratory 2.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. ular biology techniques and related procedures. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

BBMB 5420D: Introduction to Molecular Biology Techniques: Plant Transformation

(Cross-listed with BMS 5420D/ EEOB 5420D/ FSHN 5420D/ GDCB 5420D/ HORT 5420D/ NREM 5420D/ NUTRS 5420D/ VMPM 5420D/ VDPAM 5420D).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: Agrobacterium and particle gun-mediated transformation of tobacco, Arabidopsis, and maize, and analysis of tranformants. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

BBMB 5420E: Introduction to Molecular Biology Techniques: Proteomics

(Cross-listed with BMS 5420E/ EEOB 5420E/ FSHN 5420E/ GDCB 5420E/ HORT 5420E/ NREM 5420E/ NUTRS 5420E/ VMPM 5420E/ VDPAM 5420E).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: two-dimensional electrophoresis, laser scanning, mass spectrometry, and database searching. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

BBMB 5420F: Introduction to Molecular Biology Techniques:**Metabolomics**

(Cross-listed with BMS 5420F/ EEOB 5420F/ FSHN 5420F/ GDCB 5420F/ HORT 5420F/ NREM 5420F/ NUTRS 5420F/ VMPPM 5420F/ VDPAM 5420F).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: metabolomics and the techniques involved in metabolite profiling. For non-chemistry majoring students who are seeking analytical aspects into their biological research projects. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

BBMB 5420G: Introduction to Molecular Biology Techniques: Genomic

(Cross-listed with BMS 5420G/ EEOB 5420G/ FSHN 5420G/ GDCB 5420G/ HORT 5420G/ NREM 5420G/ NUTRS 5420G/ VMPPM 5420G/ VDPAM 5420G).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

BBMB 5450: Molecular Cell Signaling

(Dual-listed with BBMB 4450).

Credits: 2. Contact Hours: Lecture 2.

Prereq: (BBMB 5060 AND BBMB 5070) OR Graduate Classification

Molecular mechanisms of cellular signaling including receptor activation, desensitization and cross talk, signal transduction pathways, nuclear receptors, growth factor and extracellular matrix activators, protein kinases, caspase and transcription factor downstream signals, and lipids, gases and cyclic nucleotides as regulators of cell signaling. Course content includes current literature, student and instructor presentations and, for BBMB 5450 students only, research proposal writing and review. Offered even-numbered years. (Typically Offered: Spring)

BBMB 5490: Nuclear Magnetic Resonance Spectroscopy

(Cross-listed with CHEM 5490).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Theoretical principles of NMR, practical aspects of experimental NMR, solution and solid state NMR, methodologies for molecule characterization, protein structure determination, NMR relaxation, and recent advances. (Typically Offered: Spring)

BBMB 5530: Current Research in Chemical and Physical Biology

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Principles and applications of chemical and physical methods to analyze biological structures and function ranging from cells to individual biomolecules. Offered even-numbered years. (Typically Offered: Fall)

BBMB 5610: Molecular Biophysics

(Dual-listed with BBMB 4610).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Physical methods for the study of molecular structure and organization of biological materials. X-ray diffraction, nuclear magnetic resonance, hydrodynamics and fluorescence spectroscopy. Registration for the graduate credit commits the student to graduate-level examinations, which differ from undergraduate-level examinations in the number and/or difficulty of questions. (Typically Offered: Spring)

BBMB 5610L: Laboratory in Molecular Biophysics

Credits: 2. Contact Hours: Lecture 1, Laboratory 3.

Prereq: Senior or Graduate classification or Permission of Instructor

Practice in methods of X-ray diffraction, nuclear magnetic resonance, hydrodynamics and fluorescence spectroscopy as applied to macromolecules. (Typically Offered: Spring)

BBMB 5690: Structural Bioinformatics

(Cross-listed with BCB 5690/ COMS 5690/ CPRE 5690/ GDCB 5690).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Molecular structures including genes and gene products: protein, DNA and RNA structure. Structure determination methods, structural refinement, structure representation, comparison of structures, visualization, and modeling. Molecular and cellular structure from imaging. Analysis and prediction of protein secondary, tertiary, and higher order structure, disorder, protein-protein and protein-nucleic acid interactions, protein localization and function, bridging between molecular and cellular structures. Molecular evolution. (Typically Offered: Fall)

BBMB 5900: Special Topics

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

By arrangement.

BBMB 5920: Workshop in Bioinformatics and Computational Biology

(Cross-listed with BCB 5920).

Credits: 1. Contact Hours: Lecture 1.

Repeatable, maximum of 3 times.

Prereq: Graduate Standing or Permission of Instructor

Workshop to prepare for careers in science with professional development, including a survey of science careers using MyIDP, a career development tool. Topics include navigating career paths, internships, application portfolios, and appropriate use of social media. Emphasis on CV preparation, cover letters, job interviews, and elevator talks. Students will prepare, and evaluate grant proposals. (Typically Offered: Fall)

BBMB 5930: Workshop in Biochemistry and Biophysics

Credits: 1. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Workshops in selected topics in biochemistry and biophysics. Credit in this course does not meet the requirement for advanced graduate electives in Biochemistry. Spring only: BBMB Undergraduate Research Symposium participation. Scheduled class meetings are required in addition to attending the symposium. (Typically Offered: Fall, Spring)

Courses for graduate students:

BBMB 6150: Molecular Immunology

(Cross-listed with MICRO 6150/ VMPPM 6150).

Credits: 3. Contact Hours: Lecture 3.

Current topics in molecular aspects of immunology: T and B cell receptors; major histocompatibility complex; antibody structure; immunosuppressive drugs and viruses; and intracellular signaling pathways leading to expression of genes that control and activate immune function. Offered odd-numbered years. (Typically Offered: Fall)

BBMB 6610: Advanced Topics in Neuroscience

(Cross-listed with GDCB 6610/ KIN 6610/ NEURO 6610).

Credits: 3. Contact Hours: Lecture 3.

Students will present three journal articles and two overview lectures on topics in neuroscience that are related but outside of their own research interest. Offered even-numbered years. (Typically Offered: Spring)

BBMB 6750: Nucleic Acid Structure and Function

Credits: 2. Contact Hours: Lecture 2.

In-depth discussion of nucleic acid properties, structures and structure/function relationships. Interactions between nucleic acids and proteins will be emphasized. Offered even-numbered years. (Typically Offered: Fall)

BBMB 6810: Advanced Seminar

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Student presentations. (Typically Offered: Fall, Spring)

BBMB 6820: Departmental Seminar

Credits: Required. Contact Hours: Lecture 1.

Repeatable.

Faculty, staff and invited guest research seminar. (Typically Offered: Fall, Spring)

BBMB 6960: Research Seminar

(Cross-listed with AGRON 6960/ PLBIO 6960/ FOR 6960/ GDCB 6960/ HORT 6960).

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Research seminars by faculty and graduate students. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

BBMB 6980: Seminar in Molecular, Cellular, and Developmental Biology

(Cross-listed with MCDB 6980/ GDCB 6980/ MICRO 6980/ VMPPM 6980).

Credits: 1-2. Contact Hours: Lecture 2.

Repeatable.

Student and faculty presentations. (Typically Offered: Spring)

BBMB 6990: Research

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Research. (Typically Offered: Fall, Spring)

Bioinformatics and Computational Biology (BCB)

Courses primarily for undergraduates:

BCB 4900: Independent Study

Credits: 1-5. Repeatable, maximum of 9 credits.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

BCB 5230: Mathematical Modeling in Biology

(Dual-listed with MATH 4230/ BCBIO 4230). (Cross-listed with MATH 5230/ BCBIO 5230).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 2660 or MATH 2670 or Graduate Classification

Introduction to mathematical techniques for modeling and simulation, parameter identification, and analysis of biological systems. Applications drawn from many branches of biology and medicine. Apply differential equations, difference equations, and dynamical systems theory to a wide array of biological problems. MATH 2650 or equivalent recommended. (Typically Offered: Fall)

BCB 5440: Fundamentals of Bioinformatics

(Cross-listed with GDCB 5440/ COMS 5440/ CPRE 5440).

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

A practical, hands-on overview of how to apply bioinformatics to biological research. Recommended for biologists desiring to gain computational molecular biology skills. Topics include: sequence analysis, genomics, proteomics, phylogenetic analyses, ontology enrichment, systems biology, data visualization and emergent technologies. Offered odd-numbered years. (Typically Offered: Fall)

BCB 5460: Computational Skills for Biological Data

(Cross-listed with EEOB 5460).

Credits: 3. Contact Hours: Lecture 1, Discussion 2.

Prereq: Graduate Standing or Permission of Instructor

Computational skills necessary for biologists working with big data sets. UNIX commands, scripting in R and Python, version control using Git and GitHub, and use of high performance computing clusters. Combination of lectures and computational exercises. (Typically Offered: Fall)

BCB 5670: Bioinformatics Algorithms

(Cross-listed with COMS 5670/ CPRE 5670).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Biology as an information science. A review of the algorithmic principles that are driving the advances in bioinformatics and computational biology.

BCB 5680: Statistical Bioinformatics

(Cross-listed with COMS 5680/ GDCB 5680/ STAT 5680).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Statistical models for sequence data, including applications in genome annotation, motif discovery, variant discovery, molecular phylogeny, gene expression analysis, and metagenomics. Statistical topics include model building, inference, hypothesis testing, and simple experimental design, including for big data/complex models. (Typically Offered: Spring)

BCB 5690: Structural Bioinformatics

(Cross-listed with BBMB 5690/ COMS 5690/ CPRE 5690/ GDCB 5690).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Molecular structures including genes and gene products: protein, DNA and RNA structure. Structure determination methods, structural refinement, structure representation, comparison of structures, visualization, and modeling. Molecular and cellular structure from imaging. Analysis and prediction of protein secondary, tertiary, and higher order structure, disorder, protein-protein and protein-nucleic acid interactions, protein localization and function, bridging between molecular and cellular structures. Molecular evolution. (Typically Offered: Fall)

BCB 5700: Systems Biology

(Cross-listed with COMS 5700/ CPRE 5700/ GDCB 5700/ STAT 5700).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Algorithmic and statistical approaches in computational functional genomics and systems biology. Analysis of high throughput biological data obtained using system-wide measurements. Topological analysis, module discovery, and comparative analysis of gene and protein networks. Modeling, analysis, and inference of transcriptional regulatory networks, protein-protein interaction networks, and metabolic networks. Dynamic systems and whole-cell models. Ontology-driven, network based, and probabilistic approaches to information integration. (Typically Offered: Spring)

BCB 5850: Fundamentals of Predictive Plant Phenomics

(Cross-listed with GDCB 5850/ ME 5850).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Principles of engineering, data analysis, and plant sciences and their interplay applied to predictive plant phenomics. Transport phenomena, sensor design, image analysis, graph models, network data analysis, fundamentals of genomics and phenomics. Multidisciplinary laboratory exercises. (Typically Offered: Fall)

BCB 5900: Special Topics

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

BCB 5920: Workshop in Bioinformatics and Computational Biology

(Cross-listed with BBMB 5920).

Credits: 1. Contact Hours: Lecture 1.

Repeatable, maximum of 3 times.

Prereq: Graduate Standing or Permission of Instructor

Workshop to prepare for careers in science with professional development, including a survey of science careers using MyIDP, a career development tool. Topics include navigating career paths, internships, application portfolios, and appropriate use of social media. Emphasis on CV preparation, cover letters, job interviews, and elevator talks. Students will prepare, and evaluate grant proposals. (Typically Offered: Fall)

BCB 5980: Cooperative Education

Credits: Required. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Off-campus work periods for graduate students in the field of bioinformatics and computational biology. (Typically Offered: Fall, Spring, Summer)

BCB 5990: Creative Component

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Courses for graduate students:

BCB 6600: Selected Topics in Bioinformatics and Computational Biology

Credits: 1-4. Contact Hours: Lecture 4.

Repeatable, maximum of 4 credits.

Topics of interest in the major research areas of computational molecular biology, including genomics, structural genomics, functional genomics, and computational systems biology. (Typically Offered: Fall, Spring, Summer)

BCB 6900: Student Seminar in Bioinformatics and Computational Biology

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Student research presentations. (Typically Offered: Spring)

BCB 6910: Faculty Seminar in Bioinformatics and Computational Biology

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Faculty research series.

BCB 6930: Entrepreneurship for Graduate Students in Science and Engineering

(Cross-listed with AGRON 6930/ EE 6930/ ENGR 6930/ GENET 6930/ ME 6930).

Credits: 1. Contact Hours: Lecture 3.

Repeatable, maximum of 2 credits.

Understanding key topics of starting a technology based company, from development of technology-led idea to early-stage entrepreneurial business. Concepts discussed include: entrepreneurship basics, starting a business, funding your business, protecting your technology/ business IP. Subject matter experts and successful, technology-based entrepreneurs will provide real world examples from their experience with entrepreneurship. Learn about the world class entrepreneurship ecosystem at ISU and Central Iowa. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

BCB 6970: Graduate Research Rotation

Credits: 1-30. Repeatable.

Graduate research projects performed under the supervision of selected faculty members in the Bioinformatics and Computational Biology major. (Typically Offered: Fall, Spring, Summer)

BCB 6990: Research

Credits: 1-30. Repeatable.

Prereq: Department Permission for Course

(Typically Offered: Fall, Spring, Summer)

Bioinformatics and Computational Biology (BCBIO)

Courses primarily for undergraduates:

BCBIO 1100: BCBIO Orientation

Credits: 0.5. Contact Hours: Lecture 0.5.

First 8 weeks. Orientation to the area of bioinformatics and computational biology. For students considering a major in BCBIO. Specializations and career opportunities. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

BCBIO 3220: Introduction to Bioinformatics and Computational Biology

(Cross-listed with BIOL 3220/ GEN 3220).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2120

Genome sequencing, assembly, structural and functional annotation, and comparative genomics. Investigating these topics will develop skills in programming and scripting (Perl and/or Python), the use of biological databases, sequence alignment, similarity search, identification of sequence patterns, construction of phylogenetic trees, and comparative genomics. (Typically Offered: Fall)

BCBIO 4010: Bioinformatics of Sequences

(Cross-listed with BIOL 4010/ COMS 4010/ GEN 4010).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BCBIO 3220; (COMS 1270 OR COMS 2270); (MATH 1600 or MATH 1650); (MATH 1660 or STAT 3010); (STAT 1010 or STAT 1040 or STAT 3300) or Permission of Instructor

Application of computer science and statistics to molecular biology with a significant problem-solving component, including hands-on programming using Python to solve a variety of biological problems. String algorithms, sequence alignments, homology search, pattern discovery, genotyping, genome assembly, genome annotation, comparative genomics, protein structure. Offered odd-numbered years. (Typically Offered: Fall)

BCBIO 4060: Bioinformatics of OMICS

(Cross-listed with BIOL 4060/ COMS 4060/ GEN 4060).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2120

Introduction to cutting edge OMICS analyses including transcriptome, proteome, metabolome, DNA-protein interactome, protein-protein interactome and methylome. Genomic analysis including transcriptome analysis, cancer genomics, comparative genomics, and regulatory network analysis. (Typically Offered: Spring)

BCBIO 4230: Mathematical Modeling in Biology

(Dual-listed with MATH 5230/ BCB 5230). (Cross-listed with MATH 4230).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 2660 or MATH 2670

Introduction to mathematical techniques for modeling and simulation, parameter identification, and analysis of biological systems. Applications drawn from many branches of biology and medicine. Apply differential equations, difference equations, and dynamical systems theory to a wide array of biological problems. MATH 2650 or equivalent recommended. (Typically Offered: Fall)

BCBIO 4420A: Bioinformatics and Computational Biology Techniques: Sequence Database Searching

Credits: 0.5. Contact Hours: Lecture 0.3, Laboratory 0.5.

Repeatable, maximum of 2 credits.

Modular minicourses consisting of guided tutorials and hands-on computer software exercises focused on fundamental problems, approaches, and software applications in bioinformatics and computational biology. BIOL 3140 recommended. Offered on a satisfactory-fail basis only. (Typically Offered: Spring, Summer)

BCBIO 4420B: Bioinformatics and Computational Biology: Protein Structure Databases, Visualization, and Prediction

Credits: 0.5. Contact Hours: Lecture 0.3, Laboratory 0.5.

Repeatable, maximum of 2 credits.

Modular minicourses consisting of guided tutorials and hands-on computer software exercises focused on fundamental problems, approaches, and software applications in bioinformatics and computational biology. BIOL 3140 recommended. Offered on a satisfactory-fail basis only. (Typically Offered: Spring, Summer)

BCBIO 4420C: Bioinformatics and Computational Biology Techniques: Phylogenetic Analysis

Credits: 0.5. Contact Hours: Lecture 0.3, Laboratory 0.5.

Repeatable, maximum of 2 credits.

Modular minicourses consisting of guided tutorials and hands-on computer software exercises focused on fundamental problems, approaches, and software applications in bioinformatics and computational biology. BIOL 3140 recommended. Offered on a satisfactory-fail basis only. (Typically Offered: Spring, Summer)

BCBIO 4420D: Bioinformatics and Computational Biology Techniques: Microarray Analysis

Credits: 0.5. Contact Hours: Lecture 0.3, Laboratory 0.5.

Repeatable, maximum of 2 credits.

Modular minicourses consisting of guided tutorials and hands-on computer software exercises focused on fundamental problems, approaches, and software applications in bioinformatics and computational biology. BIOL 3140 recommended. Offered on a satisfactory-fail basis only. (Typically Offered: Spring, Summer)

BCBIO 4900: Independent Study

Credits: 1-5. Repeatable, maximum of 9 credits.

Prereq: BCBIO 3220; Junior or Senior classification; Permission of Instructor

Independent research projects for undergraduate students in bioinformatics and computational biology. Graduation Restriction: Students in the College of Liberal Arts and Sciences may use no more than 9 credits of BCBIO 4900 and 4910 toward graduation. (Typically Offered: Fall, Spring, Summer)

BCBIO 4910: Team Research Projects

Credits: 1-5. Repeatable, maximum of 9 credits.

Prereq: BCBIO 3220; Junior or Senior classification; Permission of Instructor

Research projects in bioinformatics and computational biology done by teams of students. (Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

BCBIO 5230: Mathematical Modeling in Biology

(Dual-listed with MATH 4230/ BCBIO 4230). (Cross-listed with BCB 5230/ MATH 5230).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 2660 or MATH 2670 or Graduate Classification

Introduction to mathematical techniques for modeling and simulation, parameter identification, and analysis of biological systems. Applications drawn from many branches of biology and medicine. Apply differential equations, difference equations, and dynamical systems theory to a wide array of biological problems. MATH 2650 or equivalent recommended. (Typically Offered: Fall)

Biology (BIOL)

Courses primarily for undergraduates:

BIOL 1010: Introductory Biology

Credits: 3. Contact Hours: Lecture 3.

Life considered at cellular, organism, and population levels. Function and diversity of the living world. Presentation of basic biological principles as well as topics and issues of current human interest. Graduation Restriction: BIOL 1010 does not satisfy biology major requirements. (Typically Offered: Fall, Spring, Summer)

BIOL 1100: Biology Major Orientation

Credits: 1. Contact Hours: Lecture 0.5, Discussion 0.5.

Student orientation to the Biology program. Introduction to degree requirements, university policies and deadlines, campus resources, academic success strategies, degree planning, and registration procedures. Community building through the Biology Education Success Teams Learning Community. Required for first-year direct from high school Biology majors. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

BIOL 1110: Opportunities in Biology

Credits: 0.5. Contact Hours: Lecture 1.

Orientation to opportunities in Biology. Introduction to biological science disciplines, career awareness, and professional development opportunities. Required for first-year direct from high school Biology majors. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

BIOL 1120: Transfer Student Orientation

Credits: 1. Contact Hours: Lecture 1.

Orientation to the Biology major for students transferring from other academic institutions. Reviews university resources, academic success strategies, degree requirements, opportunities for campus involvement, and professional development. Required for all new transfer students and recommended for major changes. Online with on-campus activities. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

BIOL 1130X: Exploring Possibilities in Life Sciences

(Cross-listed with GEN 1130X).

Credits: 1. Contact Hours: Lecture 1.

Seminar focusing on introducing students to life science fields and careers. Explores interdisciplinary career paths and guidance on strategies for success in achieving career goals. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

BIOL 1140X: Experiential Learning and Explorations in Life Sciences

(Cross-listed with GEN 1140X).

Credits: 1.

A second year experiential learning course focused on careers in life science fields. Sections offer themed learning allowing students to choose an immersive experience in an area of interest. Sections utilize hands-on engagement, field trips to on- and off-campus locations, and small group discussions with speakers working in different life science careers. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

BIOL 1550: Human Biology

Credits: 3. Contact Hours: Lecture 3.

A survey course of human biology, including principal structures and functions of the body systems and the diseases and disorders associated with them. Designed to meet general education requirements in natural science. Not recommended for those seeking a career in the allied health professions or for students majoring in life science. Does not satisfy biology major requirements. (Typically Offered: Fall, Spring)

BIOL 1730: Environmental Biology

(Cross-listed with ENVS 1730).

Credits: 3. Contact Hours: Lecture 3.

An introduction to the structure and function of natural systems at scales from the individual to the biosphere and the complex interactions between humans and their environment. Discussions of human population growth, biodiversity, sustainability, resource use, and pollution. Does not satisfy biology major requirements. (Typically Offered: Fall, Spring)

BIOL 2010: Introduction to Environmental Issues

(Cross-listed with ENSCI 2010/ ENVS 2010).

Credits: 2. Contact Hours: Lecture 2.

Discussion of current and emerging environmental issues such as human population growth, energy use, loss of biodiversity, water resources, and climate change. (Typically Offered: Fall)

BIOL 2040: Biodiversity

(Cross-listed with ENVS 2040).

Credits: 2. Contact Hours: Lecture 4.

Survey of the major groups of organisms and biological systems.

Definition, measurements, and patterns of distribution of organisms.

Sources of information about biodiversity. Does not satisfy biology major requirements. Half semester course. See list of life science courses (<https://www.cals.iastate.edu/student-services/lifescience>) for additional information. (Typically Offered: Spring)

BIOL 2110: Principles of Biology I

Credits: 3. Contact Hours: Lecture 3.

Introduction to the nature of life, including the diversity of microbial, plant, and animal life; the nature of heredity; evolution; and principles of ecology. Intended for life science majors. (Typically Offered: Fall, Spring)

BIOL 2110L: Principles of Biology Laboratory I

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Credit or enrollment in BIOL 2110

Laboratory to accompany 2110. (Typically Offered: Fall, Spring)

BIOL 2120: Principles of Biology II

Credits: 3. Contact Hours: Lecture 3.

Introduction to the chemical, molecular, and cellular basis of life; form and function of microbial, plant, and animal life. Intended for life science majors. HS courses in biology and chemistry necessary. Credit or enrollment in CHEM 1630 or CHEM 1770 recommended. (Typically Offered: Fall, Spring)

BIOL 2120L: Principles of Biology Laboratory II

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Credit or enrollment in BIOL 2120

Laboratory to accompany 2120. (Typically Offered: Fall, Spring)

BIOL 2510: Biological Processes in the Environment

(Cross-listed with ENSCI 2510).

Credits: 3. Contact Hours: Lecture 3.

Principles of Biology from the level of macromolecules to the biosphere.

Biological processes that affect environmental systems: including metabolism, energy pathways, biochemical reactions in cells, plant and microbial structure and function, element and water cycles. (Typically Offered: Spring)

BIOL 2550: Fundamentals of Human Anatomy

Credits: 3. Contact Hours: Lecture 3.

An introduction to human anatomy, beginning with cells and tissues, surveying all body systems, relating form to function. Systems covered include: integumentary, bones and joints, muscles, nervous, sensory, endocrine, circulatory, lymphatic, respiratory, digestive, urinary, and reproductive. Pre-Medical students should consider BIOL 3510 for their anatomy background. Does not satisfy biology major requirements. HS courses in biology and chemistry necessary. Credit or enrollment in BIOL 1010 recommended. (Typically Offered: Fall)

BIOL 2550L: Fundamentals of Human Anatomy Laboratory

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Credit or enrollment in BIOL 2550

Investigation of human anatomy using models and dissections of preserved organs and model mammals. Pre-Medical students should consider 3510 for their anatomy background. Does not satisfy biology major requirements. (Typically Offered: Fall)

BIOL 2560: Fundamentals of Human Physiology

Credits: 3. Contact Hours: Lecture 3.

An introduction to human physiology, studying the function of all body systems. Systems covered include: integumentary, bones and joints, muscles, nervous, sensory, endocrine, circulatory, lymphatic and immune, respiratory, digestive, urinary, and reproductive. Does not satisfy biology major requirements. HS courses in biology and chemistry necessary. Credit or enrollment in BIOL 1010 or BIOL 2550 recommended. (Typically Offered: Spring)

BIOL 2560L: Fundamentals of Human Physiology Laboratory

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Credit or enrollment in BIOL 2560

Student-conducted experiments investigating concepts of human physiology with computer data acquisition and analysis. Interpretation of experimental results and preparation of lab reports. Graduation Restriction: Credit In BIOL 2560L May Not Be Applied Toward Biology Major Graduation Requirements. (Typically Offered: Spring)

BIOL 2570X: Bionics

Credits: 2.

Introduction to engineering design for life sciences focusing on bionics. Cross-disciplinary experiential learning projects drawing from human anatomy, physiology, mechanical, computer, and electrical engineering disciplines. Exploration of emerging technologies for human body augmentation and how these technologies can be developed for entrepreneurship projects. (Typically Offered: Fall, Spring)

BIOL 2890X: Experiences in Biodiversity Research

Credits: 2.

Designed to provide early undergraduates with practical experience in biodiversity research and demystify the path to careers in the field. Exposure to a variety of research contexts to increase experiences and engagement with biodiversity sciences; teachings on how to communicate and peer-review biodiversity science; and empowerment to seek future research opportunities. Regular cohort-building opportunities to increase student sense of belonging in biodiversity research. Includes an overnight field trip towards the end of the semester. Elective credit. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

BIOL 2990X: Introduction to Undergraduate Research

(Cross-listed with GEN 2990X).

Credits: 1-2.

Prereq: Instructor Permission for Course

Identify a research opportunity on campus and conduct guided research under the supervision. (Typically Offered: Fall, Spring, Summer)

BIOL 3070: Women in Science and Engineering

(Cross-listed with WGS 3070/ WISE 3070).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500; Sophomore classification

The interrelationships of women and science and engineering examined from historical, sociological, philosophical, and biological perspectives. Factors contributing to under-representation; feminist critiques of science; examination of successful strategies. Does not satisfy biology major advanced credit requirements. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall)

BIOL 3110X: Genome Editing and Engineering

Credits: 1. Contact Hours: Laboratory 2.

Repeatable, maximum of 4 times.

Hands-on experiences in molecular cloning, CRISPR/Cas9 genome editing, and imaging techniques. Novel biological and cellular processes and disease-related pathways in mammalian cell culture and other model systems will be investigated through CRISPR/Cas9-mediated mutagenesis approaches. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

BIOL 3120: Ecology

(Cross-listed with AECL 3120/ ENSCI 3120).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: BIOL 2110; (BIOL 2120 or BIOL 2510)

Fundamental concepts and principles of ecology dealing with organisms, populations, communities, and ecosystems. Laboratory and field exercises examine ecological principles and methods as well as illustrate habitats. (Typically Offered: Fall, Summer)

BIOL 3130: Principles of Genetics

(Cross-listed with GEN 3130).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2110 and BIOL 2120

Introduction to the principles of transmission and molecular genetics of plants, animals, and bacteria. Recombination, structure and replication of DNA, gene expression, cloning, quantitative genetics, and population genetics. Graduation Restriction: Students may receive graduation credit for no more than one of the following: GEN 2600, GEN 3130 and 3130L, GEN 3200, BIOL 3130 and 3130L, and AGRON 3200. (Typically Offered: Fall, Spring, Summer)

BIOL 3130L: Genetics Laboratory

(Cross-listed with GEN 3130L).

Credits: 1. Contact Hours: Laboratory 4.

Prereq: Credit or enrollment in BIOL 3130

Laboratory to accompany 3130. Graduation Restriction: Students may receive graduation credit for no more than one of the following: BIOL 3130 and 3130L, GEN 2600, GEN 3130, GEN 3200, and AGRON 3200. (Typically Offered: Fall, Spring)

BIOL 3140: Principles of Molecular Cell Biology

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2110 and BIOL 2120

Integration of elementary principles of metabolism, bioenergetics, cell structure, and cell function to develop a molecular view of how the cell works. (Typically Offered: Fall, Spring)

BIOL 3150: Biological Evolution

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2110, BIOL 2110L, BIOL 2120, and BIOL 2120L

The mechanisms of evolution. Topics in microevolution: population genetics, natural selection, genetic variation, and adaptation. Macroevolution: speciation, extinction, phylogeny, and major evolutionary patterns. (Typically Offered: Fall, Spring)

BIOL 3180: Introduction to Ecosystems

(Cross-listed with AGRON 3180/ ENSCI 3180/ NREM 3180).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 12 credits in AECL, AGRON, BIOL, CHEM, FOR, GEOL, NREM

Biological and physical processes affecting material and energy flows in natural and managed ecosystems. Understanding and predicting climate and management impacts on ecosystem services and sustainability. (Typically Offered: Spring)

BIOL 3190: Analysis of Environmental Systems

(Cross-listed with ENSCI 3190/ ENVS 3190).

Credits: 3.

Prereq: ENSCI 3120; junior classification

Systems approach to the analysis and modeling of material and energy flows in natural and managed environmental systems and the primary environmental factors controlling these systems. Applications in hydrology, biogeochemistry, and population dynamics. (Typically Offered: Spring)

BIOL 3220: Introduction to Bioinformatics and Computational Biology

(Cross-listed with BCBIO 3220/ GEN 3220).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2120

Genome sequencing, assembly, structural and functional annotation, and comparative genomics. Investigating these topics will develop skills in programming and scripting (Perl and/or Python), the use of biological databases, sequence alignment, similarity search, identification of sequence patterns, construction of phylogenetic trees, and comparative genomics. (Typically Offered: Fall)

BIOL 3280: Molecular and Cellular Biology of Human Diseases

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2120

Survey of molecular, genetic, and cellular aspects of human diseases. Fundamental concepts of cell biology and how they are linked to the pathologies of different classes of human diseases. Recent scientific advances with an emphasis on new methods of diagnosis and treatment. (Typically Offered: Fall)

BIOL 3350: Principles of Human and Other Animal Physiology

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2120

Introduction to physiology of metabolic function in mammals and other animals. Metabolic processes and their interactions with various subsystems, approached from an organismal perspective. Integration of cellular, gastrointestinal, cardiovascular, respiratory, and renal processes, relevant to their control and integration at the nervous and endocrine system levels. Functional aspects of organismal physiology, energy and water balances, physiology of rest exercise, and environmental stress. Graduation Restriction: Credit for either BIOL 3350 OR BIOL 3340, but not both, may be applied toward graduation. (Typically Offered: Spring)

BIOL 3350L: Principles of Human and Other Animal Physiology Laboratory

Credits: 1. Contact Hours: Laboratory 3.

Optional laboratory to accompany Biology 3350. Student-conducted experiments investigating concepts of physiology. (Typically Offered: Spring)

BIOL 3360: Ecological and Evolutionary Animal Physiology

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2120

Study of mechanisms by which animals perform life-sustaining functions; the evolution and adaptive significance of physiology traits, the diversity of physiological mechanisms, and how physiology and ecology interact.

BIOL 3440: Human Reproduction

(Cross-listed with WGS 3440).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2120

Biology of human reproduction, including reproductive systems, hormones, and endocrinology of pregnancy, presented from a clinically-oriented perspective. Reviews health-related conditions such as infertility, sexually-transmitted diseases, and complicated pregnancy. (Typically Offered: Spring)

BIOL 3490: The Genome Perspective in Biology

(Cross-listed with GEN 3490).

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: GEN 3130 or GEN 3200

Analysis of genome, RNA, and protein data using computer technology to answer biological questions on topics ranging from microbial diversity to human health. An introduction for students in the life sciences to the fields of genomics, bioinformatics and systems. (Typically Offered: Spring)

BIOL 3500: Comprehensive Human Anatomy

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: BIOL 2120

Comprehensive survey of human anatomy, emphasizing structural and functional relationships of major organ systems. Compartmental study of normal anatomy; practical clinical application of anatomical regions. Laboratory using 3-dimensional software to study anatomy in augmented reality. Recommended for pre-medical and pre-health professional students. (Typically Offered: Fall)

BIOL 3510: Comparative Vertebrate Anatomy

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2120, junior classification

The evolution of vertebrates as reflected in the anatomy of extinct and living forms. Lecture topics include the history and diversity of vertebrates, comparisons of anatomic structures among major groups, and the adaptive significance of anatomic structures. Laboratory involves dissection of representative species. (Typically Offered: Spring)

BIOL 3510L: Comparative Vertebrate Anatomy Laboratory

Credits: 2. Contact Hours: Laboratory 4.

Prereq: BIOL 2120, junior classification

Optional laboratory to accompany BIOL 3510. Anatomical study of vertebrates including hands-on dissections of organisms such as sharks, pigeons, and rabbits. (Typically Offered: Spring)

BIOL 3520: Vertebrate Histology

Credits: 4. Contact Hours: Lecture 2, Laboratory 4.

Prereq: BIOL 2120

Microanatomy of animal cells, tissues, and organs; histology from a functional perspective; ultra-structure of cells, the four primary tissues, and different anatomical organs, focusing on function and clinical significance. Offered even-numbered years. (Typically Offered: Spring)

BIOL 3530: Introductory Parasitology

(Cross-listed with VPTH 3530/ MICRO 3530).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2120

Biology and host-parasite relationships of major groups of animal parasites, and techniques of diagnosing and studying parasites. (Typically Offered: Spring)

BIOL 3540: Animal Behavior

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2120

Ethological and sociobiological approaches to animal behavior. Genetic and developmental aspects of behavior, biological rhythms, orientation (including navigation, migration), communication, and social behavior (mating, aggression, parental care). (Typically Offered: Fall)

BIOL 3540L: Laboratory in Animal Behavior

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Credit or enrollment in BIOL 3540

Laboratory techniques for observation, description and analysis of animal activities; independent projects. (Typically Offered: Fall)

BIOL 3550: Plants and People

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2110

Uses of plants and fungi by humans and the importance of plants in the past, present, and future. Discussion of fruits, vegetables, grains, herbs, spices, beverages, oils, fibers, wood, medicines, and drugs, in the context of their agricultural, cultural, and economic roles in modern societies. Emphasis on origins and worldwide diversity of culturally important plants, their characteristics, and uses. (Typically Offered: Spring)

BIOL 3560: Dendrology

(Cross-listed with FOR 3560).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: BIOL 2110

Identification and ecology of North American woody plant species. Importance of woody plants in timber production and wildlife habitat. Historical conditions of North American forest regions will also be addressed. (Typically Offered: Fall)

BIOL 3570: Biology of Plants

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2110 and BIOL 2120

Study of the general biology of plants, including plant cells and functions, basic anatomy of tissues, meristems, and organs; adaptive morphological features. Review of processes of photosynthesis, respiration, basic plant metabolic functions, and plant reproduction. Survey of evolutionary aspects of all major groups of land plants, and relationships of plants to their environment. Intended for Biology and other life science undergraduate majors. BIOL 2110L and BIOL 2120L recommended. (Typically Offered: Fall)

BIOL 3580: Bee Biology, Management, and Beekeeping

(Cross-listed with ENT 3580).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Introductory (2000-level) biology coursework or permission of an instructor

Bee diversity and evolution, ecology, role as pollinators, behavior, anatomy, and development. Management of bees as agricultural pollinators and honey producers, focusing on honey bees. Working with live bee hives and demonstration of practical beekeeping skills will occur during several field trips to local hives. (Typically Offered: Fall)

BIOL 3600X: Marine Biology

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2110 and BIOL 2110L

Comprehensive overview of marine biology. Introduction to physical and chemical oceanography as it relates to the physiology of marine organisms and their survival and reproductive strategies. Examination of the biodiversity, richness and distribution of marine life. (Typically Offered: Fall)

BIOL 3640: Invertebrate Biology

Credits: 3-4. Contact Hours: Lecture 3, Laboratory 4.

Prereq: BIOL 2110 and BIOL 2120

Emphasis on diversity, development, physiology, and behavior of invertebrate organisms- the 'spineless wonders' of the world. Laboratory involves hands-on study and investigation of living invertebrates. (Typically Offered: Fall)

BIOL 3650: Vertebrate Biology

(Cross-listed with AECL 3650).

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: BIOL 2110 and BIOL 2110L

Evolution, biology, and classification of fish, amphibians, reptiles, birds, and mammals. Emphasis on a comparative analysis of the structure and function of organ systems. Laboratory exercises concentrate on morphology and identification of orders of vertebrates. (Typically Offered: Fall)

BIOL 3660: Plant Systematics

Credits: 4. Contact Hours: Lecture 2, Laboratory 4.

Prereq: BIOL 2110

Introduction to plant phylogenetic systematics, plant classification, survey of flowering plant families, and identification and field study of local plants. (Typically Offered: Spring)

BIOL 3700: GIS for Ecology and Environmental Science

(Cross-listed with ENSCI 3700).

Credits: 1-6. Repeatable.

Prereq: 6 credits in BIOL or ENSCI

Introduction to geographic information systems (GIS) with emphasis on ecological and environmental applications. No prior GIS experience required. Guided, individualized study of topics based on student background and interest. For students with prior experience, topics and activities are selected to build upon any previous experience and minimize duplication to previous GIS coursework. Potential topics include: basic concepts of GIS, data structures, database management, spatial analysis, modeling and visualization of ecological and environmental data. Case studies in ecological and environmental applications using ArcGIS. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

BIOL 3710: Ecological Methods

(Cross-listed with AECL 3710).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: AECL 3120 or NREM 3110; STAT 1010 or STAT 1040

Quantitative techniques used in management of natural resources with emphasis on inventory and manipulation of habitat and animal populations. (Typically Offered: Fall)

BIOL 3750: Marine Ecology and Ecosystems Dynamics

(Cross-listed with AECL 3750/ ENSCI 3750).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2110

Overview of the ecological processes, ecosystems, and biodiversity in marine environments. Ever-changing dynamics caused by environmental disturbances, internal forces, or by human impacts on species and ecosystems. (Typically Offered: Spring)

BIOL 3930A: North American Field Trips in Biology: Pre-trip Seminar

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Prereq: 6 credits BIOL; permission of instructor

Discussion of relevant biological and cultural topics during semester preceding extended field trips to North American locations of interest to biologists.

BIOL 3930B: North American Field Trips in Biology: North American Field trip

Credits: 1-3. Repeatable.

Prereq: 6 credits BIOL; permission of instructor

Extended field trip under supervision of faculty member, usually during break periods, to North American locations of interest to biologists. Inquire in the Biology Program Office, 103 Bessey Hall, for trip schedule. Report required.

BIOL 3940A: International Field Trips in Biology: Pre-trip Seminar

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Prereq: 6 credits in BIOL

Discussion of relevant biological and cultural topics during semester preceding extended field trip to international locations of interest to biologists. Meets International Perspectives Requirement.

BIOL 3940B: International Field Trips in Biology: Field Trip to International Location

Credits: 1-3. Repeatable.

Prereq: 6 credits in BIOL

Extended field trips, under supervision of faculty member, usually during break periods, to international locations of interest to biologists. Inquire in the Biology Program Office, 103 Bessey Hall, for trip schedule. Meets International Perspectives Requirement.

BIOL 3950X: Professional Development in Biological Sciences-Identifying Opportunities and Preparing Application

Credits: 2. Contact Hours: Lecture 2.

For students interested in undergraduate research, competitive internships, graduate or professional school. This course will help students identify opportunities, create, and polish your applications. (Typically Offered: Fall)

BIOL 4010: Bioinformatics of Sequences

(Cross-listed with BC BIO 4010/ COMS 4010/ GEN 4010).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BC BIO 3220; (COMS 1270 OR COMS 2270); (MATH 1600 or MATH 1650); (MATH 1660 or STAT 3010); (STAT 1010 or STAT 1040 or STAT 3300) or Permission of Instructor

Application of computer science and statistics to molecular biology with a significant problem-solving component, including hands-on programming using Python to solve a variety of biological problems. String algorithms, sequence alignments, homology search, pattern discovery, genotyping, genome assembly, genome annotation, comparative genomics, protein structure. Offered odd-numbered years. (Typically Offered: Fall)

BIOL 4020: Introduction to Pathology

(Cross-listed with VPTH 4020).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2110, BIOL 2110L, BIOL 2120, and BIOL 2120L

Introductory exploration of pathology as a medical discipline. This includes study of disease mechanisms via an introduction to general pathology topics (cell degeneration, necrosis, disturbances of growth, disturbances of blood flow, inflammation, neoplasia) and organ system-specific response to injury. (Typically Offered: Fall)

BIOL 4030: Introduction to Pathology II

(Cross-listed with VPTH 4030).

Credits: 3. Contact Hours: Lecture 3.

Prereq: VPTH 4020 and BIOL 4020

Continuation of pathology topics begun in VPTH/BIOL 4020. How specific organ systems respond to injury using principles and information covered in VPTH 4020/ BIOL 4020. Study of a set of prototypical diseases that affect humans and animals. (Typically Offered: Spring)

BIOL 4060: Bioinformatics of OMICS

(Cross-listed with BC BIO 4060/ COMS 4060/ GEN 4060).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2120

Introduction to cutting edge OMICS analyses including transcriptome, proteome, metabolome, DNA-protein interactome, protein-protein interactome and methylome. Genomic analysis including transcriptome analysis, cancer genomics, comparative genomics, and regulatory network analysis. (Typically Offered: Spring)

BIOL 4140: Life History and Reproductive Strategies

(Dual-listed with EEOB 5140).

Credits: 3. Contact Hours: Lecture 3.

Evolution of ecological adaptations at the individual, population, and species level. Emphasis is on evolutionary mechanisms and adaptive strategies related to life histories and reproduction; age and size at maturity; lifespan and senescence; offspring size/number trade-offs; sex and mating systems; sex determination and sex ratios. BIOL 3150 or equivalent recommended. Offered odd-numbered years. (Typically Offered: Fall)

BIOL 4210: Biological Principles of Aging

(Dual-listed with EEOB 5210/ GERON 5210).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2110 and BIOL 2120

Basic biological principles of aging. Course modules include an introduction to the aging process, body systems and normal aging, environment and the biology of aging. In addition, disorders and diseases of aging, prevention and treatment and exercise and aging topics will be covered. (Typically Offered: Summer)

BIOL 4230: Developmental Biology

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 3130

Principles of embryogenesis and animal development. Establishment of body axes, organ and limb development, and specification of cell fates. Emphasis on cell signaling and the control of gene expression within the context of a developing organism. Medically relevant subjects will be discussed, including stem cells, cancer biology, fertilization, and cloning. (Typically Offered: Spring)

BIOL 4230L: Developmental Biology Laboratory

Credits: 1. Contact Hours: Laboratory 3.

Repeatable, maximum of 4 times.

Experiments and explorations illustrating fundamental principles of multicellular development. (Typically Offered: Spring)

BIOL 4280: Cell Biology

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 3140

Cell structure and function in health and disease. Emphasis on cellular dynamics, transport, organelle biogenesis and signaling, and how defects in these processes disrupt cell function. (Typically Offered: Spring)

BIOL 4300: Principles of Plant Physiology

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2120; CHEM 2310 or CHEM 3320

An overview of classical and current concepts, principles, and approaches regarding the basic mechanisms of plant function underlying growth, development, and survival of plants. Topics covered include environmental and developmental signals, plant hormone action, signal transduction, mineral nutrition, water relations, metabolism, and photosynthesis. (Typically Offered: Spring)

BIOL 4340: Endocrinology

(Dual-listed with EEOB 5340).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2110 and BIOL 2120

Chemical integration of vertebrate organisms. The structure, development, and evolution of the endocrine glands and the function and structure of their hormones. (Typically Offered: Spring)

BIOL 4360: Neurobiology

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2120

Basic principles of brain function and development. Signaling of nerve cells, synaptic transmission, structure/function of ion channels and receptors, memory and synaptic plasticity, movement and central control, sensation and sensory processing, construction of neural circuits, early brain development, complex brain functions in health and disease. (Typically Offered: Fall)

BIOL 4510: Plant Evolution and Phylogeny

(Dual-listed with EEOB 5510).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: BIOL 3150

Survey of land plant evolution; phylogenetic comparison of anatomical, reproductive, and life history specializations. Relationships among bryophytes, lycophytes, pteridophytes, gymnosperms, and angiosperms emphasizing significant evolutionary changes documented by paleobotanical, morphological, and molecular studies. (Typically Offered: Fall, Spring, Summer)

BIOL 4540: Plant Anatomy

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: BIOL 2120L

Characteristics of cell and tissue types in vascular plants. Anatomy of developing and mature stems, roots, and leaves, including secondary (woody) growth. Introduction to the special anatomy of flowers and seeds. BIOL 3660 recommended. Offered odd-numbered years. (Typically Offered: Fall)

BIOL 4550: Bryophyte and Lichen Biodiversity

(Dual-listed with EEOB 5550).

Credits: 3.

Prereq: Credit in BIOL 2110 and BIOL 2110L

Introduction to the biology and ecology of mosses, liverworts, and lichens. Emphasis on identification and diversity of local representatives of these three groups of organisms. Required field trips and service-learning. (Typically Offered: Spring)

BIOL 4560: Principles of Mycology

(Cross-listed with MICRO 4560).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: 10 credits BIOL or MICRO

Morphology, diversity, and ecology of fungi; their relation to agriculture, industry, and human health. (Typically Offered: Fall)

BIOL 4570: Herpetology

(Cross-listed with AECL 4570).

Credits: 2. Contact Hours: Lecture 2.

Prereq: (BIOL 3510 AND BIOL 3510L) OR AECL/BIOL 3650

Biology, ecology, and evolution of amphibians (salamanders, frogs, caecilians) and reptiles (lizards, snakes, tuatara, turtles, crocodilians). Emphasis on structure, physiological adaptation to different environments, behavior, reproduction, roles of amphibians and reptiles in ecosystems, and conservation. Laboratory focus on survey methods, identification, relationships, distribution, habits, and habitats of amphibians and reptiles. (Typically Offered: Fall)

BIOL 4570L: Herpetology Laboratory

(Cross-listed with AECL 4570L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: (BIOL 3510 AND BIOL 3510L) OR AECL/BIOL 3650; Concurrent enrollment in AECL/BIOL 4570

Laboratory to accompany Biology/Animal Ecology 4570. Focus on survey methods, identification, relationships, distribution, habits, and habitats of amphibians and reptiles. (Typically Offered: Fall)

BIOL 4580: Ornithology

(Cross-listed with AECL 4580).

Credits: 2. Contact Hours: Lecture 2.

Prereq: (BIOL 3510 AND BIOL 3510L) OR AECL/BIOL 3650

Biology, evolution, ecology and taxonomy of birds. Emphasis on structure, physiology, behavior, communication, navigation, reproduction, and conservation. (Typically Offered: Spring)

BIOL 4580L: Ornithology Laboratory

(Cross-listed with AECL 4580L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: (BIOL 3510 AND BIOL 3510L) OR AECL/ BIOL 3650; Credit OR concurrent enrollment in AECL/BIOL 4580

Laboratory complements lecture topics with emphasis on external anatomy, identification and distribution of Midwest birds, and field trips. (Typically Offered: Spring)

BIOL 4590: Mammalogy

(Cross-listed with AECL 4590).

Credits: 2. Contact Hours: Lecture 2.

Prereq: (BIOL 3510 AND BIOL 3510L) OR AECL/BIOL 3650

Biology, ecology, and evolution of mammals. Emphasis on structure, physiological adaptation to different environments, behavior, reproduction, roles of mammals in ecosystems, and conservation. (Typically Offered: Spring)

BIOL 4590L: Mammalogy Laboratory

(Cross-listed with AECL 4590L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: (BIOL 3510 AND BIOL 3510L) OR AECL/ BIOL 3650; Concurrent enrollment in AECL/BIOL 4590

Laboratory focus on identification, survey methods, distribution, habits, and habitats of mammals. Several field trips. (Typically Offered: Spring)

BIOL 4620: Evolutionary Genetics

(Cross-listed with GEN 4620).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 3150

The population and quantitative genetic basis of evolutionary processes. The role of genetic variation in natural selection and the influences of random processes on evolutionary change. The determinants of phenotype. (Typically Offered: Fall)

BIOL 4640: Wetland Ecology

(Dual-listed with EEOB 5640/ ENSCI 5640). (Cross-listed with ENSCI 4640).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 15 credits in BIOL

Ecology, classification, creation and restoration, and management of wetlands. Emphasis on North American temperate wetlands. (Typically Offered: Fall, Spring, Summer)

BIOL 4650: Macroevolution

(Dual-listed with EEOB 5650).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 3150

The history and diversity of life on earth; evolutionary patterns and processes above the species level. Diversity from a phylogenetic perspective. Empirical exercises include: phylogeny estimation, ancestral states, estimating diversification rates, evaluating the tempo and mode of evolution, biogeographic patterns, and trait associations across the tree of life. Offered even-numbered years. (Typically Offered: Spring)

BIOL 4710: Introductory Conservation Biology

(Cross-listed with AECL 4710).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 3120

Examination of conservation issues from a population and community perspective. The role of genetics, demography, and environment in determining population viability, habitat fragmentation, reserve design, biodiversity assessment, and restoration ecology. (Typically Offered: Spring)

BIOL 4740: Plant Ecology

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 3120

Principles of plant population and community ecology. (Typically Offered: Fall, Spring, Summer)

BIOL 4760: Functional Ecology

(Dual-listed with EEOB 5760).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 3120

The nature of adaptations to physical and biotic environments. Biophysical, biomechanical, and physiological bases of the structure, form, growth, distribution, and abundance of organisms. Offered odd-numbered years. (Typically Offered: Spring)

BIOL 4800: Studies in Marine Biology

Credits: 1-8. Contact Hours: Lecture 8.

Repeatable.

Courses taken at Gulf Coast Research Laboratory and other marine biological stations are transferred to Iowa State University under this number.

BIOL 4810: Summer Field Studies

Credits: 1-8. Contact Hours: Lecture 8.

Repeatable.

Courses taken at summer biological field stations are transferred to Iowa State University under this number. See www.biology.iastate.edu for links to field stations located in different biomes: coastal, Great Lakes, taiga, deciduous forests, deserts, Rocky Mountains.

BIOL 4820: Tropical Biology

Credits: 1-4. Contact Hours: Lecture 4.

Repeatable, maximum of 8 credits.

Prereq: One year of college biology

Students registering for courses taught by the Organization for Tropical Studies will receive credit for this ISU course when requesting a transfer of credits. Knowledge of Spanish desirable but not required.

BIOL 4830: Environmental Biogeochemistry

(Dual-listed with ENSCI 5830). (Cross-listed with ENSCI 4830/ GEOL 4830).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Combined 12 credits in biology, chemistry, and physics

An exploration of biological, physical and geochemical impacts on the structure and function of ecosystems from local to global scales. Emphasis on the cycles of carbon, nitrogen, phosphorus, sulfur, and metals, and how these have been impacted by human activity. Topics may include biological feedbacks to climate change, microbial physiology and redox reactions, plant/soil feedbacks, terrestrial/aquatic linkages, early Earth processes and the origins of life. Offered odd-numbered years. (Typically Offered: Spring)

BIOL 4840: Ecosystem Ecology

(Cross-listed with ENSCI 4840).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Combined 12 credits in biology, chemistry, and physics

Introduction of the study of ecosystems and the biological and physical factors that influence their properties and dynamics. Conceptual foundations for ecosystem studies. Interactions among organisms, biological diversity, and ecosystem attributes. Quantitative analyses of accumulations, transformations, and fluxes of nutrients, water, and energy within and among ecosystems. Global change issues. Offered odd-numbered years. (Typically Offered: Spring)

BIOL 4850: Community Ecology

(Dual-listed with EEOB 5850).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 3120

The effect of interspecific interactions on the structure and dynamics of natural and managed communities; including concepts of guild structure and trophic web dynamics and their importance to the productivity, diversity, stability, and sustainability of communities. The implications of interspecific interactions in the management of wild species will be emphasized with illustrative case histories of interactions between plants, invertebrates, and vertebrates. (Typically Offered: Spring)

BIOL 4860: Aquatic Ecology

(Dual-listed with AECL 5860/ EEOB 5860/ ENSCI 5860). (Cross-listed with AECL 4860/ ENSCI 4860).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 3120 or ENSCI 3190 or ENSCI 4020 or NREM 3010

Structure and function of aquatic ecosystems with application to fishery and pollution problems. Emphasis on lacustrine, riverine, and wetland ecology. (Typically Offered: Fall)

BIOL 4860L: Aquatic Ecology Laboratory

(Dual-listed with AECL 5860L/ EEOB 5860L/ ENSCI 5860L). (Cross-listed with AECL 4860L/ ENSCI 4860L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Credit or concurrent enrollment in BIOL 4860

Field trips and laboratory exercises to accompany 4860. Hands-on experience with aquatic research and monitoring techniques and concepts. (Typically Offered: Fall)

BIOL 4870: Microbial Ecology

(Dual-listed with EEOB 5870/ ENSCI 5870/ GEOL 5870/ MICRO 5870).

(Cross-listed with ENSCI 4870/ GEOL 4870/ MICRO 4870).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 6 credits in Biology and 6 credits in Chemistry

Introduction to major functional groups of autotrophic and heterotrophic microorganisms and their roles in natural and environmental systems. Consequences of microbial activity on water chemistry, weathering, and precipitation/dissolution reactions will be emphasized. (Typically Offered: Fall)

BIOL 4880: Identification of Aquatic Organisms

Credits: 1. Contact Hours: Laboratory 3.

On-line taxonomic and identification exercises to accompany 4860. Instruction and practice in the identification of algae, aquatic macrophytes, zooplankton, and benthos. (Typically Offered: Fall, Spring)

BIOL 4890: Population Ecology

(Dual-listed with AECL 5890/ EEOB 5890). (Cross-listed with AECL 4890).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: BIOL 3120; (STAT 1010 or STAT 1040); (MATH 1510, 1600, 1650 or Graduate standing)

Concepts and theories of population dynamics with emphasis on models of growth, predation, competition, and regulation. Offered even-numbered years. (Typically Offered: Fall)

BIOL 4900: Independent Study

Credits: 1. Repeatable, maximum of 9 credits.

Prereq: Instructor Permission for Course

Independent study opportunities for undergraduate students in the biological sciences. Graduation Restriction: No more than 9 credits in BIOL 4900 may be counted toward graduation and, of those, only 2 credits may be applied toward the biology advanced course requirement. (Typically Offered: Fall, Spring, Summer)

BIOL 4910: Undergraduate Teaching Experience

Credits: 1-2. Repeatable.

Prereq: Instructor Permission for Course

For students registering to be undergraduate teaching assistants. Offered on a satisfactory-fail basis only.

BIOL 4920: Preparing for Graduate School in the Biological Sciences

Credits: 1. Contact Hours: Lecture 1.

Prereq: Sophomore classification; major in College of Agriculture and Life Sciences

For students considering pursuing a graduate degree in the biological sciences. Professional development topics including the defining of academic and career areas of interest, finding and evaluating appropriate programs of graduate study, the graduate school application process, and developing a curriculum vita. Exploration of learning opportunities at field stations, research internships, and independent research activities. (Typically Offered: Fall)

BIOL 4940: Biology Internship

Credits: 1-3. Repeatable.

Prereq: 8 credits in Biology and Permission of Instructor

Professional experiences in biological sciences. Intended for Biology majors. Graduation Restriction: No more than 9 credits in BIOL 4940 may be counted toward graduation and, of those, only 6 credits may be applied toward the Biology advanced course requirement. (Typically Offered: Fall, Spring, Summer)

BIOL 4950: Undergraduate Seminar

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Instructor Permission for Course

Content varies from year to year and may include detailed discussion of special topics in biology, current issues in biology, or careers in biology. (Typically Offered: Fall, Spring)

BIOL 4980: Cooperative Education

Credits: Required. Repeatable.

Prereq: Department Cooperative Education Coordinator Permission for Course

Required of all cooperative education students. Students must register for this course prior to commencing each work period. (Typically Offered: Fall, Spring, Summer)

BIOL 4990: Undergraduate Research Experience

Credits: 1-3. Repeatable, maximum of 9 credits.

Prereq: Instructor Permission for Course

Research opportunities for undergraduate students in the biological sciences. Intended for Biology majors. Graduation Restriction: No more than 9 credits in BIOL 4990 may be counted toward graduation and, of those, only 6 credits may be applied toward the Biology advanced course requirement. (Typically Offered: Fall, Spring, Summer)

Biomedical Engineering (BME)

Courses primarily for undergraduates:

BME 1040: Biomedical Engineering First-Year Learning Community

Credits: Required. Contact Hours: Lecture 1.

Curriculum and career planning; academic course support for first-year students. Restricted to BME majors. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

BME 1600: Biomedical Engineering Problems with Computer Applications Laboratory

Credits: 3.

Prereq: Credit or enrollment in MATH 1650 or satisfactory (76+) score on mathematics placement exam

Formulation and solution of engineering problems; significant figures; use of SI units; graphing and curve-fitting; flowcharting; introduction to material balances, statics, and electric circuits in the context of biomedical engineering problems; use of spreadsheet programs to solve and present engineering problems; solution of engineering problems using computer programming languages. Only one of ENGR 1600, ABE 1600, AERE 1600, BME 1600, CHE 1600, CE 1600, CPRE 1850, EE 1850, IE 1480, ME 1600 and SE 1850 may count towards graduation. (Typically Offered: Fall, Spring)

BME 2010: Faculty-guided Professional Development in Biomedical Engineering

Credits: Required. Contact Hours: Lecture 1.

Professionalism in the context of Biomedical Engineering. Examination and selection of emphasis areas and electives in collaboration with a faculty mentor. Discussion of internships and research opportunities within Biomedical Engineering. . Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

BME 2200: Introduction to Biomedical Engineering

(Cross-listed with CHE 2200).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2120; (CHEM 1670 or CHEM 1770); (ABE 1600 or AERE 1600 or BME 1600 or CE 1600 or CHE 1600 or CPRE 1850 or EE 1850 or ENGR 1600 or IE 1480 or ME 1600 or SE 1850); MATH 1660; PHYS 2320

Engineering analysis of basic biology and engineering problems associated with living systems and health care delivery. The course will illustrate biomedical engineering applications in such areas as: biotechnology, biomechanics, biomaterials and tissue engineering, and biosignal and image processing, and will introduce the basic life sciences and engineering concepts associated with these topics. (Typically Offered: Fall, Spring)

BME 2700: Introduction to Biomedical Engineering Design

Credits: 2.

Prereq: ABE 1600, AERE 1600, BME 1600, CE 1600, CHE 1600, CPRE 1850, EE 1850, ENGR 1600, IE 1480, ME 1600, or SE 1850

Problem-based learning to introduce students to biomedical engineering design concepts, tools, and methodologies. Students will work in small groups and use computer-aided design (CAD), virtual design, and computational tools to propose and validate feasible solutions to real-world biomedical engineering problems with industrial and/or clinical relevance. (Typically Offered: Spring)

BME 3410: BioMEMs and Nanotechnology

(Cross-listed with EE 3410).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BME 2200

Overview of Micro-Electro-Mechanical-System (MEMS) technologies for bioengineering, fundamentals of microfluidic device design, fabrication, and characterization, survey of microfluidic functional building blocks for lab-on-a-chip applications including mixers, valves, channels, and chambers. Topics of nanotechnology in bioengineering, nanoscale building block technologies for bioengineering including self-assembling, surface chemical treatment, nano-imprinting, nano-particles, nano-tubes, nano-wires, and stimuli-responsive biomaterials.

BME 3520: Molecular, Cellular and Tissue Biomechanics

Credits: 3. Contact Hours: Lecture 3.

Prereq: BME 2200; MATE 2730

Introduction to the anatomy of the musculoskeletal system and connective tissue. Range of movement, joint dislocation, bone deformity and fracture. Application of continuum mechanics to both living and non-living systems. Laws of motion, free-body diagrams and simple force analysis of musculoskeletal system. Biomechanical response of soft and hard tissues with emphasis on microstructure and mechanical properties. Applications to bioengineering design.

BME 4400: Biomedical Applications of Chemical Engineering

(Dual-listed with CHE 5400). (Cross-listed with CHE 4400).

Credits: 3. Contact Hours: Lecture 3.

Prereq: CHE 2100 or CHE 2200, MATH 2660 or MATH 2670, PHYS 2320

Applications of material and energy balances, transport phenomena, chemical reaction engineering, and thermodynamics to problems in biomedical engineering and applied physiology; survey of biomedical engineering; biomaterials; biomedical imaging.

BME 4470: Biomedical Design and Manufacturing

(Dual-listed with IE 5470). (Cross-listed with IE 4470).

Credits: 3. Contact Hours: Lecture 3.

Exploration of biology, materials, body mechanics, manufacturing, quality control, and ethics and the intersection of these subjects as they relate to biomedical manufacturing. Study of medical data (CT, MRI, etc.) processing, biomedical design, 3D bioprinting and additive manufacturing concepts.

BME 4500: Biosensors

(Cross-listed with EE 4500).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BME 2200

Overview of biosensors and bioanalytical challenges; designing for performance including various analytical problems, ion-selective membranes, characteristics of enzymes and basics of bioaffinity sensing; fundamentals of bioselective layers including depositing films and membranes, surfaces for immobilization and bioselective agents; survey of different biosensing technologies including electroanalytical, biomembrane, optical, and acoustic-wave based sensors.

BME 4500L: Biosensors Laboratory

(Cross-listed with EE 4500L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: BME 2200; concurrent enrollment in BME 4500 or EE 4500

Laboratory course accompanying BME 4500. Design, fabrication, and characterization of various electrical, chemical, polymer, optical and acoustic sensors.

BME 4560: Biomaterials

(Dual-listed with MSE 5560). (Cross-listed with MATE 4560).

Credits: 3. Contact Hours: Lecture 3.

Prereq: CHEM 1780 and (MATE 2160 or MATE 2730 or MATE 3920)

Presentation of the basic chemical and physical properties of biomaterials, with special emphasis on metallic, ceramic, polymeric, and composite biomaterials, as they are related to their manipulation by the engineer for incorporation into living systems. Role of microstructure and properties needed to select and design biomaterials used in medical devices, artificial organs, implants, and prostheses. Overview of medical science vis-à-vis materials science. (Typically Offered: Fall)

BME 4900: Independent Study

Credits: 1-6. Repeatable, maximum of 6 credits.

Prereq: Department Permission for Course

Investigation of biomedical engineering topics of special interest to student and supervising faculty member with a final written report.

(Typically Offered: Fall, Spring, Summer)

Biomedical Sciences (BMS)

Courses primarily for undergraduates:

BMS 3290: Anatomy and Physiology of Domestic Animals

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2120 and BIOL 2120L

Survey of body systems of domestic animals. Provides a medical science orientation particularly useful to students in a preveterinary medicine curriculum. (Typically Offered: Spring)

BMS 4380: Principles of Physiology

(Dual-listed with BMS 5380).

Credits: 4. Contact Hours: Lecture 4.

Principles of neurophysiology, endocrine and reproductive physiology, muscle physiology, cardiovascular, respiratory, renal, and digestive physiology, and regulation of body fluid. (Typically Offered: Fall)

BMS 4390: Principles of Pharmacology

(Dual-listed with BMS 5390).

Credits: 4. Contact Hours: Lecture 4.

General principles of drug actions; drug disposition; drug acting on, cardiovascular, respiratory, renal, gastrointestinal, and endocrine systems; anti-inflammatory and antibiotic drug; anti-cancer drugs; anesthetics CNS stimulants; lifestyle drugs; drug addiction, abuse and dependence; drugs in sport; drugs for obesity; biopharmaceuticals and gene therapy; drug development. (Typically Offered: Spring)

BMS 4470: Introduction to Human Gross Anatomy

(Dual-listed with BMS 5470).

Credits: 4. Contact Hours: Lecture 2, Laboratory 6.

Examination of gross anatomy and neuroanatomy of the human. Laboratories will center on regional anatomy study through human cadaver dissection in addition to models, virtual learning solutions, radiologic imaging and case studies. (Typically Offered: Fall)

BMS 4480: Principles of Human Gross Anatomy

Credits: 4. Contact Hours: Lecture 2, Laboratory 6.

Repeatable, maximum of 2 times.

BMS 448 will be a laboratory-centered course that focuses on prosected human cadavers to develop an in-depth understanding of human anatomical function. The course will follow a regional approach and stress relationships between neighboring anatomical structures. During laboratory sessions, students teams will study anatomy from multiple individuals to gain an appreciation for anatomical variation and effects on the body from aging, disease, etc. Additional laboratory activities include study in osteology, radiograph interpretation and case studies. (Typically Offered: Spring, Summer)

BMS 4500X: Introduction to a Research Career in Industry

(Cross-listed with VMPM 4500X).

Credits: 1. Contact Hours: Lecture 2.

Explores research career paths in industry. Course will discuss ways students can prepare competitive applications and skill sets necessary for success. Concepts of regulatory constraints, quality management systems and intellectual property will also be introduced. Material will be presented by industry associates and leaders. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

BMS 4900H: Independent Study: Honors

Credits: 1-5. Repeatable.

Prereq: Permission of Instructor; Membership in the University Honors Program

(Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

BMS 5010: Selected Research Methods in Biomedical Sciences

Credits: 3.

Prereq: Graduate Standing or Permission of Instructor

Experience in biomedical techniques in selected BMS laboratories that include but is not limited to cytochemical methods, molecular biological techniques, extracellular and intracellular unit recording, microiontophoresis, microinjection, spectrophoto-fluorometric analysis of chemicals, use of radioisotopes, radioimmunoassay, Ca²⁺ imaging, confocal microscopy, fluorescence microscopy, and immunocytochemistry. (Typically Offered: Fall, Spring, Summer)

BMS 5020: Methods in Biomedical Sciences

Credits: 3. Contact Hours: Laboratory 6.

Prereq: Graduate Standing or Permission of Instructor

Provides laboratory experience in the application of methods in biomedical sciences, including animal physiology and pharmacology laboratory techniques; human physiology recordings and urinalysis; pharmacokinetics; basic techniques in analytical laboratory; basic pathology, immunology, bacteriology, and virology laboratory techniques. (Typically Offered: Spring)

BMS 5030: Fundamentals of Biomedical Sciences

Credits: 1. Contact Hours: Lecture 1.

Prereq: Graduate Standing or Permission of Instructor

Institutional training essential for biomedical research, orientation to institutional career services and communication resources, professional development activities and practice with critical evaluation of data presentation and interpretation in biomedical literature. (Typically Offered: Fall)

BMS 5300: Biomedical Sciences I

(Dual-listed with BMS 7330).

Credits: 6. Contact Hours: Lecture 4, Laboratory 6.

Prereq: Graduate Standing or Permission of Instructor

Microscopic anatomy and physiology of cells, tissues, cardiovascular system, respiratory system, and urinary system. (Typically Offered: Fall)

BMS 5310: Principles of Morphology II

(Dual-listed with BMS 7331).

Credits: 4. Contact Hours: Lecture 2, Laboratory 6.

Prereq: Graduate Standing or Permission of Instructor

Comparative and topographic anatomy of horse, ruminants, pig, and chicken. (Typically Offered: Spring)

BMS 5330: Biomedical Sciences I

(Dual-listed with BMS 7333).

Credits: 6. Contact Hours: Lecture 5, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Microscopic anatomy and physiology of cells, tissues, cardiovascular system, respiratory system, and urinary system. (Typically Offered: Fall)

BMS 5340: Biomedical Sciences II

(Dual-listed with BMS 7334).

Credits: 6. Contact Hours: Lecture 5, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Microscopic anatomy of the immune system and integument.

Microscopic anatomy and physiology of the digestive system, endocrine system, and reproductive system. (Typically Offered: Spring)

BMS 5350: Molecular and Cellular Basis of Disease

Credits: 1. Contact Hours: Lecture 1.

Prereq: Graduate Standing or Permission of Instructor

Descriptions of molecular and cellular biology, especially as it pertains to veterinary medicine. Discussions of cellular components, cellular functions and anomalies thereof. Emphasis placed on divergences relevant to companion animals and livestock. (Typically Offered: Spring)

BMS 5370: Neuroanatomy

(Dual-listed with BMS 7337).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Neuroanatomy of domestic animals. (Typically Offered: Spring)

BMS 5380: Principles of Physiology

(Dual-listed with BMS 4380).

Credits: 4. Contact Hours: Lecture 4.

Prereq: Graduate Standing or Permission of Instructor

Principles of neurophysiology, endocrine and reproductive physiology, muscle physiology, cardiovascular, respiratory, renal, and digestive physiology, and regulation of body fluid. (Typically Offered: Fall)

BMS 5390: Principles of Pharmacology

(Dual-listed with BMS 4390).

Credits: 4. Contact Hours: Lecture 4.

Prereq: Graduate Standing or Permission of Instructor

General principles of drug actions; drug disposition; drug acting on, cardiovascular, respiratory, renal, gastrointestinal, and endocrine systems; anti-inflammatory and antibiotic drug; anti-cancer drugs; anesthetics CNS stimulants; lifestyle drugs; drug addiction, abuse and dependence; drugs in sport; drugs for obesity; biopharmaceuticals and gene therapy; drug development. (Typically Offered: Spring)

BMS 5420A: Introduction to Molecular Biology Techniques: DNA Techniques

(Cross-listed with BBMB 5420A/ EEOB 5420A/ FSHN 5420A/ GDCB 5420A/ HORT 5420A/ NREM 5420A/ NUTRS 5420A/ VDPAM 5420A/ VMPM 5420A).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes genetic engineering procedures, sequencing, PCR, and genotyping. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

BMS 5420B: Introduction to Molecular Biology Techniques: Protein

(Cross-listed with BBMB 5420B/ EEOB 5420B/ FSHN 5420B/ GDCB 5420B/ HORT 5420B/ NREM 5420B/ NUTRS 5420B/ VDPAM 5420B).

Credits: 1. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. Offered on a satisfactory-fail basis only. (Typically Offered: Spring, Summer)

BMS 5420C: Introduction to Molecular Biology Techniques: Cell Techniques

(Cross-listed with BBMB 5420C/ EEOB 5420C/ FSHN 5420C/ GDCB 5420C/ HORT 5420C/ NREM 5420C/ NUTRS 5420C/ VMPM 5420C/ VDPAM 5420C).

Credits: 1. Contact Hours: Laboratory 2.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. ular biology techniques and related procedures. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

BMS 5420D: Introduction to Molecular Biology Techniques: Plant Transformation

(Cross-listed with BBMB 5420D/ EEOB 5420D/ FSHN 5420D/ GDCB 5420D/ HORT 5420D/ NREM 5420D/ NUTRS 5420D/ VMPM 5420D/ VDPAM 5420D).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: Agrobacterium and particle gun-mediated transformation of tobacco, Arabidopsis, and maize, and analysis of transformants. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

BMS 5420E: Introduction to Molecular Biology Techniques: Proteomics

(Cross-listed with BBMB 5420E/ EEOB 5420E/ FSHN 5420E/ GDCB 5420E/ HORT 5420E/ NREM 5420E/ NUTRS 5420E/ VMPM 5420E/ VDPAM 5420E).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: two-dimensional electrophoresis, laser scanning, mass spectrometry, and database searching. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

BMS 5420F: Introduction to Molecular Biology Techniques: Metabolomics

(Cross-listed with BBMB 5420F/ EEOB 5420F/ FSHN 5420F/ GDCB 5420F/ HORT 5420F/ NREM 5420F/ NUTRS 5420F/ VMPM 5420F/ VDPAM 5420F).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: metabolomics and the techniques involved in metabolite profiling. For non-chemistry majoring students who are seeking analytical aspects into their biological research projects. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

BMS 5420G: Introduction to Molecular Biology Techniques: Genomic

(Cross-listed with BBMB 5420G/ EEOB 5420G/ FSHN 5420G/ GDCB 5420G/ HORT 5420G/ NREM 5420G/ NUTRS 5420G/ VMPM 5420G/ VDPAM 5420G).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

BMS 5430: Pharmacology and Therapeutics

(Dual-listed with BMS 7443).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Pharmacology and therapeutic uses of fluids, antimicrobial and antiparasitic drugs, clinical use of veterinary drugs, and adverse drug reactions. (Typically Offered: Fall)

BMS 5470: Introduction to Human Gross Anatomy

(Dual-listed with BMS 4470).

Credits: 4. Contact Hours: Lecture 2, Laboratory 6.

Prereq: Graduate Standing or Permission of Instructor

Examination of gross anatomy and neuroanatomy of the human. Laboratories will center on regional anatomy study through human cadaver dissection in addition to models, virtual learning solutions, radiologic imaging and case studies. (Typically Offered: Fall)

BMS 5500X: Introduction to a Research Career in Industry

(Dual-listed with BMS 4500/ VMPM 4500). (Cross-listed with VMPM 5500X).

Credits: 1. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Explores research career paths in industry. Course will discuss ways students can prepare competitive applications and skill sets necessary for success. Concepts of regulatory constraints, quality management systems and intellectual property will also be introduced. Material will be presented by industry associates and leaders. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

BMS 5540: General Pharmacology

(Cross-listed with TOX 5540).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

General principles; drug disposition; drugs acting on the nervous, cardiovascular, renal, gastrointestinal, and endocrine systems. (Typically Offered: Spring)

BMS 5560: Cellular, Molecular and Developmental Neuroscience

(Cross-listed with NEURO 5560/ GDCB 5560).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Fundamental principles of neuroscience including cellular and molecular neuroscience, nervous system development, and regulatory systems. Offered odd-numbered years. (Typically Offered: Fall)

BMS 5750: Cell Biology

(Cross-listed with TOX 5750).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

A multi-instructor course covering major topics in cell structure and function, including: universal features of prokaryotic and eukaryotic cells, types of utilization and conversion of energy, genetic control of cell shape and functionality, internal organization of cells, communication between cells and their environment, development of multicellular systems. Students have to write a term paper. (Typically Offered: Fall)

BMS 5900A: Anatomy

Credits: 1-7. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

BMS 5900B: Physiology

Credits: 1-7. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

BMS 5900C: Pharmacology

Credits: 1-7. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

BMS 5900D: Cell Biology

Credits: 1-7. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

BMS 5990: Creative Component

Credits: 1-3. Repeatable.

Prereq: BMS Graduate Student

Creative component for non-thesis Master of Science degree. (Typically Offered: Fall, Spring, Summer)

Courses for graduate students:**BMS 6880: Research Review**

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

A forum for BMS students to gain experience in the critical exchange of ideas through oral presentation and discussion of scientific information. (Typically Offered: Fall)

BMS 6900A: Anatomy

Credits: 1-5. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

BMS 6900B: Physiology

Credits: 1-5. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

BMS 6900C: Pharmacology

Credits: 1-5. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

BMS 6900D: Cell Biology

Credits: 1-5. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

BMS 6980A: Seminar: Attendance

Credits: Required. Contact Hours: Lecture 1.

Repeatable.

(Typically Offered: Fall, Spring)

BMS 6980B: Seminar: Attendance and Presentation

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Attendance and presentation required. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

BMS 6980C: Seminar: Attendance and Report

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Attendance to all BMS seminars and written reports are required.

(Typically Offered: Fall, Spring)

BMS 6990A: Research: Anatomy

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

BMS 6990B: Research: Physiology

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

BMS 6990C: Research: Pharmacology

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

BMS 6990D: Research: Cell biology

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

Courses primarily for professional curriculum students:

BMS 7330: Biomedical Sciences I

(Dual-listed with BMS 5300).

Credits: 6. Contact Hours: Lecture 4, Laboratory 6.

Prereq: First-year classification in veterinary medicine or graduate student status

Microscopic anatomy and physiology of cells, tissues, cardiovascular system, respiratory system, and urinary system. (Typically Offered: Fall)

BMS 7331: Principles of Morphology II

(Dual-listed with BMS 5310).

Credits: 4. Contact Hours: Lecture 2, Laboratory 6.

Prereq: First-year classification in veterinary medicine. BMS 3300

Comparative and topographic anatomy of horse, ruminants, pig, and chicken. (Typically Offered: Spring)

BMS 7333: Biomedical Sciences I

(Dual-listed with BMS 5330).

Credits: 6. Contact Hours: Lecture 5, Laboratory 3.

Prereq: First-year classification in veterinary medicine or graduate student status

Microscopic anatomy and physiology of cells, tissues, cardiovascular system, respiratory system, and urinary system. (Typically Offered: Fall)

BMS 7334: Biomedical Sciences II

(Dual-listed with BMS 5340).

Credits: 6. Contact Hours: Lecture 5, Laboratory 3.

Prereq: First-year classification in veterinary medicine or graduate student status

Microscopic anatomy of the immune system and integument.

Microscopic anatomy and physiology of the digestive system, endocrine system, and reproductive system. (Typically Offered: Spring)

BMS 7335: Molecular and Cellular Basis of Disease

Credits: 1. Contact Hours: Lecture 1.

Descriptions of molecular and cellular biology especially as it pertains to veterinary medicine. Discussions of cellular components, cellular functions and anomalies thereof. Emphasis placed on divergences relevant to companion animals and livestock. (Typically Offered: Fall)

BMS 7336: Veterinary Nutrition

Credits: 2. Contact Hours: Lecture 2.

Introduce basic biochemical aspects of metabolism and function of energy, protein, fat, minerals and vitamins in the diet. Determine nutrient requirements of food animals, pets, and horses under various physiological states. Understand fate of various nutrients in simple stomached animals, ruminants, and cecal fermenters. Discuss clinical nutrition problems specific to each species. (Typically Offered: Fall)

BMS 7337: Neuroanatomy

(Dual-listed with BMS 5370).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Neuroanatomy of domestic animals. (Typically Offered: Spring)

BMS 7339: Clinical Foundations I

(Cross-listed with VCS 7339).

Credits: 1. Contact Hours: Lecture 1, Laboratory 2.

Canine physical examination; basic behavior, animal handling and restraint; medical record keeping. (Typically Offered: Fall)

BMS 7345: Case Study I

Credits: 1. Contact Hours: Laboratory 2.

Clinical applications of basic sciences taught concurrently in the fall semester of the first year curriculum in veterinary medicine. (Typically Offered: Fall)

BMS 7346: Case Study II

Credits: 1. Contact Hours: Laboratory 2.

Clinical applications of basic sciences taught concurrently in the spring semester of the first year curriculum in veterinary medicine. (Typically Offered: Spring)

BMS 7354: General Pharmacology

(Dual-listed with TOX 3540). (Cross-listed with TOX 7354).

Credits: 3. Contact Hours: Lecture 3.

General principles; drug disposition; drugs acting on the nervous, cardiovascular, renal, gastrointestinal, and endocrine systems. (Typically Offered: Spring)

BMS 7401: Intro to Aquatic Animal Medicine

(Dual-listed with AECL 4010).

Credits: 1.

8-week course. Introductory course with focus on fin fish production, health and medicine. Course content will help define future roles for veterinarians, producers, and service providers. Emphasis will be placed on water-evaluation, anatomy, pathology, infectious diseases, nutrition, regulatory constraints in production, food safety, biosecurity and current research. Field trip to aquaculture facility. (Typically Offered: Spring)

BMS 7403: Behavior of Domestic Animals

Credits: 1. Contact Hours: Lecture 1.

Prereq: Classification in Veterinary Medicine

Normal and abnormal behavior of domestic animals. Offered odd-numbered years. (Typically Offered: Spring)

BMS 7443: Pharmacology and Therapeutics

(Dual-listed with BMS 5430).

Credits: 3. Contact Hours: Lecture 3.

Pharmacology and therapeutic uses of fluids, antimicrobial and antiparasitic drugs, clinical use of veterinary drugs, and adverse drug reactions. (Typically Offered: Fall)

BMS 7490: Independent Study

Credits: 1-5. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

BMS 7496: International Experience

Credits: 1-12. Repeatable.

Prereq: Vet Med classification or permission of instructor

International Preceptorships and Study Abroad Group programs. Opportunities for students to be involved in applied clinical, production, and/or research experiences in international locations. The course consists of 40 hour per week experiential learning opportunities. (Typically Offered: Spring)

Business Administration (BUSAD)

Courses primarily for undergraduates:

BUSAD 1020: Business Learning Team Orientation

Credits: 1. Contact Hours: Lecture 1.

A required orientation for all College of Business Students involved with a Business Learning Team. Review of college and university requirements, transfer credits, academic planning, university policies and deadlines and registration procedures. Includes a consideration of various business majors and careers, tools for success in college including writing skills and presentations from employers, alumni and current students. (Typically Offered: Fall, Spring)

BUSAD 1030: Orientation

Credits: 1. Contact Hours: Lecture 1.

A required orientation for all College of Business students. Review of college and university requirements, transfer credits, academic planning, university policies and deadlines, and registration procedures. Includes group advising for course selection and registration. (Typically Offered: Fall, Spring)

BUSAD 1050: Exploration of Majors & Careers in Business

Credits: 1. Contact Hours: Lecture 1.

Exploration course providing in-depth information and education regarding majors and related careers in business, with the goal for students of making a decision on which business major(s) to pursue. 8 week course. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

BUSAD 2030: Professional Development in Business

Credits: 1. Contact Hours: Lecture 1.

Prereq: Credit or enrollment in BUSAD 1020 or BUSAD 1030

Designed to develop prepared, professional and engaged students directly aligned with current workplace competencies: individual and team strengths, professional branding, developing and implementing a professional job/internship search, resume and other professional job seeking communications, interviewing, evaluating offers, and networking. Team presentations will be a requirement of this course.

BUSAD 2500: Applied Principles of Business

Credits: 3. Contact Hours: Lecture 3.

Introduction to the functional areas of business and how the functional areas are integrated for the purpose of implementing business strategy. Introduces students to decision making tools (spreadsheets and databases) that are integral to business decision making. Includes application exercises to all functional areas of business.

BUSAD 2920: CYstarters 2.0 Entrepreneurship Seminar

Credits: 1. Contact Hours: Lecture 1.

Repeatable, maximum of 3 credits.

Prereq: Instructor Permission for Course

Advanced study of entrepreneurship and student venture coaching, a continuation of the CYstarters summer accelerator experience. This hands-on course provides student entrepreneurs with the resources and support needed to grow their business. Class will include seminars with successful entrepreneurs and professional service providers, goal setting, a formal pitch presentation, group accountability, and mentoring in an immersive experiential environment. Class participants must have completed the 11-week CYstarters summer accelerator experience through the Pappajohn Center for Entrepreneurship. (Typically Offered: Fall, Spring)

BUSAD 3010: Introduction to International Business

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Foundation for international business theory and practices with an emphasis on understanding the intersection of business, culture, politics, law, and economics. Views from both the United States and countries abroad will be presented. (Typically Offered: Fall, Spring)

BUSAD 3910A: Professional Experiential Learning: Domestic Internship

Credits: 1. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

Supervised work experience in a business related discipline. Offered on a satisfactory-fail basis only.

BUSAD 3910B: Professional Experiential Learning: International Internship

Credits: 1. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

Supervised work experience in a business related discipline. Offered on a satisfactory-fail basis only.

BUSAD 3910C: Professional Experiential Learning: Domestic Travel and Study

Credits: 1. Repeatable, maximum of 6 credits.

Supervised travel and study in a business related discipline. Offered on a satisfactory-fail basis only.

BUSAD 3910D: Professional Experiential Learning: International Travel and Study

Credits: 1. Repeatable, maximum of 6 credits.

Supervised travel and study in a business related discipline. Offered on a satisfactory-fail basis only.

BUSAD 3980: Cooperative Education

Credits: Required. Repeatable, maximum of 3 times.

Prereq: Instructor Permission for Course

Required of all cooperative education students engaged in full-time internship/co-op. Students must register for this course prior to commencing each work period. No more than three credits may be taken in addition to BUSAD 3980 during any given semester. Offered on a satisfactory-fail basis only.

BUSAD 4900A: Independent Study: International Business

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

BUSAD 4900C: Independent Study: Consulting, Investment Banking and Related Industries

Credits: 3. Contact Hours: Lecture 1, Laboratory 4.

Prereq: Instructor Permission for Course

Application of course learning to solve real-life business problems. Through the combination of significant experiential-learning activities, online academic lectures and readings, and writing assignments, this course will provide students with unique experiences to enhance skills such as formulating problems, structuring and prioritizing problems, synthesizing results, and communicating intuition from complicated analyses. (Typically Offered: Fall, Spring, Summer)

BUSAD 4900E: Independent Study: Entrepreneurship

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

BUSAD 4900G: Independent Study: General

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Independent Study.

BUSAD 4900H: Independent Study: Honors

Credits: 1-3. Repeatable.

Prereq: Permission of Instructor; Membership in the University Honors Program

BUSAD 4910: Okoboji Entrepreneurship Institute

Credits: 1-3.

Advanced study of entrepreneurship that includes a team-based entrepreneurial simulation, seminars with successful entrepreneurs and business community leaders, a formal pitch presentation, and networking and mentoring in an immersive experiential environment. Students must apply and be selected for participation.

Courses primarily for graduate students, open to qualified undergraduates:

BUSAD 5010: Strategic Management

(Cross-listed with STB 5010).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Admission to the Graduate Program in Seed Technology and Business or Permission of Instructor

Critical analysis of current practice and case studies in strategic management with an emphasis on integrative decision making. Strategy formulation and implementation will be investigated in the context of complex business environments.

BUSAD 5020: Quantitative Business Analysis and Decision Making

Credits: 3. Contact Hours: Lecture 3.

Prereq: Ivy College of Business Graduate Student or instructor permission

Introduction to the sources and statistical analysis of data as well as optimization models for use in making business decisions. Data collection, descriptive and inferential statistics including hypothesis testing, analysis of variance, multiple regression, linear programming and simulation.

BUSAD 5030: Information Systems

(Cross-listed with STB 5030).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Admission to the Graduate Program in Seed Technology and Business or Permission of Instructor

Introduction to a broad variety of information systems (IS) topics, including current and emerging developments in information technology (IT), IT strategy in the context of corporate strategy, and IS planning and development of enterprise architectures. Cases, reading, and discussions highlight the techniques and tactics used by managers to cope with strategic issues within an increasingly technical and data-driven competitive environment.

BUSAD 5040: Marketing and Logistics

(Cross-listed with STB 5040).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Admission to the Graduate Program in Seed Technology and Business or Permission of Instructor

Integration of the business functions concerned with the marketing and movement of goods along the supply chain with the primary goal of creating value for the ultimate customer. Coordination of marketing, production, and logistics activities within the firm and with outside suppliers and customers in the supply chain.

BUSAD 5070: Organizational Behavior

(Cross-listed with STB 5070).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Admission to the Graduate Program in Seed Technology and Business or Permission of Instructor

Understanding human behavior in organizations, and the nature of organizations from a managerial perspective. Special emphasis on how individual differences, such as perceptions, personality, and motivation, influence individual and group behavior in organizations and on how behavior can be influenced by job design, leadership, groups, and the structure of organizations.

BUSAD 5080: Accounting and Finance

(Cross-listed with STB 5080).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Admission to the Graduate Program in Seed Technology and Business or Permission of Instructor

Survey of fundamental topics in accounting and finance. Financial statement reporting and analysis for agriculture firms, corporate governance issues related to financial reporting, (e.g., Sarbanes-Oxley). Basic tools and techniques used in financial management, including stock and bond valuation. How to assess and use capital budgeting methods to evaluate proposed firm investments.

BUSAD 5090: International Seed Business Practices, Policies, & Regulation

(Cross-listed with STB 5090).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Admission to the Graduate Program in Seed Technology and Business or Permission of Instructor

Cultural, financial, economic, political, legal/regulatory environments shaping an organization's international business strategy. Topics include entry (and repatriation) of people, firms, goods, services, and capital. Special attention to the institutions of seed regulation and policy. Ethical issues facing managers operating in an international context.

BUSAD 5900: Special Topics in Business

Credits: 3. Repeatable.

Prereq: Department Permission for Course

A special topics course covering contemporary issues in business. Topics vary by semester.

BUSAD 5910: Professional Experiential Learning

Credits: 1-5. Repeatable.

Prereq: Permission of Instructor; Permission of Department Chair

Academically supervised travel and/or work experiences in a business related discipline.

BUSAD 5920: MBA Professional Skills Development

Credits: 1.5. Contact Hours: Lecture 1.5.

Prereq: Enrolled in MBA program

Provides first-year MBA students with tools necessary to develop and implement a successful internship and career search, and to develop professional skills critical for success in the competitive business environment. Topics include career search strategy, resume and cover letter development, interviewing, strategic networking, salary negotiation, impression management, team skills development, presentation skills development, and business etiquette. Required for all full-time MBA students. Offered on a satisfactory-fail basis only.

BUSAD 5930: Business Specialty Masters Seminar

Credits: Required. Contact Hours: Lecture 1.

Prereq: College of Business Graduate Student

Provides incoming specialty masters students in the Ivy College of Business with an introduction to college and program resources in the areas of student services, career services, and program support. Required for all full-time residential Ivy masters students. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

BUSAD 5940: MBA Professional Skills Development II

Credits: 1.5. Contact Hours: Lecture 1.5.

Prereq: BUSAD 5920

A second course designed to improve the professional skills of first-year MBA students. Emphasis on building effective communications and networking skills. Students will participate in professional workshops, company visits, executive speaker seminars, service learning projects, business case competitions, and related activities. Offered on a satisfactory-fail basis only.

BUSAD 5950X: Executive Analysis and Presentation

(Dual-listed with MIS 4950/ SCM 4950).

Credits: 3. Contact Hours: Lecture 3.

Prereq: College of Business Graduate Student

This is a hands-on course where students analyze real business problems and develop strategic recommendations for senior management. Through case studies and real-world examples, students will hone their analytical skills, learn to identify key issues, evaluate various stakeholders' perspectives, and propose actionable solutions that align with organizational goals. This course prepares students for leadership roles, equipping them with critical thinking and problem-solving skills necessary to significantly impact the business world. (Typically Offered: Fall, Spring)

BUSAD 5960: Professional Development and Executive Communications

Credits: 3. Contact Hours: Lecture 3.

Prereq: College of Business Graduate Student

Refine executive business core competencies through professional development topics, a speaker series and individualized coaching. The course is designed to enhance existing professional communication skill sets for emerging leaders. Various communication focuses may include: executive presentations, communication strategies, and other topics relevant to working professionals. (Typically Offered: Summer)

BUSAD 5970: Part-Time Cooperative Education

Credits: Required. Repeatable.

Prereq: Department Permission for Course

Career development growth through a process of analyzing and reporting experiential learning endeavors. Students may complete this course during or pursuant to completion of a summer- or semester-length internship or co-op experience. International students must have completed two graduate course semesters at Iowa State University before taking the course. Offered on a satisfactory-fail basis only.

BUSAD 5980: Cooperative Education

Credits: Required. Repeatable.

Prereq: Department Permission for Course

Professional work experience. Students must register for this course prior to commencing work. Offered on a satisfactory-fail basis only.

BUSAD 5990A: Creative Component: Accounting

Credits: 3. Repeatable.

Prereq: Department Permission for Course

Preparation and writing of creative component.

BUSAD 5990C: Creative Component: Finance

Credits: 3. Repeatable.

Prereq: Department Permission for Course

Preparation and writing of creative component.

BUSAD 5990E: Creative Component: Management

Credits: 3. Repeatable.

Prereq: Department Permission for Course

Preparation and writing of creative component.

BUSAD 5990F: Creative Component: Marketing

Credits: 3. Repeatable.

Prereq: Instructor Permission for Course

Preparation and writing of creative component.

BUSAD 5990I: Creative Component: Agribusiness

Credits: 3. Repeatable.

Prereq: Department Permission for Course

Preparation and writing of creative component.

BUSAD 5990J: Creative Component: General Business

Credits: 3. Repeatable.

Prereq: Department Permission for Course

Preparation and writing of creative component.

BUSAD 5990K: Creative Component: Management Information Systems

Credits: 3. Repeatable.

Prereq: Department Permission for Course

Preparation and writing of creative component.

BUSAD 5990L: Creative Component: Supply Chain Management

Credits: 3. Repeatable.

Prereq: Department Permission for Course

Preparation and writing of creative component.

Courses for graduate students:**BUSAD 6440: Business Research Methods**

Credits: 3. Contact Hours: Lecture 3.

Prereq: In PhD program in the College of Business or Permission of Instructor

A survey of the wide variety of research methods used in business.

Methods will be presented and discussed with emphasis on applicability in different research situations. (Typically Offered: Fall)

BUSAD 6990: Research

Credits: 3-6. Repeatable.

Prereq: Ivy College of Business PhD student or instructor permission

Research. (Typically Offered: Fall, Spring, Summer)

Chemical Engineering (CHE)

Courses primarily for undergraduates:**CHE 1040: Chemical Engineering Learning Community**

Credits: Required. Contact Hours: Lecture 1.

Curriculum in career planning and academic course support for Freshmen learning team. (Typically Offered: Fall)

CHE 1600: Chemical Engineering Problems with Computer Applications Laboratory

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: (MATH 1430 or satisfactory scores on mathematics placement examinations) AND (MATH 1650 or satisfactory scores on mathematics placement examinations)

Formulation and solution of engineering problems. Significant figures.

Use of SI units. Graphing and curve-fitting. Flowcharting. Introduction

to material balances, engineering economics, and design. Use of

spreadsheet programs to solve and present engineering problems.

Solution of engineering problems using computer programming

languages. Chemical Engineering examples. Satisfactory placement

scores can be found at: [https://math.iastate.edu/academics/](https://math.iastate.edu/academics/undergraduate/aleks/placement/)

undergraduate/aleks/placement/. Graduation Restriction: Only one of

ENGR 1600, ABE 1600, AERE 1600, CHE 1600, CE 1600, CPRE 1850,

EE 1850, IE 1480, ME 1600, and SE 1850 may count towards graduation.

(Typically Offered: Fall, Spring)

CHE 2020: Chemical Engineering Seminar

Credits: Required. Contact Hours: Lecture 1.

Professionalism in the context of the engineering/technical workplace.

Introduction to chemical engineering career opportunities. Process and

workplace safety. Development and demonstration of key workplace

competencies: teamwork, professionalism and ethical responsibility,

ability to engage in life-long learning, and knowledge of contemporary

issues. Resumes; professional portfolios; preparation for internship

experiences. Restricted to CHE majors. Offered on a satisfactory-fail

basis only. (Typically Offered: Fall, Spring, Summer)

CHE 2040: Chemical Engineering Continuing Learning Community

Credits: Required. Contact Hours: Lecture 1.

Curriculum and career planning, academic course support for learning community.

CHE 2050: Chemical Engineering Progress Assessment

Credits: Required. Contact Hours: Lecture 1.

Prereq: CHEM 1780, MATH 1660, CHE 1600

Assessment of proficiency in general chemistry, calculus (including

infinite series and applications of derivatives and integrals), and material

balances, and an ability to use the principles of science and mathematics

to identify, formulate, and solve engineering problems. Offered on a

satisfactory-fail basis only. (Typically Offered: Fall, Spring)

CHE 2100: Material and Energy Balances

Credits: 3. Contact Hours: Lecture 3.

Prereq: CHEM 1780, MATH 1660, CHE 1600

Introduction to chemical processes. Physical behavior of gases, liquids,

and solids. Application of material and energy balances to chemical

engineering equipment and processes. (Typically Offered: Fall, Spring)

CHE 2200: Introduction to Biomedical Engineering

(Cross-listed with BME 2200).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2120; (CHEM 1670 or CHEM 1770); (ABE 1600 or AERE 1600 or BME 1600 or CE 1600 or CHE 1600 or CPRE 1850 or EE 1850 or ENGR 1600 or IE 1480 or ME 1600 or SE 1850); MATH 1660; PHYS 2320

Engineering analysis of basic biology and engineering problems associated with living systems and health care delivery. The course will illustrate biomedical engineering applications in such areas as: biotechnology, biomechanics, biomaterials and tissue engineering, and biosignal and image processing, and will introduce the basic life sciences and engineering concepts associated with these topics. (Typically Offered: Fall, Spring)

CHE 2900: Introduction to Undergraduate Research/Independent Study

Credits: 1. Repeatable, maximum of 2 credits.

Prereq: Instructor Permission for CHE Course

Introduction to independent study with emphasis on skills necessary to pursue further independent study of a topic of special interest to student and faculty. Topics may include introductions to laboratory safety, standard operating procedures, design of experiments, data analysis, computational methods, literature searches, and professional communications. Pre-enrollment contract between student and instructor required. Graduation Restriction: Not applicable to the B.S. in Chemical Engineering degree. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

CHE 3100: Computational Methods in Chemical Engineering

Credits: 3. Contact Hours: Lecture 3.

Prereq: CHE 1600, CHE 2050, CHE 2100, MATH 2650

Numerical methods for solving systems of linear and nonlinear equations, ordinary differential equations, numerical differentiation and integration, and nonlinear regression using chemical engineering examples. (Typically Offered: Fall, Spring)

CHE 3250: Chemical Engineering Laboratory I

Credits: 2. Contact Hours: Laboratory 4.

Prereq: CHE 3570; CHE 3810; (STAT 2310 or STAT 3050); (Credit or concurrent enrollment in ENGL 3090 or ENGL 3120 or ENGL 3140 or JLMC 3470)

Experiments covering fundamental material and energy balances, momentum and energy transport operations, and thermodynamics. Computer applications. (Typically Offered: Fall, Spring)

CHE 3560: Transport Phenomena I

Credits: 3. Contact Hours: Lecture 3.

Prereq: CHE 2050 AND CHE 2100 AND (PHYS 2310 or PHYS 2310H) AND PHYS 2310L AND (credit or concurrent enrollment in MATH 2670)

Momentum and mechanical energy balances. Incompressible and compressible fluid flow. Applications to fluid drag, piping system design, filtration, packed beds and settling. (Typically Offered: Fall, Spring)

CHE 3570: Transport Phenomena II

Credits: 3. Contact Hours: Lecture 3.

Prereq: CHE 3560

Conduction and diffusion, convective heat and mass transfer, boiling and condensation, radiation, and design of heat exchange equipment. Introduction to diffusion. Graduation Restriction: Credit for only FSHN 3510 or CHE 3570 may be applied toward graduation for the Food Science major or Food Science minor. (Typically Offered: Fall, Spring)

CHE 3580: Separations

Credits: 3. Contact Hours: Lecture 3.

Prereq: CHE 3100, CHE 3570, and CHE 3810

Diffusion and mass transfer in fluids. Analysis and design of continuous contacting and multistage separation processes. Binary and multicomponent distillation, absorption, extraction, evaporation, membrane processes, and simultaneous heat and mass transfer. (Typically Offered: Fall, Spring)

CHE 3810: Chemical Engineering Thermodynamics

Credits: 3. Contact Hours: Lecture 3.

Prereq: CHE 2020, MATH 2670, PHYS 2320, CHEM 3250 and Credit or concurrent enrollment in CHE 3100 and PHYS 2320L

Application of thermodynamic principles to chemical engineering problems. Thermodynamic properties of fluids, phase equilibria, and chemical reaction equilibria. (Typically Offered: Fall, Spring)

CHE 3820: Chemical Reaction Engineering

Credits: 3. Contact Hours: Lecture 3.

Prereq: CHE 3100, CHE 3810; credit or enrollment in CHE 3570

Kinetics of chemical reactions. Design of homogeneous and heterogeneous chemical reactors. (Typically Offered: Fall, Spring)

CHE 3910: Foreign Study Orientation

Credits: 3. Contact Hours: Lecture 3.

Prereq: CHE 3570, CHE 3810; credit or enrollment in ENGL 3140 or ENGL 3090 or ENGL 3120 or JLMC 3470

Graduation Restriction: Credit for graduation allowable only upon completion of CHE 3920. Meets International Perspectives Requirement. (Typically Offered: Spring)

CHE 3920: Foreign Study Program

Credits: 4. Contact Hours: Lecture 4.

Prereq: CHE 3580, CHE 3820, and CHE 3910

Study of chemical engineering including laboratories and lectures at collaborating international universities. Comparative study of U.S. and international manufacturing facilities. Expenses required. Meets International Perspectives Requirement. (Typically Offered: Summer)

CHE 4060: Environmental Chemodynamics

(Dual-listed with CHE 5060).

Credits: 3. Contact Hours: Lecture 3.

Prereq: CHE 3570 and CHE 3810

Examines the mechanisms and rates of chemical transport across air, water, and soil interfaces. Applications of transport and thermodynamic fundamentals to movement of chemicals in the environment.

CHE 4080: Surface and Colloid Chemistry

(Dual-listed with CHE 5080).

Credits: 3. Contact Hours: Lecture 3.

Prereq: CHE 3810

Examines the factors underlying interfacial phenomena, with an emphasis on the thermodynamics of surfaces, structural aspects, and electrical phenomena. Application areas include emulsification, foaming, detergency, sedimentation, fluidization, nucleation, wetting, adhesion, flotation, and electrophoresis.

CHE 4100: Electrochemical Engineering

(Dual-listed with CHE 5100).

Credits: 3. Contact Hours: Lecture 3.

Prereq: CHE 3570, CHE 3810, and CHE 3820

Electrochemical engineering principles in thermodynamics, electrode kinetics, charge and mass transport; modeling and simulation; electrocatalysis; electrochemical reactions; applications of electrochemical engineering in fuel cells, batteries and electrolyzers. (Typically Offered: Fall)

CHE 4120: Core Concepts in Chemical Engineering

Credits: 3. Contact Hours: Lecture 3.

Prereq: CHEM 3250; MATH 2670; PHYS 2310 or PHYS 2310H; PHYS 2310L

Survey of the engineering science fundamentals in chemical engineering. Topics include material balances, energy balances, thermodynamics, transport phenomena, and reaction engineering. Graduation Restriction: Credit for CHE 4120 may not be applied to any undergraduate or graduate degree programs in chemical engineering. (Typically Offered: Spring, Summer)

CHE 4150: Biochemical Engineering

(Dual-listed with CHE 5150).

Credits: 3. Contact Hours: Lecture 3.

Prereq: CHE 3570, CHEM 3310; BBMB 3010 or BBMB 3030 or BBMB 4040

Application of basic chemical engineering principles in biochemical and biological process industries such as enzyme technology and fermentation.

CHE 4200: Chemical Process Safety

Credits: 3. Contact Hours: Lecture 3.

Prereq: CHE 3570 and CHE 3810

Application of transport phenomena, thermodynamics, and chemical kinetics to the study of safety, health, and loss prevention. Government regulations, industrial hygiene, relief sizing, runaway reactions, toxic release, and dispersion models will be used. Fires, explosions, risk assessment, hazard identification, case studies, accident investigations, and design considerations will be studied. (Typically Offered: Fall, Spring)

CHE 4210: Process Control

Credits: 3. Contact Hours: Lecture 3.

Prereq: CHE 3580, CHE 3820, and MATH 2670

Control of industrial chemical processes. Device applications and limitations. Dynamics of chemical process components and process control systems. (Typically Offered: Fall, Spring)

CHE 4260: Chemical Engineering Laboratory II

Credits: 2. Contact Hours: Laboratory 4.

Prereq: CHE 3250, CHE 3580, and CHE 3820

Experiments in heat and mass transfer, staged operations, chemical reactor performance, unit processes. Computer applications. Graduation Restriction: Only one of CHE 4260 or 4270 may count toward graduation. (Typically Offered: Fall, Spring)

CHE 4270: Biological Engineering Laboratory

Credits: 2. Contact Hours: Laboratory 4.

Prereq: CHE 3250, CHE 3580, CHE 3820; BBMB 3010 or BBMB 3030 or BBMB 4040

Experiments on biological applications in chemical engineering. (Typically Offered: Spring)

CHE 4290: Chemical Engineering Product Design

Credits: 3. Contact Hours: Lecture 3.

Prereq: CHE 3580 and CHE 3820

Application of core chemical engineering concepts to product design. Market and economic analysis, and technical feasibility. Literature and intellectual property search. Environmental, regulatory, and safety considerations. (Typically Offered: Fall, Spring)

CHE 4300: Process and Plant Design

Credits: 4. Contact Hours: Lecture 2, Laboratory 6.

Prereq: CHE 3580 and CHE 3820

Synthesis of chemical engineering processes, equipment and plants. Cost estimation and feasibility analysis. (Typically Offered: Fall, Spring)

CHE 4400: Biomedical Applications of Chemical Engineering

(Dual-listed with CHE 5400). (Cross-listed with BME 4400).

Credits: 3. Contact Hours: Lecture 3.

Prereq: CHE 2100 or CHE 2200, MATH 2660 or MATH 2670, PHYS 2320

Applications of material and energy balances, transport phenomena, chemical reaction engineering, and thermodynamics to problems in biomedical engineering and applied physiology; survey of biomedical engineering; biomaterials; biomedical imaging.

CHE 4470: Polymers and Polymer Engineering

(Dual-listed with CHE 5470).

Credits: 3. Contact Hours: Lecture 3.

Prereq: CHEM 3310; CHE 3820 or MATE 3510

Chemistry of polymers, addition and condensation polymerization. Physical and mechanical properties, polymer rheology, production methods. Applications of polymers in the chemical industry.

CHE 4900: Undergraduate Research/Independent Study

Credits: 1-6. Repeatable, maximum of 6 credits.

Prereq: Department Permission for CHE Course

Investigation of topics of special interest to student and faculty with a final written report or presentation. Election of course and topic must be approved in advance by Department with completion of Study Proposal. Graduation Restriction: No more than 6 credits of CHE 4900 may be counted towards technical electives.

CHE 4900H: Undergraduate Research/Independent Study: Honors

Credits: 1-6. Repeatable, maximum of 6 credits.

Prereq: Department Permission for Course; Membership in the University Honors Program

Investigation of topics of special interest to student and faculty with a final written report or presentation. Election of course and topic must be approved in advance by Department with completion of Study Proposal. Graduation Restriction: No more than 6 credits of CHE 4900 may be counted towards technical electives.

CHE 4990: Applied Industrial Research

Credits: 3. Repeatable, maximum of 6 credits.

Prereq: CHE 2050; CHE 2100; Permission of Instructor

Application of core chemical engineering concepts to solve industrially-sponsored process design problems in teams. Introduction to literature review and analysis, intellectual property, and project management. (Typically Offered: Fall, Spring)

Courses primarily for graduate students, open to qualified undergraduates:

CHE 5060: Environmental Chemodynamics

(Dual-listed with CHE 4060).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Examines the mechanisms and rates of chemical transport across air, water, and soil interfaces. Applications of transport and thermodynamic fundamentals to movement of chemicals in the environment. (Typically Offered: Fall, Spring, Summer)

CHE 5080: Surface and Colloid Chemistry

(Dual-listed with CHE 4080).

Credits: 3. Contact Hours: Lecture 3.

Prereq: CHE 3810 or graduate standing

Examines the factors underlying interfacial phenomena, with an emphasis on the thermodynamics of surfaces, structural aspects, and electrical phenomena. Application areas include emulsification, foaming, detergency, sedimentation, fluidization, nucleation, wetting, adhesion, flotation, and electrophoresis. Term project required for graduate credit.

CHE 5100: Electrochemical Engineering

(Dual-listed with CHE 4100).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (CHE 3570, CHE 3810, and CHE 3820) or graduate standing

Electrochemical engineering principles in thermodynamics, electrode kinetics, charge and mass transport; modeling and simulation; electrocatalysis; electrochemical reactions; applications of electrochemical engineering in fuel cells, batteries and electrolyzers. (Typically Offered: Fall)

CHE 5150: Biochemical Engineering

(Dual-listed with CHE 4150).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Application of basic chemical engineering principles in biochemical and biological process industries such as enzyme technology and fermentation.

CHE 5400: Biomedical Applications of Chemical Engineering

(Dual-listed with BME 4400/ CHE 4400).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (CHE 2100 or CHE 2200, MATH 2660 or MATH 2670, PHYS 2320) or graduate standing

Applications of material and energy balances, transport phenomena, chemical reaction engineering, and thermodynamics to problems in biomedical engineering and applied physiology; survey of biomedical engineering; biomaterials; biomedical imaging.

CHE 5420: Polymeric Biomaterials

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Polymeric biomaterials, overview of biomaterial requirements, different classes of polymers used as biomaterials, specific bioapplications of polymers.

CHE 5450: Analytical and Numerical Methods

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Analysis of equipment and processes by analytic and/or numerical solution of descriptive differential equations. Operational and series techniques, boundary value problems, numerical interpolation and approximation, integration techniques. (Typically Offered: Fall)

CHE 5470: Polymers and Polymer Engineering

(Dual-listed with CHE 4470).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Chemistry of polymers, addition and condensation polymerization. Physical and mechanical properties, polymer rheology, production methods. Applications of polymers in the chemical industry.

CHE 5540: Integrated Transport Phenomena

Credits: 4. Contact Hours: Lecture 4.

Prereq: Graduate Standing or Permission of Instructor

Conservation equations governing diffusive and convective transport of momentum, thermal energy and chemical species. Transport during laminar flow in conduits, boundary layer flow, creeping flow. Heat and mass transport coupled with chemical reactions and phase change. Scaling and approximation methods for mathematical solution of transport models. Diffusive fluxes; conservation equations for heat and mass transfer; scaling and approximation techniques; fundamentals of fluid mechanics; unidirectional flow; creeping flow; laminar flow at high Reynolds number; forced-convection heat and mass transfer in confined and unconfined laminar flows. (Typically Offered: Fall)

CHE 5620: Bioseparations

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Principles and techniques for separation and recovery of biologically-produced molecules, especially proteins. Relationship between the chemistry of biological molecules and efficient separation and preservation of biological activity. Includes centrifugation and filtration, membrane processing, extraction, precipitation and crystallization, chromatography, and electrophoresis.

CHE 5720: Turbulence

(Cross-listed with AERE 5720).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Qualitative features of turbulence. Statistical representation of turbulent velocity fields: averages, moments, correlations, length and time scales and the energy cascade. Averaged equations of motion, closure requirements, Reynolds averaged models. Homogeneous shear flows, free shear flows, boundary layers. Numerical simulation of turbulence: DNS, LES, DES.

CHE 5800: Introduction of Project Management for Thesis Research

(Cross-listed with MSE 5800/ IE 5800).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Tools and skills of Project Management (PM) adapted from industry to improve efficiency in thesis research. Project charter initiation for thesis, timeline and meeting scheduling tools, expectation management, and communication with advisors. Practice of the PM skills using student's own thesis. Presentation of a project charter. Demonstration of knowledge of related PM skills and the ability of utilizing these skills for thesis research. Sharing thesis ideas and learning experience in the Graduate for Advancing Professional Skills (GAPS) learning community. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

CHE 5830: Advanced Thermodynamics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Application of thermodynamic principles to chemical engineering problems. Thermodynamic properties of non-ideal fluids and solutions; phase and chemical-reaction equilibria/stability. (Typically Offered: Fall)

CHE 5870: Advanced Chemical Reactor Design

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Analysis of complex reactions and kinetics. Fixed bed, fluidized bed, and other industrial reactors. Analysis and design of non-ideal flow mixing, and residence times. Heterogeneous reactors. (Typically Offered: Spring)

CHE 5900: Independent Study

Credits: 2-6. Repeatable.

Prereq: Instructor Permission for Course

Investigation of an approved topic on an individual basis.

CHE 5950A: Special Topics: Separations

Credits: 2-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

CHE 5950B: Special Topics: Advanced Control Theory

Credits: 2-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

CHE 5950C: Special Topics: Crystallization

Credits: 2-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

CHE 5950D: Special Topics: Thermodynamics

Credits: 2-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

CHE 5950E: Special Topics: Protein Engineering/Bioseparations

Credits: 2-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

CHE 5950F: Special Topics: Biological Engineering

Credits: 2-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

CHE 5950G: Special Topics: Materials and Biomaterials

Credits: 2-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

CHE 5950H: Special Topics: Surfaces

Credits: 2-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

CHE 5950I: Special Topics: Combinatorial Design

Credits: 2-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

CHE 5990: Creative Component

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Courses for graduate students:

CHE 6010: Seminar

Credits: Required. Contact Hours: Lecture 1.

Repeatable.

Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

CHE 6250: Metabolic Engineering

Credits: 3. Contact Hours: Lecture 3.

Principles of metabolic engineering. Emphasis on emerging examples in biorenewables and plant metabolic engineering. Overview of biochemical pathways, determination of flux distributions by stoichiometric and labeling techniques; kinetics and thermodynamics of metabolic networks; metabolic control analysis; genetic engineering for overexpression, deregulation, or inhibition of enzymes; directed evolution; application of bioinformatics, genomics, and proteomics.

CHE 6320: Multiphase Flow

(Cross-listed with ME 6320).

Credits: 3. Contact Hours: Lecture 3.

Single particle, multiparticle and two-phase fluid flow phenomena (gas-solid, liquid-solid and gas-liquid mixtures); particle interactions, transport phenomena, wall effects; bubbles, equations of multiphase flow. Dense phase (fluidized and packed beds) and ducted flows; momentum, heat and mass transfer. Computer solutions. Offered even-numbered years. (Typically Offered: Spring)

CHE 6420: Principles and Applications of Molecular Simulation

Credits: 3. Contact Hours: Lecture 3.

Principles of statistical physics. General features of molecular simulations including Monte Carlo (MC) methods, molecular mechanics (MM), and molecular dynamics (MD). Overview of intermolecular and interatomic potentials. Evaluation of phase equilibria, free energies, and surface/interfacial properties. Coarse-grained methods.

CHE 6880: Catalysis and Catalytic Processes

Credits: 3. Contact Hours: Lecture 3.

Principles and applications of heterogeneous and homogeneous catalysis. Adsorption. Reaction kinetics and mass transfer effects. Catalyst characterization. Industrial catalytic processes.

CHE 6920: Independent Study

Credits: 2-6. Repeatable.

Prereq: Instructor Permission for Course

Investigation of an approved topic on an individual basis. Election of course and topic must be approved in advance by Program of Study Committee.

CHE 6950A: Advanced Topics: Separations

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

CHE 6950B: Advanced Topics: Advanced Statistical Modeling and Control

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

CHE 6950C: Advanced Topics: Crystallization

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

CHE 6950D: Advanced Topics: Thermodynamics

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

CHE 6950E: Advanced Topics: Protein Engineering/Bioseparations

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

CHE 6950F: Advanced Topics: Biological Engineering

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

CHE 6950G: Advanced Topics: Materials and Biomaterials

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

CHE 6950H: Advanced Topics: Surfaces

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

CHE 6950I: Advanced Topics: Combinatorial Design

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

CHE 6950J: Advanced Topics: Polymeric and Nanostructured Materials

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

CHE 6950K: Advanced Topics: Biomaterials and Tissue Engineering

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

CHE 6950L: Advanced Topics: Catalysis, Reaction Engineering, and Renewable Energy

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

CHE 6970: Engineering Internship

Credits: Required. Repeatable.

One semester and one summer maximum per academic year professional work period. (Typically Offered: Fall, Spring, Summer)

CHE 6980A: Chemical Engineering Teaching Practicum: Teaching Practicum

Credits: 1. Contact Hours: Lecture 1.

Discussions intended to foster the development of graduate students as teaching assistants and future chemical engineering instructors. Topics include classroom and laboratory instruction, grading, and developing a teaching philosophy. (Typically Offered: Fall)

CHE 6980B: Chemical Engineering Teaching Practicum: Teaching Experience

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Prereq: Instructor Permission for Course

Participation in the instruction of a CHE course under the mentorship of a CBE faculty member. Typical activities may include lecture preparation and delivery, laboratory instruction, design of assessments, problem-solving sessions, office hours, and grading. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

CHE 6990: Research

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Advanced topic for thesis/dissertation. Offered on a satisfactory-fail basis only.

Chemistry (CHEM)

Courses primarily for undergraduates:

CHEM 0500: Preparation for College Chemistry

Credits: 0. Contact Hours: Lecture 2, Discussion 1.

An in-depth active learning experience designed to impart the fundamental concepts and principles of chemistry, with an emphasis on mathematics skills and logical thinking. For students intending to enroll in general chemistry and who have not taken high school chemistry or who have not had a high school college preparatory chemistry course who need a review of chemical problem solving and chemical concepts. 1-year high school algebra recommended. Graduation Restriction: Credit for CHEM 0500 does not count toward graduation. (Typically Offered: Fall, Spring)

CHEM 1010A: Chemistry Learning Community Orientation: On-Campus Orientation

Credits: 1. Contact Hours: Lecture 1.

Integration of first year and transfer students into the chemistry program. Introduction and overview of degree requirements and support services on campus, assistance with transition to college and community life, and team-building and leadership activities. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

CHEM 1010B: Chemistry Learning Community Orientation: Professional Development Opportunities

Credits: 1. Contact Hours: Lecture 1.

Integration of first year and transfer students into the chemistry program. Introduction and overview of degree requirements and support services on campus, assistance with transition to college and community life, and team-building and leadership activities. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

CHEM 1020L: Physical Sciences for Elementary Education

(Cross-listed with PHYS 1020L).

Credits: 3. Contact Hours: Lecture 1, Laboratory 4.

Prereq: Credit or concurrent enrollment in MATH 1950 OR Permission of Instructor

Physical science principles for future elementary teachers. Emphasis on experiments that address current elementary science education standards and that are appropriate for their future students to do, such as measurements of mass, length, time, light from atoms, charge and current, motion due to forces, energy and work, heat, waves, optics, building bridges and making musical instruments, studying states of matter and chemical reactions. (Typically Offered: Fall, Spring)

CHEM 1100: Cutting-Edge Chemistry: Research and Career Opportunities

Credits: 1. Contact Hours: Lecture 1.

Overview of careers in chemistry: industrial, governmental, and academic careers; literature and compound search instruction; professional ethics; and an introduction to joining a research lab. For students majoring or minoring in chemistry or chemistry-related fields. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

CHEM 1600: Chemistry in Modern Society

Credits: 3. Contact Hours: Lecture 3.

Aspects of chemistry visible to a non-scientist in our society. A survey of selected areas of chemistry with emphasis on the interface between chemistry and other fields of human activity. (Typically Offered: Fall, Spring)

CHEM 1630: College Chemistry

Credits: 4. Contact Hours: Lecture 3, Discussion 1.

Prereq: Credit or concurrent enrollment in CHEM 1630L

A general survey of chemistry with an emphasis on conceptual problems for those who are not physical and biological science or engineering majors. Nomenclature, chemical reactions, stoichiometry, atomic structure, periodic properties, chemical bonding, states of matter, solutions, thermochemistry, acid-base theory, oxidation-reduction reactions, basic chemical kinetics, and chemical equilibrium. 1 year of high school algebra and geometry and CHEM 0500 or 1 year of high school chemistry necessary. Graduation Restriction: Only one of CHEM 1630, 1670, 1770, or 2010 may count toward graduation. (Typically Offered: Fall, Spring, Summer)

CHEM 1630L: Laboratory in College Chemistry

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Credit or enrollment for credit in CHEM 1630

Laboratory to accompany CHEM 1630. Must be taken with CHEM 1630. Graduation Restriction: Only one of CHEM 1630L, 1670L, and 1770L may count toward graduation. (Typically Offered: Fall, Spring, Summer)

CHEM 1670: General Chemistry for Engineering Students

Credits: 4. Contact Hours: Lecture 3, Discussion 1.

Principles of chemistry and properties of matter explained in terms of modern chemical theory with emphasis on topics of general interest to the engineer. MATH 1400 or 2 years of high school algebra and 1 year of high school geometry and CHEM 0500 or 1 year of high school chemistry necessary. Graduation Restriction: Only one of CHEM 1630, 1670, 1770, or 2010 may count toward graduation. (Typically Offered: Fall, Spring)

CHEM 1670L: Laboratory in General Chemistry for Engineering

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Credit or enrollment for credit in CHEM 1670

Laboratory to accompany 1670. Graduation Restriction: Only one of CHEM 1630L, 1670L, and 1770L may count toward graduation. (Typically Offered: Fall, Spring)

CHEM 1770: General Chemistry I

Credits: 4. Contact Hours: Lecture 3, Discussion 1.

Prereq: Credit or enrollment in CHEM 1770L

The first semester of a two-semester sequence which explores chemistry at a greater depth and with more emphasis on concepts, problems, and calculations than 1630. Recommended for physical and biological science majors, chemical engineering majors, and all others intending to take 3000-level chemistry courses. Principles and quantitative relationships, stoichiometry, chemical equilibrium, acid-base chemistry, thermochemistry, rates and mechanism of reactions, changes of state, solution behavior, atomic structure, periodic relationships, chemical bonding. Chemistry and Biochemistry majors may consider taking CHEM 2010. MATH 1400 or 2 years of high school algebra and 1 year of high school geometry and CHEM 0500 or 1 year of high school chemistry necessary. Graduation Restriction: Only one of CHEM 1630, 1670, 1770, or 2010 may count toward graduation. (Typically Offered: Fall, Spring, Summer)

CHEM 1770L: Laboratory in General Chemistry I

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Credit or concurrent enrollment in CHEM 1770

Laboratory to accompany 1770. 1770L must be taken with 1770. Graduation Restriction: Only one of CHEM 1630L, 1670L, and 1770L may count toward graduation. (Typically Offered: Fall, Spring, Summer)

CHEM 1770N: Laboratory in General Chemistry I

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Credit or concurrent enrollment in CHEM 1770

Laboratory to accompany CHEM 1770. CHEM 1770N must be taken with CHEM 1770. For Chemistry and Biochemistry majors. Laboratory to accompany CHEM 1770. CHEM 1770N must be taken with CHEM 1770. Graduation Restriction: Only one of CHEM 1630, 1670, 1770, or 2010 may count toward graduation. (Typically Offered: Fall)

CHEM 1780: General Chemistry II

Credits: 3. Contact Hours: Lecture 2, Discussion 1.

Prereq: CHEM 1630 or CHEM 1670 or (CHEM 1770; CHEM 1770L)

Continuation of 1770. Recommended for physical or biological science majors, chemical engineering majors, and all others intending to take 3000-level chemistry courses. (Typically Offered: Fall, Spring, Summer)

CHEM 1780L: Laboratory in College Chemistry II

Credits: 1. Contact Hours: Laboratory 3.

Prereq: CHEM 1770L and (Credit or concurrent enrollment in CHEM 1780)

Laboratory to accompany 1780. 1780L is not a necessary co-requisite with 1780. (Typically Offered: Fall, Spring, Summer)

CHEM 2010: Advanced General Chemistry

Credits: 5. Contact Hours: Lecture 4, Discussion 1.

Prereq: Credit or concurrent enrollment in MATH 1650 or MATH 1660 or MATH 2650; concurrent enrollment in CHEM 2010L

A one-semester course in general chemistry designed to give students an in-depth, broad-based view of modern chemistry, and, in part, to facilitate participation in independent undergraduate research. Topics include stoichiometry, atomic and molecular structure, chemical bonding, kinetics, chemical equilibria, and thermodynamics. Discussion of current trends in various chemical disciplines, which may be given by guest experts in chemistry, biochemistry, and chemical engineering, will help the student appreciate the scope of the chemical sciences and how research is carried out. One year HS chemistry and one year HS physics, or advanced chemistry necessary. Graduation Restriction: Only one of CHEM 1630L, 1670L, and 1770L may count toward graduation. (Typically Offered: Fall)

CHEM 2010L: Laboratory in Advanced General Chemistry

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Credit or concurrent enrollment in CHEM 2010

Laboratory to accompany 2010. Introductory lab experience in synthesis and analysis to prepare students for research activities. 2010L must be taken with 2010. Graduation Restriction: Only one of 1630L, 1670L, 1770L, 1770N or 2010L may count toward graduation. (Typically Offered: Fall)

CHEM 2110: Quantitative and Environmental Analysis

Credits: 2. Contact Hours: Lecture 2.

Prereq: (CHEM 1630 and CHEM 1630L) or (CHEM 1780) or (CHEM 2010 and CHEM 2010L); concurrent enrollment in CHEM 2110L

Theory and practice of elementary volumetric, chromatographic, electrochemical and spectrometric methods of analysis. Chemical equilibrium, sampling, and data evaluation. Emphasis on environmental analytical chemistry; the same methods are widely used in biological and materials sciences as well. (Typically Offered: Fall, Spring)

CHEM 2110L: Quantitative and Environmental Analysis Laboratory

Credits: 2. Contact Hours: Laboratory 6.

Prereq: Credit or enrollment for credit in CHEM 2110

Introductory laboratory experience in volumetric, spectrometric, electrochemical and chromatographic methods of chemical analysis. (Typically Offered: Fall, Spring)

CHEM 2310: Elementary Organic Chemistry

Credits: 3. Contact Hours: Lecture 3.

Prereq: (CHEM 1630; CHEM 1630L) or (CHEM 1770; CHEM 1770L) or CHEM 1670; credit or concurrent enrollment in CHEM 2310L

A survey of modern organic chemistry including nomenclature, structure and bonding, and reactions of hydrocarbons and important classes of natural and synthetic organic compounds. For students desiring only an elementary course in organic chemistry. Students in physical or biological sciences and premedical or pre-veterinary curricula should take the full year sequence 3310 and 3320 (with the accompanying laboratories 3310L and 3320L). Graduation Restriction: Only one of CHEM 2310 and 3310 or BBMB 2210 may count toward graduation. (Typically Offered: Fall, Spring, Summer)

CHEM 2310L: Laboratory in Elementary Organic Chemistry

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Credit or concurrent enrollment in CHEM 2310; (CHEM 1630L or CHEM 1770L)

Laboratory to accompany 2310. 2310L must be taken with 2310. Graduation Restriction: Only one of CHEM 2310L and 3310L may count toward graduation. (Typically Offered: Fall, Spring, Summer)

CHEM 2980: Cooperative Education

Credits: Required. Repeatable.

Prereq: Permission of the department cooperative education coordinator; sophomore classification

Required of all cooperative education students. Students must register for this course prior to commencing each work period. (Typically Offered: Fall, Spring, Summer)

CHEM 2990: Undergraduate Research (for Freshmen and Sophomores)

Credits: 1-30. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

CHEM 3010: Inorganic Chemistry

Credits: 2. Contact Hours: Lecture 2.

Prereq: CHEM 3240

Atomic and molecular structure and bonding principles; molecular shapes and symmetry; acids and bases; solid-state structures and properties; inorganic chemistry of H, B, C. (Typically Offered: Spring)

CHEM 3160: Instrumental Methods of Chemical Analysis

Credits: 2. Contact Hours: Lecture 2.

Prereq: CHEM 2110, CHEM 2110L, MATH 1660, and concurrent enrollment in CHEM 3160L

Quantitative and qualitative instrumental analysis. Operational theory of instruments, atomic and molecular absorption and emission spectroscopy, electroanalysis, mass spectrometry, liquid and gas chromatography, electrophoresis, literature of chemical analysis. PHYS 2320 recommended. (Typically Offered: Fall)

CHEM 3160L: Instrumental Analysis Laboratory

Credits: 2. Contact Hours: Laboratory 6.

Prereq: Credit or enrollment in CHEM 3160

Advanced laboratory experience in UV-visible spectrophotometry, atomic absorption and emission spectrometry, electrochemistry, gas and liquid chromatography, electrophoresis, mass spectrometry, and other instrumental methods. (Typically Offered: Fall)

CHEM 3210L: Laboratory in Physical Chemistry

Credits: 2. Contact Hours: Lecture 1, Laboratory 3.

Prereq: Credit or enrollment in CHEM 3240 or CHEM 3250

Error analysis; use of computers for interfacing to experiments and for data analysis; thermodynamics, infrared and optical spectroscopy, lasers. Not applicable towards the B.S. degree in Chemistry. Graduation Restriction: Only one of CHEM 3210L and 3202L may count toward graduation. (Typically Offered: Spring)

CHEM 3220L: Laboratory in Physical Chemistry

Credits: 3. Contact Hours: Lecture 1, Laboratory 6.

Prereq: CHEM 3240 or CHEM 3250

Error analysis; use of computers for interfacing to experiments and for data analysis; thermodynamics, surface science, infrared and optical spectroscopy, lasers. Graduation Restriction: Only one of CHEM 3210L and 3220L may count toward graduation. (Typically Offered: Spring)

CHEM 3240: Introductory Quantum Mechanics

Credits: 3. Contact Hours: Lecture 3.

Prereq: CHEM 1780; MATH 1660; PHYS 2320

Quantum mechanics, atomic and molecular structure, spectroscopy, kinetic theory of gases, chemical kinetics. (Typically Offered: Fall, Spring)

CHEM 3250: Chemical Thermodynamics

Credits: 3. Contact Hours: Lecture 3.

Prereq: CHEM 1780; MATH 1660; PHYS 2320

Classical thermodynamics 1st, 2nd, and 3rd laws with applications to gases and interfacial systems, multicomponent, multiphase equilibrium of reacting systems, surface chemistry, and electrochemical cells. Students taking a two-semester physical chemistry sequence are advised to take 3240 first; in the spring semester, a molecular-based section of this course, stressing statistical thermodynamics, is offered for which knowledge of 3240 is useful. (Typically Offered: Fall, Spring)

CHEM 3260: Chemical Kinetics

Credits: 1. Contact Hours: Lecture 1.

Prereq: CHEM 1670, CHEM 1770, CHEM 1780 or CHEM 2010 and MATH 1660

Kinetic theory, rate laws, temperature dependence of rate constants, transition-state theory, reaction mechanisms, kinetic isotope effects, catalysts, Michaelis-Menten kinetics, and Marcus theory. CHEM 3240 and CHEM 3250 recommended. (Typically Offered: Spring)

CHEM 3310: Organic Chemistry I

Credits: 3. Contact Hours: Lecture 3.

Prereq: CHEM 1780 or CHEM 2010

The first half of a two-semester sequence. Modern organic chemistry including nomenclature, synthesis, structure and bonding, reaction mechanisms. For students majoring in physical and biological sciences, premedical and pre-veterinary curricula, chemistry and biochemistry. Students desiring only one semester of organic chemistry should take 2310 and 2310L, not 3310. (Typically Offered: Fall, Spring, Summer)

CHEM 3310L: Laboratory in Organic Chemistry I

Credits: 1. Contact Hours: Laboratory 3.

Prereq: CHEM 1770L or CHEM 2010L; credit or enrollment for credit in CHEM 3310

Laboratory to accompany 3310. Chemistry and biochemistry majors are encouraged to take 3330L. Graduation Restriction: Only one of CHEM 2310L and 3310L may count toward graduation. (Typically Offered: Fall, Spring, Summer)

CHEM 3320: Organic Chemistry II

Credits: 3. Contact Hours: Lecture 3.

Prereq: CHEM 3310

Continuation of 3310. Modern organic chemistry including nomenclature, synthesis, structure and bonding, reaction mechanisms, natural products, carbohydrates and proteins. For students majoring in physical and biological sciences, premedical and pre-veterinary curricula, chemistry and biochemistry. Enrollment in CHEM 3320L highly recommended. (Typically Offered: Fall, Spring, Summer)

CHEM 3320L: Laboratory in Organic Chemistry II

Credits: 1. Contact Hours: Laboratory 3.

Prereq: CHEM 3310L AND (credit or concurrent enrollment in CHEM 3320)

Laboratory to accompany 3320. Chemistry and biochemistry majors are encouraged to take 3340L. (Typically Offered: Fall, Spring, Summer)

CHEM 3330L: Laboratory in Organic Chemistry I (for Chemistry and Biochemistry Majors)

Credits: 2. Contact Hours: Laboratory 6.

Prereq: Credit or enrollment for credit in CHEM 3310

Laboratory to accompany 3310 for chemistry and biochemistry majors. (Typically Offered: Fall)

CHEM 3340L: Laboratory in Organic Chemistry II (for Chemistry and Biochemistry Majors)

Credits: 2. Contact Hours: Laboratory 6.

Prereq: CHEM 3330L, credit or enrollment for credit in CHEM 3320

Laboratory to accompany 3320 for chemistry and biochemistry majors. (Typically Offered: Spring)

CHEM 3980: Cooperative Education

Credits: Required. Repeatable.

Prereq: Permission of Department Cooperative Education Coordinator; Junior classification

Required of all cooperative education students. Students must register for this course prior to commencing each work period. (Typically Offered: Fall, Spring, Summer)

CHEM 3990: Undergraduate Research

Credits: 1-30. Repeatable.

Prereq: Permission of Instructor; Sophomore classification

A comprehensive research report, describing the work performed, the justification or purpose of the research work, the results obtained, and including appropriate literature references/citations must be submitted to the undergraduate chemistry office and the research faculty member. Reports must contain a title, abstract, introduction, procedural details (experimental, computational, or theoretical), results, discussion, and references. Graduation Restriction: No more than six total credits of CHEM 3990 and CHEM 4990 may count toward graduation. Credits earned in 3990/4990/4900 may only be used to meet one of the advanced course requirements for the B.S. degree.

CHEM 4010L: Inorganic Chemistry Laboratory

Credits: 1. Contact Hours: Laboratory 3.

Prereq: CHEM 4020

Preparation and characterization of inorganic and organometallic compounds by modern techniques. For students majoring in chemistry or biochemistry. (Typically Offered: Spring)

CHEM 4020: Advanced Inorganic Chemistry

Credits: 3. Contact Hours: Lecture 3.

Prereq: CHEM 3010

Chemistry of the d and f metals. Structure, bonding, electronic spectra, and reaction mechanisms. Aspects of organometallic solid state and bioinorganic chemistry. CHEM 3310 recommended. (Typically Offered: Fall)

CHEM 4900: Independent Study

Credits: 1-30. Repeatable.

Prereq: 6 credits in CHEM at 3000 level or higher; Permission of Instructor

Graduation Restriction: No more than 9 credits of CHEM 4900 may count toward graduation.

CHEM 4980: Cooperative Education

Credits: Required. Repeatable.

Prereq: Permission of Department Cooperative Education Coordinator; Senior classification

Required of all cooperative education students. Students must register for this course prior to commencing each work period. (Typically Offered: Fall, Spring, Summer)

CHEM 4990: Senior Research

Credits: 2-3. Repeatable, maximum of 6 credits.

Prereq: 3.0 GPA in CHEM, PHYS, and MATH courses; Permission of Instructor

Research in chosen area of chemistry. This course should be elected for two consecutive semesters. For students majoring in chemistry. A comprehensive and formal research report/senior thesis, describing the work performed, the justification or purpose of the research work, the results obtained, and including appropriate literature references/citations must be submitted to the undergraduate chemistry office and the research faculty member. Reports must contain a title, abstract, introduction, procedural details (experimental, computational, or theoretical), results, discussion, and references. Graduation Restriction: No more than six total credits of CHEM 3990 and CHEM 4990 may count toward graduation.

Courses primarily for graduate students, open to qualified undergraduates:**CHEM 5010L: Inorganic Preparations**

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Preparation and characterization of inorganic and organometallic compounds by modern research techniques. (Typically Offered: Fall)

CHEM 5020: Advanced Inorganic Chemistry

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Chemistry of the main group (s, p) and transition (d, f) metals. Structure, bonding, electronic spectra, and reaction mechanisms. Aspects of organometallic, solid state, bioinorganic, and nano chemistry. (Typically Offered: Fall)

CHEM 5050: Physical Inorganic Chemistry

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Elementary group theory and molecular orbital theory applied to inorganic chemistry. Spectroscopic methods of characterization of inorganic compounds and organometallic compounds. (Typically Offered: Fall)

CHEM 5110: Advanced Analytical Chemistry

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

General methods of quantitative inorganic and organic analysis. Aqueous and nonaqueous titrimetry; selective reagents; sampling and sample dissolution; modern instrumentation; sensors; atomic and molecular microscopy; bioanalytical methods; data evaluation; chemometrics; and analytical literature. (Typically Offered: Fall)

CHEM 5120: Electrochemical Methods of Analysis

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Principles of convective-diffusional mass transport in electroanalysis. Applications of potentiometry, voltammetry, and coulometry. Introduction to heterogeneous and homogeneous kinetics in electroanalysis. Analog and digital circuitry. Interfacing. (Typically Offered: Fall)

CHEM 5130: Analytical Molecular and Atomic Spectroscopy

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to physical optics and design of photometric instruments. Principles of absorption, emission, fluorescence, and Raman spectroscopy. Error and precision of optical methods. Ultraviolet, visible, and infrared methods of qualitative and quantitative organic and inorganic analysis. (Typically Offered: Spring)

CHEM 5160: Analytical Separations

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Principles and examples of inorganic and organic separation methods applied to analytical chemistry. Solvent extraction, volatilization, ion exchange, liquid and gas chromatography, and electrophoresis. (Typically Offered: Fall)

CHEM 5310: Organic Synthesis I

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Survey of organic functional group transformations. (Typically Offered: Spring)

CHEM 5320: Organic Synthesis II

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Synthesis of complex organic compounds including natural products. (Typically Offered: Fall)

CHEM 5370: Physical Organic Chemistry I

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Survey of reactive intermediates including cations, anions, carbenes, and radicals. (Typically Offered: Fall)

CHEM 5380: Physical Organic Chemistry II

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Molecular structure, stereochemistry, introduction to reaction mechanisms, thermodynamic and kinetic data, linear free energy relationships, isotope effects, orbital symmetry. (Typically Offered: Spring)

CHEM 5490: Nuclear Magnetic Resonance Spectroscopy

(Cross-listed with BBMB 5490).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Theoretical principles of NMR, practical aspects of experimental NMR, solution and solid state NMR, methodologies for molecule characterization, protein structure determination, NMR relaxation, and recent advances. (Typically Offered: Spring)

CHEM 5500: Safety in the Chemical Laboratory

Credits: 1. Contact Hours: Lecture 1.

Prereq: Junior, Senior, or Graduate Standing

Introduction to laboratory safety and chemical hygiene. Use of engineering controls and personal protective equipment. Chemical storage and waste disposal practices. Handling hazardous chemicals. Radiation safety and laser safety. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

CHEM 5550: Teaching College Chemistry

Credits: 2. Contact Hours: Lecture 2.

Prereq: Junior, Senior, or Graduate Standing

Methods of instruction, strategies and techniques for effective teaching and learning along with practice teaching in undergraduate chemistry recitation and laboratory courses. Cooperative learning, guided-inquiry, learning cycles, conceptual change, models and modeling, concept maps, visualization, computer simulations, web-based delivery systems, and learning theories. Offered even-numbered years. (Typically Offered: Spring)

CHEM 5610: Fundamentals of Quantum Mechanics

Credits: 4. Contact Hours: Lecture 4.

Prereq: Graduate Standing or Permission of Instructor

Schrodinger equation and exact solutions; square wells and barriers; harmonic oscillator; the hydrogen atom; atomic orbitals; operators including angular momenta; time-independent and time-dependent perturbation theory; Schrodinger and Heisenberg representations; unitary operators; interaction picture, density matrix. (Typically Offered: Fall)

CHEM 5620: Fundamentals of Atomic and Molecular Quantum Mechanics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Variational method, many electron atoms; addition of angular momentum, self-consistent field method for open and closed shells, linear combinations of atomic orbitals, origin of chemical bonding, many-electron diatomic and polyatomic molecules, treatments of electron correlation, approximation methods. (Typically Offered: Spring)

CHEM 5630: Statistical Mechanics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Microscopic and macroscopic properties, laws of thermodynamics, ensembles and distribution functions, applications to gases, solids, and chemical equilibrium. (Typically Offered: Spring)

CHEM 5640: Molecular Spectroscopy and Structure

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Maxwell's field equations, interaction of light with matter including time-dependent perturbation theory, microwave, vibrational (infra-red, Raman) and electronic spectroscopies, symmetry derived selection rules, special lineshapes and introduction to nonlinear and coherent laser spectroscopies. Offered even-numbered years. (Typically Offered: Spring)

CHEM 5710: Solid-State Chemistry

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Structural principles, synthetic strategies, analytical methods, and chemical bonding issues applied to solids. Atomic packings and networks, short-range vs. long-range order, defects; phase diagrams, reactive fluxes, chemical transport; diffraction, spectroscopy; energy bands and their bonding interpretations. Offered even-numbered years. (Typically Offered: Spring)

CHEM 5720: Spectrometric Identification of Organic Compounds

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Principles of infrared, ultraviolet, nuclear magnetic resonance, and mass spectroscopy as applied to organic chemistry. (Typically Offered: Fall)

CHEM 5730: Nanochemistry

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Synthesis, characterization, properties and applications of nanoscale materials (≈ 0.5 -500 nm), relationship with molecular, meso and bulk compounds. Chemistry of solid surfaces, zero-, one- and two- dimensional (0D, 1D, 2D) nanostructures, semiconductor quantum dots, plasmonic nanoparticles, carbon nanomaterials, porous nanomaterials, potential health and safety impacts. Offered odd-numbered years. (Typically Offered: Spring)

CHEM 5740: Organometallic Chemistry of the Transition Metals

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Transition metal complexes with ligands such as cyclopentadienyl, olefins, acetylenes, benzenes, and carbon monoxide. Coverage of structure, bonding, reactivity, fundamental mechanisms, and homogeneous catalysis. Offered odd-numbered years. (Typically Offered: Spring)

CHEM 5750: Diffraction and Crystal Structure

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Fundamentals of structure determination for single crystals emphasizing symmetry, diffraction geometry and instrumentation, sample preparation and handling, data collection strategies, methods of structure solution and refinement, presentation of results, and crystallographic databases. Offered odd-numbered years. (Typically Offered: Spring)

CHEM 5760: Surface Chemistry

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Gas-surface interactions and techniques of characterization. Idealized surface lattices, surface tension, Wulff plots, work function, adsorbate-adsorbate interactions, 2D phase diagrams, diffusion, thin film growth, adsorption and desorption mechanisms/energetics/kinetics, adsorption isotherms, vacuum techniques, electron- and ion-based spectroscopies for surface analysis (including AES, FIM, XPS, UPS, EXAFS, EELS, SIMS, LEED and STM). Offered even-numbered years. (Typically Offered: Fall)

CHEM 5770: Mass Spectrometry

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Basic physics, instrumentation, chemical and biological applications of mass spectrometry. (Typically Offered: Spring)

CHEM 5780: Chemical Kinetics and Mechanisms

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Rates and mechanisms; reversible, consecutive, and competing reactions; chain mechanisms; kinetic isotope effects; very rapid reactions; acid-base catalysis, theories of unimolecular reactions; transition state and Marcus theories. Offered even-numbered years. (Typically Offered: Spring)

CHEM 5790: Introduction to Research in Chemistry

Credits: Required. Contact Hours: Lecture 1.

Prereq: Graduate Standing or Permission of Instructor

Introduction to the various areas of research in chemistry at Iowa State University. (Typically Offered: Fall)

CHEM 5800: Introduction to Computational Quantum Chemistry

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Basic principles of quantum mechanics, schrodinger equation. Hartree-Fock/molecular orbital theory, introduction to group theory, introduction to modern methods of computational chemistry; applications include molecular structure, potential energy surfaces and their relation to chemical reactions; molecular spectroscopy, photochemistry, solvent effects and surface chemistry. Offered odd-numbered years. (Typically Offered: Fall)

CHEM 5830: Chemical Group Theory

Credits: 1. Contact Hours: Lecture 1.

Prereq: Graduate Standing or Permission of Instructor

Basic concepts and theorems, representation theory; point groups, molecular orbitals, molecular states, molecular vibrations, rotation group and angular momenta; space groups and crystals; permutation group, antisymmetry, and spin states. (Typically Offered: Fall)

CHEM 5990: Nonthesis Research

Credits: 1-30. Repeatable.

*Prereq: Instructor Permission for Course***Courses for graduate students:****CHEM 6000: Seminar in Inorganic Chemistry**

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

(Typically Offered: Fall, Spring)

CHEM 6010: Selected Topics in Inorganic Chemistry

Credits: 1-2. Contact Hours: Lecture 2.

Repeatable.

Topics such as molecular structure and bonding; organometallic compounds; physical techniques of structure determination; nonaqueous solutions; Zintl phases; transition-metal oxides; free-radical reactions; electron transfer reactions; metal-metal bonding; and bioinorganic chemistry of nucleic acids. (Typically Offered: Fall, Spring)

CHEM 6110: Seminar in Analytical Chemistry

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

(Typically Offered: Fall, Spring)

CHEM 6190: Special Topics in Analytical Chemistry

Credits: 1-2. Contact Hours: Lecture 2.

Repeatable.

Raman spectroscopy, sensors, spectroelectrochemistry, capillary electrophoresis, analytical plasmas, chemometrics and bioanalytical chemistry. (Typically Offered: Fall, Spring)

CHEM 6310: Seminar in Organic Chemistry

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

(Typically Offered: Fall, Spring)

CHEM 6320: Selected Topics in Organic Chemistry

Credits: 1-2. Contact Hours: Lecture 2.

Repeatable.

Topics of current interest in organic chemistry such as spectroscopy, physical organic chemistry, photochemistry, organometallic chemistry, mechanisms of oxidations and reductions, modern organic synthesis, reactive intermediates, bioorganic chemistry, and polymers. (Typically Offered: Fall, Spring)

CHEM 6600: Seminar in Physical Chemistry

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

(Typically Offered: Spring)

CHEM 6670: Special Topics in Physical Chemistry

Credits: 1-2. Contact Hours: Lecture 2.

Advanced and recent developments in physical chemistry are selected for each offering. (Typically Offered: Fall, Spring)

CHEM 6990: Research

Credits: 1-30. Repeatable.

Chinese (CHIN)

Courses primarily for undergraduates:

CHIN 1010: Elementary Mandarin Chinese I

Credits: 4. Contact Hours: Lecture 4.

Introduction to spoken and written colloquial Mandarin through pinyin and simplified characters. For students whose native language is not Chinese. (Typically Offered: Fall)

CHIN 1020: Elementary Mandarin Chinese II

Credits: 4. Contact Hours: Lecture 4.

Prereq: CHIN 1010

Introduction to spoken and written colloquial Mandarin through pinyin and simplified characters. For students whose native language is not Chinese. Meets International Perspectives Requirement. (Typically Offered: Spring)

CHIN 2010: Intermediate Mandarin Chinese I

Credits: 4. Contact Hours: Lecture 4.

Prereq: CHIN 1020

Development of speaking, writing, reading, and listening skills. Review and expansion of grammar skills, intensification of character acquisition. For students whose native language is not Chinese. Meets International Perspectives Requirement. (Typically Offered: Fall)

CHIN 2020: Intermediate Mandarin Chinese II

Credits: 4. Contact Hours: Lecture 4.

Prereq: CHIN 2010

Development of speaking, writing, reading, and listening skills. Review and expansion of grammar skills, intensification of character acquisition. For students whose native language is not Chinese. Meets International Perspectives Requirement. (Typically Offered: Spring)

CHIN 3010: Advanced Mandarin Chinese I

Credits: 3. Contact Hours: Lecture 3.

Prereq: CHIN 2020

Continuing development of speaking, writing, reading, and listening skills beyond intermediate level. Expansion of cultural literacy through a variety of texts from the humanities, social sciences, mass media and business. Native speakers of Chinese are allowed to enroll. Meets International Perspectives Requirement. (Typically Offered: Fall)

CHIN 3020: Advanced Mandarin Chinese II

Credits: 3. Contact Hours: Lecture 3.

Prereq: CHIN 3010

Continuing development of speaking, writing, reading, and listening skills beyond intermediate level. Expansion of cultural literacy through a variety of texts from the humanities, social sciences, mass media and business. Native speakers of Chinese are allowed to enroll. Meets International Perspectives Requirement. (Typically Offered: Spring)

CHIN 3040: Chinese for Global Professionals

Credits: 4. Contact Hours: Lecture 4.

Prereq: CHIN 2020

Introduction to professional language and culture in China and Chinese-speaking regions in Asia. Development of all four language skills, focusing on practical applications in the professional contexts. Development of global awareness and cross-cultural understanding. Preparation for internships. Meets International Perspectives Requirement. (Typically Offered: Spring)

CHIN 3700: Chinese Literature in English Translation

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Topics may include traditional prose, poetry, novel and drama; twentieth-century fiction and film. All readings and class discussions in English. Meets International Perspectives Requirement. (Typically Offered: Fall)

CHIN 3710X: Chinese Calligraphy: History, Appreciation and Practice
(Cross-listed with ARTH 3710X).

Credits: 3. Repeatable, maximum of 6 credits.

Chinese calligraphy is a unique form of visual art. Combining theoretical and experiential learning, this course offers a comprehensive introduction to Chinese calligraphy, including its history, theory and criticism, social functions, and cultural significance. It also provides students with opportunities to cultivate their artistic creativity and skills through hands-on practices. Taught in English, no knowledge of Chinese language required. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

CHIN 3720: Introduction to Chinese Culture

Credits: 3. Contact Hours: Lecture 3.

Interdisciplinary introduction to Chinese society and culture from earliest times to the present. Topics include ancient literature, philosophy, religion, art, architecture, customs, transition to a modern society, social changes, urban life, popular culture, and contemporary values and ideas. Taught in English. Meets International Perspectives Requirement. (Typically Offered: Spring)

CHIN 3750: China Today

Credits: 3-4. Contact Hours: Lecture 4.

Repeatable.

Topics vary by instructor but this course mainly focuses on contemporary economy, politics, religion, governance, family and healthcare, technology, society, and culture in China today. Meets International Perspectives Requirement.

CHIN 3780: Chinese Film and Society

Credits: 3. Contact Hours: Lecture 3.

Survey of Chinese cinematic history from 1896 to the present against the background of China's constant sociocultural transformation; emphasis on narrative themes, film history, and film criticism. Topics vary according to faculty interest. Taught in English. Meets International Perspectives Requirement.

CHIN 4030A: Seminar in Chinese Language and Culture: Translating Contemporary Chinese Texts

Credits: 3. Contact Hours: Lecture 3.

Prereq: CHIN 3020

Critical understanding of authentic texts at the advanced level through reading, translation, and/or application in professional contexts; consolidation of existing language skills, in-depth analysis of cultural issues, and development of professional language proficiency. Taught in Chinese. Native Chinese speakers may register with override request. Meets International Perspectives Requirement.

CHIN 4030B: Seminar in Chinese Language and Culture: Topics on Business and Professions

Credits: 3. Contact Hours: Lecture 3.

Prereq: CHIN 3020

Critical understanding of authentic texts at the advanced level through reading, translation, and/or application in professional contexts; consolidation of existing language skills, in-depth analysis of cultural issues, and development of professional language proficiency. Taught in Chinese. Native Chinese speakers may register with override request. Meets International Perspectives Requirement.

CHIN 4030C: Seminar in Chinese Language and Culture: Reading Chinese Texts

Credits: 3. Contact Hours: Lecture 3.

Prereq: CHIN 3020

Critical understanding of authentic texts at the advanced level through reading, translation, and/or application in professional contexts; consolidation of existing language skills, in-depth analysis of cultural issues, and development of professional language proficiency. Taught in Chinese. Native Chinese speakers may register with override request. Meets International Perspectives Requirement.

CHIN 4900: Independent Study

Credits: 1-6. Repeatable.

Prereq: 6 credits in CHIN; Permission of Department Chair

Designed to meet student needs in areas beyond current course offerings or to accommodate the desire to integrate a study of literature or language with special issues in major fields. (Typically Offered: Fall, Spring, Summer)

CHIN 4990: Internship in Chinese

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: 9 credits of CHIN at the 3000-level; Permission of Department

Work experience using Chinese in the public or private sector, combined with academic work under faculty supervision. Graduation Restriction: No more than 3 credits may apply toward the Chinese minor or LCP minor. Offered on a satisfactory-fail basis only.

Civil Engineering (CE)

Courses primarily for undergraduates:

CE 1110: Geomatics

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: CE 1600 or (ABE 1600 or AERE 1600 or BME 1600 or CHE 1600 or CPRE 1850 or EE 1850 or ENGR 1600 or IE 1480 or ME 1600 or SE 1850); CE 1700; MATH 1650

Fundamentals of geospatial measurement theory, computations, analysis, and instrumentation relative to engineering surveys. Includes distance and angular measurement and analyses; elevation, area, and volume determinations; construction staking; errors in observations; traversing; horizontal and vertical curve layout; geographical information systems; and equipment used for measurements. (Typically Offered: Fall, Spring)

CE 1200: Civil Engineering Learning Community

Credits: 1. Contact Hours: Discussion 2, Lecture 1.

Integration of first-year students into the Civil Engineering program. Assignments and activities involving teamwork, academic preparation, study skills, and preparation for entry into the Civil Engineering profession. Completed both individually and in learning teams under the direction of faculty and peer mentors. (Typically Offered: Fall, Spring)

CE 1600: Engineering Problems with Computational Laboratory

Credits: 3. Contact Hours: Laboratory 2, Lecture 2.

Prereq: Credit or Enrollment in MATH 1650

Engineering approach to solving problems and presenting results with applications to examples in civil, construction, and environmental engineering, such as problems in statics. Dimensions and units. Data processing, graphing, and curve fitting. Formulating and solving fundamental and practical engineering problems with spreadsheets and a structured programming language. Graduation Restriction: Only one of ENGR 1600, ABE 1600, AERE 1600, CE 1600, CHE 1600, CPRE 1850, EE 1850, IE 1480, ME 1600, and SE 1850 may count towards graduation. (Typically Offered: Fall, Spring)

CE 1700: Graphics for Civil Engineering

Credits: 2. Contact Hours: Laboratory 4.

Prereq: Credit or concurrent enrollment in MATH 1430 or MATH 1450 (or satisfactory scores on mathematics placement assessments)

Integration of fundamental graphics, computer modeling, and engineering design. Applications of multi-view drawings and dimensioning. Techniques for visualizing, analyzing, and communicating 3-D geometries. Application of the design process. Freehand and computer methods. Satisfactory placement scores can be found at: <https://math.iastate.edu/academics/undergraduate/aleks/placement/>. (Typically Offered: Fall, Spring)

CE 2060: Engineering Economic Analysis and Professional Issues in Civil Engineering

Credits: 3. Contact Hours: Lecture 3.

Prereq: (CE 1200 or CONE 1210 or CONE 1220 or ENGR 1310 or ENVE 1200); ENGL 2500; MATH 1660

Engineering/managerial analysis of the economic aspects of project proposals. Alternative sources of funds; time value of money; expenditure of capital funds and methods of evaluating alternative projects. Professionalism, licensure, liability, ethics, leadership, risk analysis, social responsibility, creative and critical thinking, and applications/impacts of regulations in civil engineering. ECON 1010 recommended. (Typically Offered: Fall, Spring)

CE 2740: Engineering Statics

Credits: 3. Contact Hours: Lecture 3.

Prereq: PHYS 2310 or PHYS 2310H; PHYS 2310L; and (Credit or concurrent enrollment in MATH 1660 or MATH 1660H)

Vector analysis; analysis of force systems; resultant in two and three dimensions; free-body diagrams; equilibrium; analysis of trusses, frames, and machines; friction, belts and pulleys; shear and bending moment in beams, centroid and center of mass; second moments of areas. (Typically Offered: Fall, Spring, Summer)

CE 3060: Project Management for Civil Engineers

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Engineering Basic Program Courses

Project management, including work breakdown structures, cost estimating, scheduling, and project control. Civil engineering project life cycle, including planning, design, construction, and maintenance processes. Techniques in interpretation of contract documents, plan reading, and in estimating quantities. (Typically Offered: Fall, Spring)

CE 3260: Principles of Environmental Engineering

(Cross-listed with ENVE 3260).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: [CHEM 1670 or (CHEM 1770 and CHEM 1780)] AND MATH 1660 AND (credit or concurrent enrollment in ABE 3780)

Introduction to environmental problems, water quality indicators and requirements, potable water quality and quantity objectives, water sources and treatment methods; water pollution control objectives and treatment methods; survey of solid and hazardous waste management and air pollution control. (Typically Offered: Fall, Spring)

CE 3320: Structural Analysis I

Credits: 3. Contact Hours: Lecture 3, Laboratory 1.

Prereq: EM 3240

Loads, shear, moment, and deflected shape diagrams for beams and framed structures. Deformation calculations. Approximate methods. Application of consistent deformation methods to continuous beams and frames. Application of displacement or slope deflection methods to continuous beams and frames without sway. Influence lines for determinate and indeterminate structures. Computer applications to analyze beams and frames. Validation of computer results. (Typically Offered: Fall, Spring, Summer)

CE 3330: Structural Steel Design I

Credits: 3. Contact Hours: Lecture 3, Laboratory 1.

Prereq: CE 3320, EM 3270

AISC design methods for structural steel buildings. Design of steel tension members. Design of steel members for flexure. Design of members for compression. Beam-Column member design. Introduction to steel building systems. Steel moment frames and concentrically braced frames. Design of commonly used connections in steel buildings. (Typically Offered: Fall, Spring)

CE 3340: Reinforced Concrete Design I

Credits: 3. Contact Hours: Lecture 3, Laboratory 1.

Prereq: CE 3320, EM 3270

ACI design methods for structural concrete members. Emphasis on the analysis and design for flexure of singly reinforced and doubly reinforced sections, T-section, one-way slabs, short columns, and isolated footings. Analysis and design for shear, and serviceability. Bond, anchorage, and development of reinforcement. (Typically Offered: Fall, Spring, Summer)

CE 3550: Principles of Transportation Engineering

Credits: 3. Contact Hours: Lecture 3.

Prereq: CE 1110

Introduction to planning, design, and operations of transportation facilities. Road user, vehicle and roadway characteristics. Technological, economic and environmental factors. Asset management, transportation planning, capacity analysis, traffic control, geometric design, traffic safety. (Typically Offered: Fall, Spring)

CE 3600: Geotechnical Engineering

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: EM 3240, credit or enrollment in GEOL 2010 or CONE 2410

Introduction to geotechnical engineering and testing. Identification and classification tests, soil water systems, principles of settlement, stresses in soils, and shear strength testing; slope stability, retaining walls, bearing capacity. (Typically Offered: Fall, Spring)

CE 3720: Engineering Hydrology and Hydraulics

Credits: 3. Contact Hours: Lecture 3.

Prereq: ABE 3780; (STAT 2310 or STAT 3050)

The hydrologic cycle: precipitation, infiltration, runoff, evapotranspiration, groundwater, and streamflow. Hydrograph analysis, flood routing, frequency analysis and urban hydrology. Applied hydraulics including pipe and channel flow with design applications in culverts, pumping, water distribution, storm and sanitary sewer systems. Design project required. (Typically Offered: Fall, Spring)

CE 3820: Design of Concretes

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: CE 2740

Physical and chemical properties of bituminous, portland, and other cements; aggregate properties and blending; mix design and testing of concretes; admixtures, mixing, handling, placing and curing; principles of pavement thickness design. (Typically Offered: Fall, Spring)

CE 3830: Design of Portland Cement Concrete

Credits: 1.

Prereq: CE 2740

For CONE students only. Physical and chemical properties of portland cement and p.c. concrete. Mix design and testing of p.c. concrete. Graduation Restriction: Credit for both CE 3820 and CE 3830 may not be applied for graduation. (Typically Offered: Fall, Spring)

CE 3880: Sustainable Engineering and International Development

(Cross-listed with ABE 3880/ EE 3880).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Junior Classification in an Engineering Major

Multi-disciplinary approach to sustainable engineering and international development, sustainable development, appropriate design and engineering, feasibility analysis, international aid, business development, philosophy and politics of technology, and ethics in engineering. Engineering-based projects from problem formulation through implementation. Interactions with partner community organizations or international partners such as nongovernment organizations (NGOs). Course readings, final project/design report. Meets International Perspectives Requirement. (Typically Offered: Fall)

CE 3950: Global Perspectives in Transportation

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 2 times.

Background on historical civil engineering design and construction. Impacts of historical, cultural, social, economic, ethical, environmental, and political conditions on the design and construction of various infrastructure projects outside the United States. Global road safety and intermodal operations. Addressing transportation problems in a large metropolitan area. Meets International Perspectives Requirement. (Typically Offered: Spring)

CE 4030: Program and Outcome Assessment

Credits: Required. Contact Hours: Lecture 1.

Assessment of CE Curriculum and educational objectives. Assessments to be reviewed by the CE Department to incorporate potential improvements. Verification of undergraduate application for graduation by the end of the first week of class. Permission of instructor for students who are scheduled for summer graduation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

CE 4130: Applied and Environmental Geophysics

(Dual-listed with GEOL 5130/ CE 5130/ ENSCI 5130). (Cross-listed with GEOL 4130/ ENSCI 4130).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Seismic, gravity, magnetic, resistivity, electromagnetic, and ground-penetrating radar techniques for shallow subsurface investigations and imaging. Data interpretation methods. Lab emphasizes computer interpretation packages. Field work with seismic - and resistivity-imaging systems and radar. Introductory geology, algebra, and trigonometry recommended. Offered odd-numbered years. (Typically Offered: Spring)

CE 4170: Boundary Surveys

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: CE 1110

Basic principles of boundary surveying with a focus on the legal principles affecting the determination of land boundaries. Concepts include boundaries, ownership, boundary law principles, easements, sequential and simultaneous conveyances, case studies, riparian rights, state laws and rules for practicing surveying, American Land Title Association (ALTA) surveys and standards, U.S. public land survey system; unwritten land transfers; plats of survey; land descriptions and boundary evidence. (Typically Offered: Spring)

CE 4280: Water and Wastewater Treatment Plant Design

(Cross-listed with ENVE 4280).

Credits: 3. Contact Hours: Lecture 3.

Prereq: CE 3260

Physical, chemical and biological processes for the treatment of water and wastewater including coagulation and flocculation, sedimentation, filtration, adsorption, chemical oxidation/disinfection, fixed film and suspended growth biological processes and sludge management. Design project. (Typically Offered: Spring)

CE 4390: Seismic Methods in Geology, Engineering, and Petroleum Exploration

(Dual-listed with GEOL 5390/ CE 5390). (Cross-listed with GEOL 4390).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Physics of elastic-wave propagation. Seismic surveys in environmental imaging, engineering, and petroleum exploration. Reflection and refraction techniques. Data collection, processing, and geological interpretation. Field work with state-of-the-art equipment. Introductory geology, algebra, and trigonometry recommended. Offered even-numbered years. (Typically Offered: Spring)

CE 4460: Bridge Design

(Dual-listed with CE 5460).

Credits: 3.

Prereq: CE 3330, CE 3340

Bridge design in structural steel and reinforced concrete. Application of AASHTO Bridge Design Specifications. Analysis techniques for complex structures. Preliminary designs include investigating alternative structural systems and materials. Final designs include preparation of design calculations and sketches. Design project. Offered odd-numbered years. (Typically Offered: Spring)

CE 4480: Building Design

(Dual-listed with CE 5480).

Credits: 3.

Prereq: CE 3330, CE 3340

Building design in structural steel and reinforced concrete. Investigation of structural behavior. Gravity and lateral load resisting systems. Application of current building codes and design specifications. In-depth analysis of gravity and wind loads on buildings. Review of building designs. Preliminary designs include investigating alternative structural systems. Approximate methods of structural analysis for gravity and lateral loads. Final designs include preparation of design calculations and sketches. Design project. Offered even-numbered years. (Typically Offered: Spring)

CE 4490: Structural Health Monitoring

(Dual-listed with CE 5490).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Senior classification in an Engineering major or Permission of Instructor

Introductory and advanced topics in structural health monitoring (SHM) of aeronautical, civil, and mechanical systems. Topics include sensors, signal processing in time and frequency domains, data acquisition and transmission systems, design of integrated SHM solutions, nondestructive evaluation techniques, feature extraction methods, and cutting-edge research in the field of SHM. Graduate students will have a supervisory role to assist students in 4490 and an additional design project or more in-depth analysis and design.

CE 4510: Urban Transportation Planning Models

(Dual-listed with CE 5510).

Credits: 3. Contact Hours: Lecture 3.

Prereq: CE 3550; (STAT 2310 or STAT 3050)

Urban transportation planning context and process. Project planning and programming. Congestion, mitigation, and air quality issues. Transportation data sources. Travel demand and network modeling. Use of popular travel demand software and applications of geographic information systems. (Typically Offered: Fall)

CE 4530: Highway Design

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: CE 3060, CE 3550

Introduction to highway planning and design. Design, construction, and maintenance of highway facilities. Level-of-service, stopping sight distance, highway alignment, earthwork and pavement design. Design project, oral reports and written reports. Computer applications. (Typically Offered: Fall)

CE 4600: Foundation Engineering

Credits: 3. Contact Hours: Lecture 3.

Prereq: CE 3600

Fundamentals of foundation engineering. Exploration, sampling, and in-situ tests. Shallow and deep foundations. Settlement and bearing capacity analyses. Stability of excavations and earth retaining structures. Design project. (Typically Offered: Fall, Spring)

CE 4620: Site Evaluations for Civil Engineering Projects

(Dual-listed with CE 5620).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: CE 3600 or Permission of Instructor

Identification and mapping of engineering soils from aerial photos, maps, and soil surveys. Planning subsurface investigations, geomaterials prospecting, geotechnical hazards, geomorphology, in situ testing and sampling, geophysical site characterization, instrumentation and monitoring, interpretation of engineering parameter values for design.

CE 4670: Geomaterials Stabilization

(Dual-listed with CE 5670).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: (CE 3600; [CE 3820 or CE 3830]) or Permission of Instructor

Soil and aggregate physical, chemical and biological stabilization procedures. Stabilization analysis and design. Ground modification and compaction methods. Geosynthetics application and design.

CE 4730: Groundwater Hydrology

(Dual-listed with CE 5730/ ENSCI 5730).

Credits: 3. Contact Hours: Lecture 3.

Prereq: CE 3720

Principles of groundwater flow, hydraulics of wells, super-position, slug and pumping tests, streamlines and flownets, and regional groundwater flow. Contaminant transport. Computer modeling. Individual and group projects. (Typically Offered: Fall)

CE 4775X: Geospatial Modelling for Environmental Management

(Dual-listed with CE 5775X).

Credits: 3. Contact Hours: Lecture 3.

Prereq: CE 3720 or instructor permission

Geospatial analyses performed with a cloud-based platform capable of working at planetary scale. Applications include air pollution, urban heat islands, mapping of water resources, fire monitoring, deforestation, land cover changes, and the application of geospatial data to monitor resilience and sustainability in cities in the context of the Sustainable Development Goals (SDGs). (Typically Offered: Fall)

CE 4830: Pavement Analysis and Design

Credits: 3. Contact Hours: Lecture 3.

Prereq: CE 3600 and CE 3820

Analysis, behavior, performance, and structural design of pavement systems. Topics include climate factors, rehabilitation, life cycle design economics, material and system response, pavement foundations and traffic loadings. Development of models for and analysis of pavement systems. Use of transfer functions relating pavement response to pavement performance. Evaluation and application of current and evolving pavement design practices and procedures. Mechanistic-based pavement design techniques and concepts. Analysis of the effects of maintenance activities on pavement performance and economic evaluation of pavement systems. Design project. (Typically Offered: Spring)

CE 4840: Advanced Design of Concretes

(Dual-listed with CE 5840).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: CE 3820

Asphalt binder characterization, fundamentals of asphalt rheology, asphalt materials behavior under loading and temperature effects. High-strength, lightweight, fiber-reinforced, and self-consolidating portland cement concretes, mix design, properties, advanced performance testing. Design project.

CE 4850: Civil Engineering Design

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: (CE 3330 or CE 3340) AND CE 2060 AND CE 3060 AND CE 3260 AND CE 3550 AND CE 3600 AND CE 3720 AND CE 3820 AND SPCM 2120

The civil engineering design process, interacting with the client, identification of the engineering problems, development of a technical proposal, identification of design criteria, cost estimating, planning and scheduling, codes and standards, development of feasible alternatives, selection of best alternative, and oral presentation. Course enrollment limited to final graduating semester. (Typically Offered: Fall, Spring)

CE 4880: Sustainable Civil Infrastructure Systems

(Dual-listed with CE 5880).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Instructor Permission for Course

Sustainable planning, life cycle analysis, appropriate engineering design, investment levels and overall rating of civil engineering infrastructure systems, including highway, bridge, airport, rail, dam, power and port facilities. Complementary assessment of future civil infrastructure sustainability impacts and challenges in relation to autonomous and electric vehicle development. Overview regarding US and global availability and supply of critical infrastructure commodities (e.g., cement, stone, metals, phosphorus, uranium, etc.). Directed course readings and multiple project/design reports. (Typically Offered: Fall)

CE 4890: Pavement Preservation and Rehabilitation

(Dual-listed with CE 5890).

Credits: 3. Contact Hours: Lecture 3.

Prereq: CE 3820

Overview of pavement preservation and pavement rehabilitation techniques. Overview and selection of materials used in pavement preservation and rehabilitation strategies. Evaluating suitability of pavement preservation and pavement rehabilitation strategies based on existing structure, pavement distresses and non-condition factors. Use of recycled pavement materials in pavement reconstruction techniques. (Typically Offered: Fall, Spring)

CE 4900: Independent Study

Credits: 1-3. Repeatable.

Prereq: Department Permission for Course

Independent study in any phase of civil engineering. Pre-enrollment contract required. Graduation Restriction: No more than 6 credits of CE 4900 may be counted towards engineering topics electives. (Typically Offered: Fall, Spring, Summer)

CE 4900H: Independent Study: Honors

Credits: 1-3. Repeatable.

Prereq: Department Permission for Course; Membership in the University Honors Program

Independent study for an honors project in any phase of civil engineering. This course requires an approved proposal to the College of Engineering Honors Committee and pre-enrollment contract. Graduation Restriction: No more than 6 credits of CE 4900H may be counted towards engineering topics electives. (Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:**CE 5010: Preconstruction Project Engineering and Management**

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or enrollment in CONE 4220 or CE 3060 or graduate standing

Application of engineering and management control techniques to construction project development from conceptualization to notice to proceed. Emphasis is on managing complex projects using 5-dimensional project management theory.

CE 5020: Construction Project Engineering and Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: (Credit or enrollment in CONE 4220 or CE 5940A or permission of instructor) OR Graduate classification

Application of engineering and management control techniques to complex construction projects. Construction project control techniques, project administration, construction process simulation, quality management, and productivity improvement programs.

CE 5030: Construction Finance and Business Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: (Credit or enrollment in CONE 4220 or CE 5940A or permission of instructor) OR Graduate classification

Fundamental theories and applied methods for financial management of construction projects and companies. Construction accounting, cash flow analysis, financial planning and management, and risk analysis. Case studies.

CE 5050: Design of Construction Systems

Credits: 3. Contact Hours: Lecture 3.

Prereq: CE 3330, CE 3600, CONE 3220, CONE 3400; or graduate standing

Advanced design of concrete formwork and falsework systems. Design for excavation and marine construction including temporary retaining structures and cofferdams. Aggregate production operations, including blasting, crushing, and conveying systems. Rigging system design.

CE 5100: Information Technologies for Construction

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Information technologies including microcomputer based systems, management information systems, automation technologies, computer-aided design, and expert systems and their application in the construction industry. Overview of systems acquisition, communications, and networking.

CE 5130: Applied and Environmental Geophysics

(Dual-listed with GEOL 4130/ CE 4130/ ENSCI 4130). (Cross-listed with GEOL 5130/ ENSCI 5130).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Seismic, gravity, magnetic, resistivity, electromagnetic, and ground-penetrating radar techniques for shallow subsurface investigations and imaging. Data interpretation methods. Lab emphasizes computer interpretation packages. Field work with seismic - and resistivity-imaging systems and radar. Introductory geology, algebra, and trigonometry recommended. Offered odd-numbered years. (Typically Offered: Spring)

CE 5190: Methods for Data-Driven Computational Engineering Research

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Instructor Permission for Course

Recent advances in computational and statistical methods and theories that will promote data-driven engineering research. Solve various engineering problems involving complex, large-scale engineering data. Experience representing complex engineering data and real-world populations, handle uncertainty behind the data, assess impact of the uncertainty on complex engineering responses, learn and predict engineering responses by solely using data, leverage data to complement high-precision computer simulations, handle random real-world information, and cure engineering data plagued with many incomplete data points. High-performance cluster of CoE (HPC-Class) will be utilized for computational exercises and practical projects. Ample examples and computational programs will be provided to students for applications to their own research.

CE 5200: Environmental Engineering Chemistry

(Dual-listed with CE 4200/ ENSCI 4200). (Cross-listed with ENSCI 5200).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: CE 3260, CHEM 1780 OR Graduate classification

Principles of chemical and physical phenomena applicable to the treatment of water and wastewater and natural waters; including chemical equilibria, reaction kinetics, acid-base equilibria, chemical precipitation, redox reactions, and mass transfer principles. Individual laboratory practicals and group projects required. (Typically Offered: Fall)

CE 5210: Environmental Biotechnology

(Dual-listed with CE 4210/ ENSCI 4210). (Cross-listed with ENSCI 5210).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: CE 3260 OR Graduate classification

Fundamentals of biochemical and microbial processes applied to environmental engineering processes, role of microorganisms in wastewater treatment and bioremediation, bioenergetics and kinetics, metabolism of xenobiotic compounds, waterborne pathogens and parasites, and disinfection. Term paper and oral presentation. (Typically Offered: Fall)

CE 5220: Water Pollution Control Processes

(Cross-listed with ENSCI 5220).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: (CE 4210 or CE 5210) or Graduate Classification

Fundamentals of biochemical processes, aerobic growth in a single CSTR, multiple events in complex systems, and techniques for evaluating kinetic parameters; unit processes of activated sludge system, attached growth systems, stabilization and aerated lagoon systems, biosolids digestion and disposal, nutrient removal, and anaerobic treatment systems.

CE 5230: Physical-Chemical Treatment Process

(Cross-listed with ENSCI 5230).

Credits: 3.

Prereq: ENVE 4260, or ABE 4510, or AGRON 4590, or CE 5200, or ENSCI 3820, or permission of instructor

Mass balances. Principles and design of physical-chemical unit processes including ideal and realistic reactors; heterogeneous process including gas transfer, sorption, precipitation, and dissolution; redox; flocculation/coagulation; gravity separations; filtration; and membrane processes, electrodialysis, fouling, and scaling. Emphasis on water and wastewater treatment for environmental, health, and aesthetic ends. Case studies in secondary industries.

CE 5280: Solid and Hazardous Waste Management

(Cross-listed with ENSCI 5280).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: CE 3260; junior or higher standing

Evaluation, characterization, assessment, planning and design of solid and hazardous waste management systems, regulatory requirements, material characterization and collection, minimization and recycling, energy and materials recovery, composting, off-gas treatment, incineration, stabilization, and landfill design. Design of treatment and disposal systems, including physical, chemical, and biological treatment, solidification, incineration, secure landfill design, and final disposal site closure plus restoration.

CE 5320: Structural Analysis II

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: CE 3320 OR Graduate classification

Analysis of indeterminate structural problems by the consistent deformation and generalized direct displacement methods. Direct stiffness method for 2-D frames, grids, 3-D frames. Special topics for the stiffness method. (Typically Offered: Fall)

CE 5330: Structural Steel Design II

Credits: 3. Contact Hours: Lecture 3.

Prereq: CE 3330 OR Graduate classification

Theoretical background and development of AISC Specification equations. In-depth analysis and design of tension members, columns, beams, beam-columns, and plate girders. Emphasis on Load and Resistance Factor Design. Elastic and inelastic buckling of members and member elements. Investigation of amplification factors for members subject to combined bending and axial load and to combined bending and torsion. Effective Length Method and Direct Analysis Method of design. Approximate Second-Order Analysis. Biaxial bending. Torsion and combined bending and torsion of W-shapes.

CE 5340: Reinforced Concrete Design II

Credits: 3. Contact Hours: Lecture 3.

Prereq: CE 3340

Advanced topics in reinforced concrete analysis and design. Moment-curvature and load-deflection behavior. Design of reinforced concrete long columns, two-way floor slabs, and isolated and combined footings. Design and behavior considerations for torsion, biaxial bending, and structural joints. Strut-and-tie modeling.

CE 5350: Prestressed Concrete Structures

Credits: 3. Contact Hours: Lecture 3.

Prereq: CE 3340 or Graduate classification

Design of prestressed concrete structures, review of hardware, stress calculations, prestress losses, section proportioning, flexural design, shear design, deflections, and statically indeterminate structures.

CE 5380X: Emerging Materials for Structural Engineering

Credits: 3. Contact Hours: Lecture 3.

Prereq: (CE 3330 and CE 3340) or permission of instructor

Properties and applications of emerging materials for safe and resilient structures. High and ultra-high performance cementitious materials, metallic products, fiber-reinforced polymers, and their sustainable alternatives. Relevant standards, codes, and guidelines for the analysis and design of structures made with materials beyond conventional concrete and steel. Practical considerations and advanced manufacturing methods, such as 3D printing strategies. (Typically Offered: Fall)

CE 5390: Seismic Methods in Geology, Engineering, and Petroleum Exploration

(Dual-listed with GEOL 4390/ CE 4390). (Cross-listed with GEOL 5390).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Physics of elastic-wave propagation. Seismic surveys in environmental imaging, engineering, and petroleum exploration. Reflection and refraction techniques. Data collection, processing, and geological interpretation. Field work with state-of-the-art equipment. Introductory geology, algebra, and trigonometry recommended. Offered even-numbered years. (Typically Offered: Spring)

CE 5410: Dynamic Analysis of Structures

Credits: 3. Contact Hours: Lecture 3.

Prereq: (ME 3450 and credit or enrollment in CE 5320) or Graduate Classification

Single and multi-degree-of-freedom systems. Free and forced vibrations. Linear and nonlinear response. Modal analysis. Response spectra. Seismic analysis.

CE 5420: Structural Analysis by Finite Elements

Credits: 3. Contact Hours: Lecture 3.

Prereq: CE 5320 or permission of instructor

Use of the finite element method for the analysis of complex structural configurations. Plane stress, solid, Axisymmetric and plate elements. Numerical integration. Use of general purpose finite element programs.

CE 5450: Seismic Design

Credits: 3. Contact Hours: Lecture 3.

Prereq: CE 3330, CE 3340

Seismic hazard in the United States. Engineering characteristics of ground motions. Structural damage in past earthquakes. Capacity design philosophy for seismic resistant design. Conceptual design of structures. Capacity design process including design of structural members.

CE 5460: Bridge Design

(Dual-listed with CE 4460).

Credits: 3.

Prereq: CE 3330, CE 3340

Bridge design in structural steel and reinforced concrete. Application of AASHTO Bridge Design Specifications. Analysis techniques for complex structures. preliminary designs include investigating alternative structural systems and materials. Final designs include preparation of design calculations and sketches. Design project. Offered odd-numbered years. (Typically Offered: Spring)

CE 5480: Building Design

(Dual-listed with CE 4480).

Credits: 3.

Prereq: CE 3330, CE 3340

Building design in structural steel and reinforced concrete. Investigation of structural behavior. Gravity and lateral load resisting systems. Application of current building codes and design specifications. In-depth analysis of gravity and wind loads on buildings. Review of building designs. preliminary designs include investigating alternative structural systems. Approximate methods of structural analysis for gravity and lateral loads. Final designs include preparation of design calculations and sketches. Design project. Offered even-numbered years. (Typically Offered: Spring)

CE 5490: Structural Health Monitoring

(Dual-listed with CE 4490).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Senior classification in an Engineering major or Permission of Instructor

Introductory and advanced topics in structural health monitoring (SHM) of aeronautical, civil, and mechanical systems. Topics include sensors, signal processing in time and frequency domains, data acquisition and transmission systems, design of integrated SHM solutions, nondestructive evaluation techniques, feature extraction methods, and cutting-edge research in the field of SHM. Graduate students will have a supervisory role to assist students in 4490 and an additional design project or more in-depth analysis and design.

CE 5510: Urban Transportation Planning Models

(Dual-listed with CE 4510).

Credits: 3. Contact Hours: Lecture 3.

Prereq: [CE 3550; (STAT 2310 or STAT 3050)] OR Graduate classification

Urban transportation planning context and process. Project planning and programming. Congestion, mitigation, and air quality issues. Transportation data sources. Travel demand and network modeling. Use of popular travel demand software and applications of geographic information systems. (Typically Offered: Fall)

CE 5520: Traffic Safety, Operations, and Maintenance

Credits: 3. Contact Hours: Lecture 3.

Prereq: CE 3550 or Graduate classification

Engineering aspects and fundamental principles of transportation safety. Reduction of crash incidence and severity through highway design and traffic control, and maintenance activities. Safety management best practices, safe systems, and other state-of-the-art practices in transportation safety. Human behaviors and how to influence them using engineering countermeasures to improve safety outcome metrics. Offered even-numbered years. (Typically Offered: Spring)

CE 5530: Traffic Engineering

Credits: 3. Contact Hours: Lecture 3.

Prereq: CE 3550 or Graduate classification

Driver, pedestrian, and vehicular characteristics. Traffic characteristics; highway capacity; traffic studies and analyses. Principles of traffic control for improved highway traffic service. Application of appropriate computing software and tools. (Typically Offered: Fall)

CE 5550: Traffic Flow Theories for Existing and Emerging Modes

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Classification or Permission of Instructor

Introduction to the classic traffic flow theories and the recent developments in autonomous vehicles. Models and theories that characterize the flow of traffic in its many facets, including human factor, automation, and traffic control. Project based learning method. Work in teams and apply analytical methods to study time-dependent traffic networks, probabilistic queuing systems and the mixed environment of autonomous and human-operated vehicles.

CE 5560: Transportation Data Analysis

Credits: 3. Contact Hours: Lecture 3.

Prereq: CE 3550; a STAT course at 3000 level or higher

Statistical, econometric, and data science principles applied to real-world transportation data. Includes identification of data sources and limitations. Fundamentals of reproducibility and replicability, validation (including spatial and temporal validation), differences and purposes of inferential, descriptive, predictive, causal models, etc. Linear regression, count regression, and discrete choice models. Basic utility theory and decision making with applications in transportation. Emphasis is placed on practical applications, proper model development, assumption checking, and usability of results.

CE 5570: Transportation Systems Analysis

Credits: 3. Contact Hours: Lecture 3.

Prereq: (CE 3550; 3 credits in STAT) or Graduate Standing

Travel studies and analysis of data. Transportation systems forecasts and analyses. Statewide, regional, and local transportation system planning. Network level systems planning and operations. Optimization of systems.

CE 5580: Transportation Systems Development and Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: CE 3550

Study of designated problems in traffic engineering, transportation planning, and development. Forecasting and evaluation of social, economic, and environmental impacts of proposed solutions; considerations of alternatives. Formulation of recommendations and publication of a report. Presentation of recommendations in the host community.

CE 5590: Transportation Infrastructure/Asset Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: CE 3550 or Graduate classification

Engineering management techniques for maintaining and managing infrastructure assets. Systematic approach to management through value engineering, engineering economics, and life cycle cost analysis. Selection and scheduling of maintenance activities. Analysis of network-wide resource needs. Project level analysis.

CE 5600: Fundamentals of Soil Mechanics

Credits: 3. Contact Hours: Lecture 3.

Prereq: CE 3600 or Permission of Instructor

Nature of soil deposits, seepage, settlement and secondary compression, consolidation theories and analysis, failure theories, stress paths, introduction to critical state soil mechanics, constitutive models, soil strength under various drainage conditions, liquefaction of soil, pore pressure parameters, selection of soil parameters.

CE 5610: Applied Foundation Engineering

Credits: 3. Contact Hours: Lecture 3.

Prereq: CE 4600 or instructor approval

Analysis and design of shallow and deep foundations, lateral earth pressure theories and retaining structures, field investigations, in-situ testing, and foundations on problematic soils. Foundation engineering reports.

CE 5620: Site Evaluations for Civil Engineering Projects

(Dual-listed with CE 4620).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: CE 3600 or Permission of Instructor

Identification and mapping of engineering soils from aerial photos, maps, and soil surveys. Planning subsurface investigations, geomaterials prospecting, geotechnical hazards, geomorphology, in situ testing and sampling, geophysical site characterization, instrumentation and monitoring, interpretation of engineering parameter values for design.

CE 5630: Experimental Methods in Geo-Engineering

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: CE 3600 or Permission of Instructor

Principles of geo-engineering laboratory testing including the conduct, analysis, and interpretation of permeability, consolidation, triaxial, direct and ring shear, and direct simple shear tests. Issues regarding laboratory testing versus field testing and acquisition, transport, storage, and preparation of samples for geotechnical testing. Field and laboratory geotechnical monitoring techniques, including the measurements of deformation, strain, total stress and pore water pressure.

CE 5640: Application of Numerical Methods to Geotechnical Design

Credits: 3. Contact Hours: Lecture 3.

Prereq: CE 5600 or instructor approval

Application of numerical methods to analysis and design of foundations, underground structures, and soil-structure interaction. Application of slope stability software. Layered soils, bearing capacity and settlement for complex geometries, wave equation for piles, and foundation vibrations.

CE 5650: Fundamentals of Geomaterials Behavior

Credits: 3. Contact Hours: Lecture 3.

Prereq: CE 3820 or permission of instructor

Atoms and molecules, crystal chemistry, clay minerals, structure of solids, phase transformations and phase equilibria. Surfaces and interfacial phenomena, colloid chemistry, mechanical properties. Applications to soils and civil engineering materials. Overview of state-of-the-art instrumental techniques for analysis of the physicochemical properties of soils and civil engineering materials.

CE 5670: Geomaterials Stabilization

(Dual-listed with CE 4670).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: (CE 3600; [CE 3820 or CE 3830]) or Permission of Instructor

Soil and aggregate physical, chemical and biological stabilization procedures. Stabilization analysis and design. Ground modification and compaction methods. Geosynthetics application and design.

CE 5680: Dynamics of Soils and Foundations

Credits: 3. Contact Hours: Lecture 3.

Prereq: CE 3600, EM 3450 or instructor permission

Dynamic soil properties and their measurement. Foundation dynamics and soil-structure interaction. Sources and characteristics of dynamic loads. Vibration of single- and multi-degree-of-freedom systems. Vibration of continuous systems; 1D, 2D, and 3D analyses, wave propagation. Liquefaction concepts and analysis methods. Introduction to geotechnical earthquake engineering.

CE 5690: Ground Improvement

Credits: 3. Contact Hours: Lecture 3.

Prereq: CE 3600 or Permission of Instructor or Graduate Classification

Classification of ground improvement methods. Dynamic compaction, vibrocompaction, preloading using fill surcharge, vacuum or a combination of both and prefabricated vertical drains, vibro replacement or stone columns, dynamic replacement, sand compaction piles, geotextile confined columns, rigid inclusion, column supported embankment, microbial methods, particulate and chemical grouting, lime and cement columns, jet grouting, and deep cement mixing.

CE 5700: Applied Hydraulic Design

Credits: 3. Contact Hours: Lecture 3.

Prereq: CE 3720

Flow characteristics in natural and constructed channels; principles of hydraulic design of culverts, bridge waterway openings, spillways, hydraulic gates and gated structures, pumping stations, and miscellaneous water control structures; pipe networks, mathematical modeling. Design project. Offered odd-numbered years. (Typically Offered: Fall)

CE 5710: Surface Water Hydrology

(Cross-listed with ENSCI 5710).

Credits: 3. Contact Hours: Lecture 3.

Prereq: CE 3720 or Graduate Classification

Analysis of hydrologic data including precipitation, infiltration, evapotranspiration, direct runoff and streamflow; theory and use of frequency analysis; theory of streamflow and reservoir routing; use of deterministic and statistical hydrologic models. Fundamentals of surface water quality modeling, point and non-point sources of contamination. (Typically Offered: Spring)

CE 5720: Analysis and Modeling Aquatic Environments

(Cross-listed with ENSCI 5720).

Credits: 3. Contact Hours: Lecture 3.

Prereq: CE 3720 or Graduate Classification

Principles of surface water flows and mixing. Introduction to hydrologic transport and water quality simulation in natural water systems. Advection, diffusion and dispersion, chemical and biologic kinetics, and water quality dynamics. Applications to temperature, dissolved oxygen, primary productivity, and other water quality problems in rivers, lakes and reservoirs. Deterministic vs. stochastic models. Offered even-numbered years. (Typically Offered: Fall)

CE 5730: Groundwater Hydrology

(Dual-listed with CE 4730). (Cross-listed with ENSCI 5730).

Credits: 3. Contact Hours: Lecture 3.

Prereq: CE 3720 or Graduate Classification

Principles of groundwater flow, hydraulics of wells, super-position, slug and pumping tests, streamlines and flownets, and regional groundwater flow. Contaminant transport. Computer modeling. Individual and group projects. (Typically Offered: Fall)

CE 5760: Environmental Flows

Credits: 3. Contact Hours: Lecture 3.

Prereq: ABE 3780

Analysis and applications of flows in civil engineering, environmental engineering, and water resources. Primary topics include conservation laws, laminar flow, turbulence, mixing, diffusion, dispersion, water waves, and boundary layers. Associated applications include particle settling, transfer at air-water and water-sediment boundaries, flow and friction in pipes and open channels, contaminant transport, waves in lakes, jets, plumes, and salt wedges.

CE 5775X: Geospatial Modelling for Environmental Management

(Dual-listed with CE 4775X).

Credits: 3. Contact Hours: Lecture 3.

Geospatial analyses performed with a cloud-based platform capable of working at planetary scale. Applications include air pollution, urban heat islands, mapping of water resources, fire monitoring, deforestation, land cover changes, and the application of geospatial data to monitor resilience and sustainability in cities in the context of the Sustainable Development Goals (SDGs). (Typically Offered: Fall)

CE 5810: Geotechnical and Materials Engineering Seminar

Credits: Required. Contact Hours: Lecture 1.

Repeatable.

Prereq: Graduate classification

Students and outside/invited speakers give weekly presentations about the ongoing research work and Geotechnical and Materials Engineering issues. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

CE 5830: Pavement Analysis and Design

Credits: 3. Contact Hours: Lecture 3.

Prereq: CE 3600 and CE 3820

Analysis, behavior, performance, and structural design of pavement systems. Topics include climate factors, rehabilitation, life cycle design economics, material and system response, pavement foundations and traffic loadings. Development of models for and analysis of pavement systems. Use of transfer functions relating pavement response to pavement performance. Evaluation and application of current and evolving pavement design practices and procedures. Mechanistic-based pavement design techniques and concepts. Analysis of the effects of maintenance activities on pavement performance and economic evaluation of pavement systems. Design project. (Typically Offered: Spring)

CE 5840: Advanced Design of Concretes

(Dual-listed with CE 4840).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: CE 3820 OR Graduate classification

Asphalt binder characterization, fundamentals of asphalt rheology, asphalt materials behavior under loading and temperature effects. High-strength, lightweight, fiber-reinforced, and self-consolidating portland cement concretes, mix design, properties, advanced performance testing. Design project.

CE 5860: Advanced Asphalt Materials

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: CE 3820

Advanced asphalt concrete (SUPERPAVE) mix designs. Aggregates. Admixtures. Production and construction, quality control and inspection. Nondestructive testing. Pavement thickness design. Materials engineering reports.

CE 5870: Advanced Portland Cement Concretes

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: (CE 3820 or CE 3830)

Hydraulic cements, aggregates, admixtures, and concrete mix design; cement hydration and microstructure development; fresh, early-age, and mechanical properties of concrete; concrete distress examination, damage mechanism, and prevention.

CE 5880: Sustainable Civil Infrastructure Systems

(Dual-listed with CE 4880).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Instructor Permission for Course

Sustainable planning, life cycle analysis, appropriate engineering design, investment levels and overall rating of civil engineering infrastructure systems, including highway, bridge, airport, rail, dam, power and port facilities. Complementary assessment of future civil infrastructure sustainability impacts and challenges in relation to autonomous and electric vehicle development. Overview regarding US and global availability and supply of critical infrastructure commodities (e.g., cement, stone, metals, phosphorus, uranium, etc.). Directed course readings and multiple project/design reports. (Typically Offered: Fall)

CE 5890: Pavement Preservation and Rehabilitation

(Dual-listed with CE 4890).

Credits: 3. Contact Hours: Lecture 3.

Prereq: CE 3820

Overview of pavement preservation and pavement rehabilitation techniques. Overview and selection of materials used in pavement preservation and rehabilitation strategies. Evaluating suitability of pavement preservation and pavement rehabilitation strategies based on existing structure, pavement distresses and non-condition factors. Use of recycled pavement materials in pavement reconstruction techniques. (Typically Offered: Fall, Spring)

CE 5900: Special Topics

Credits: 1-5. Repeatable.

Prereq: Instructor Permission for Course

Pre-enrollment contract required. (Typically Offered: Fall, Spring, Summer)

CE 5910: Seminar in Environmental Engineering

Credits: Required. Contact Hours: Lecture 1.

Repeatable.

Prereq: Graduate classification

Contemporary environmental engineering issues. Outside speakers. Review of ongoing research in environmental engineering. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

CE 5940A: Special Topics Construction Engineering and Mgt.: Planning and Scheduling

Credits: 3. Contact Hours: Lecture 3.

Prereq: CE 3060 or graduate standing

Studies in planning and scheduling including scheduling and estimating.

CE 5940J: Special Topics Construction Engineering and Mgt.: Trenchless Technologies

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Instructor Permission for Course

Studies in trenchless technologies.

CE 5940K: Special Topics Construction Engineering and Mgt.: Electrical and Mechanical Construction

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Instructor Permission for Course

Studies in electrical and mechanical construction.

CE 5940L: Special Topics Construction Engineering and Mgt.: Advanced Building Construction Topics - LEED for New Construction

Credits: 3. Contact Hours: Lecture 3.

Prereq: CONE 3520 or CE 3060 or graduate standing or permission of instructor

Studies in advanced building construction topics including LEED. (Typically Offered: Summer)

CE 5940M: Special Topics Construction Engineering and Mgt.: Design Build Construction

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Prereq: Instructor Permission for Course

Studies in design build construction.

CE 5940N: Special Topics Construction Engineering and Mgt.: Industrial Construction

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Studies in industrial construction.

CE 59400: Special Topics Construction Engineering and Mgt.: Highway and Heavy Construction

Credits: 3. Contact Hours: Lecture 3.

Prereq: CONE 3220 or CE 3060 or graduate standing

Studies in highway and heavy construction.

CE 5940P: Special Topics Construction Engineering and Mgt.: Advanced Building Energy Systems and Technologies

Credits: 3. Contact Hours: Lecture 3.

Prereq: CONE 3520 or graduate standing or permission of instructor

Studies in advanced building technologies including building energy modeling, building energy performance and efficiency assessments, and demand side management for smart grid applications.

CE 5940Q: Special Topics Construction Engineering and Mgt.: Construction Quality Control

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Instructor Permission for Course

Studies in construction quality control.

CE 5940R: Special Topics Construction Engineering and Mgt.: Risk Management

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Instructor Permission for Course

Studies in risk management.

CE 5940S: Special Topics Construction Engineering and Mgt.: Building Information Modeling

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Instructor Permission for Course

Studies in building information modeling.

CE 5940U: Spl Topics Construction Engineering and Mgt.: Introduction to Utility Engineering and Coordination

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Classification or Permission of Instructor

Studies in utility infrastructure, utility investigations, utility construction methods, utility conflict analysis, and general utility design.

CE 5990: Creative Component

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Pre-enrollment contract required. Advanced topic for creative component report in lieu of thesis. Offered on a satisfactory-fail basis only.

Courses for graduate students:

CE 6500B: Advanced Topics in Transportation Engineering: Traffic Operations

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate classification

CE 6500C: Advanced Topics in Transportation Engineering: Big Data Analysis

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Topics in transportation engineering related to data analysis.

CE 6500D: Advanced Topics in Transportation Engineering: Traffic Simulation

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

CE 6900: Advanced Topics

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Pre-enrollment contract required. (Typically Offered: Fall, Spring, Summer)

CE 6910: Seminar in Transportation Planning

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Provides an overview of current transportation issues; speakers provide seminars on a variety of timely transportation topics. (Typically Offered: Fall, Spring)

CE 6970: Engineering Internship

Credits: Required. Repeatable.

One semester and one summer maximum per academic year professional work period. Offered on a satisfactory-fail basis only.

CE 6990: Research

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Advanced topic for thesis/dissertation.

Classical Studies (CLST)

Courses primarily for undergraduates:

CLST 2730: Greek and Roman Mythology

Credits: 3. Contact Hours: Lecture 3.

Survey of the legends, myths of the classical world with emphasis on the principal gods, and heroes, and their relation to ancient social, psychological, and religious practices; some attention may be given to important modern theories. Meets International Perspectives Requirement.

CLST 2730H: Greek and Roman Mythology: Honors

Credits: 4. Contact Hours: Lecture 3, Discussion 1.

Prereq: Membership in the University Honors Program

Survey of the legends, myths of the classical world with emphasis on the principal gods, and heroes, and their relation to ancient social, psychological, and religious practices; some attention may be given to important modern theories. Meets International Perspectives Requirement.

CLST 2750: The Ancient City

Credits: 3. Contact Hours: Lecture 3.

Examination of ancient urban life, including historical context, physical space, material culture, religion, literature, and art; examination of civic identity (the "polis"). Contrast between the concepts of urban and rural. Examples drawn from one or several selected ancient cities; some attention to modern methods of recovering the conditions of ancient urban life and the fundamental concept of the city in European history. Meets International Perspectives Requirement.

CLST 3040: Cultural Heritage of the Ancient World

(Cross-listed with HIST 3040).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Historical examination of art, literature, thought, and religious beliefs of major civilizations of the ancient Mediterranean countries until the end of the 8th century.

CLST 3100: Ancient Philosophy

(Cross-listed with PHIL 3100).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 3 credits in PHIL or Permission of Instructor

Survey of ancient Greek philosophy, focusing on the pre-Socratics, Plato, and Aristotle. Questions concerning being, knowledge, language, and the good life are treated in depth. (Typically Offered: Fall)

CLST 3500: Rhetorical Traditions

(Cross-listed with ENGL 3500/ SPCM 3500).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500

Ideas about the relationship between rhetoric and society in contemporary and historical contexts. An exploration of classical and contemporary rhetorical theories in relation to selected topics that may include politics, gender, race, ethics, education, science, or technology. (Typically Offered: Spring)

CLST 3530: World Literature: Western Foundations through Renaissance

(Cross-listed with ENGL 3530).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500

Representative works of drama, poetry, and prose from ancient times through the mid-seventeenth century. Consideration of Western traditions within global contexts. Attention to religious and ethnic diversity; oral, manuscript, and print cultures; political authority; and the impact of translation on form, meaning, and reception of texts. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

CLST 3670: Christianity in the Roman Empire

(Cross-listed with RELIG 3670).

Credits: 3. Contact Hours: Lecture 3.

An historical introduction to the rise of Christianity in the Roman empire, with special attention to the impact of Greco-Roman culture on the thought and practice of Christians and the interaction of early Christians with their contemporaries.

CLST 3680: Religions of Ancient Greece and Rome

(Cross-listed with RELIG 3680).

Credits: 3. Contact Hours: Lecture 3.

Nature, origins and development of religious beliefs and practices in ancient Greece and Rome from earliest times up to the rise of Christianity. Roles of divinities and rituals in lives of individuals and families and the governing of city-states and empires. Emphasis on historical contexts of the Graeco-Roman world and influences of neighboring cultures in Africa and Asia. Meets International Perspectives Requirement.

CLST 3690: Ancient Egypt

(Cross-listed with ANTHR 3690).

Credits: 3. Contact Hours: Lecture 3.

Archaeology and culture of Ancient Egypt from prehistory to Late Antiquity. Exploration of literature, religion, social history, government, and architecture. Discussion of major archaeological sites and methods; examination of interaction with other ancient near eastern and Mediterranean civilizations. Meets International Perspectives Requirement.

CLST 3700X: Topics in the Ancient Mediterranean

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 12 credits.

Topics in ancient Greek, Roman, or Egyptian culture vary according to faculty interest. Readings from ancient and modern sources in English. Meets International Perspectives Requirement.

CLST 3720: Greek and Roman Tragedy and Comedy

Credits: 3. Contact Hours: Lecture 3.

Greek and Roman drama from the beginnings until today. Readings in English from authors such as Aeschylus, Sophocles, Euripides, Aristophanes, Menander, Plautus, Terence, Seneca. Course may cover performance, theories of comedy and tragedy, recent and current expressions of the comic and tragic in film and other media. Meets International Perspectives Requirement.

CLST 3720H: Greek and Roman Tragedy and Comedy: Honors

Credits: 4. Contact Hours: Lecture 4.

Prereq: Membership in the University Honors Program

Greek and Roman drama from the beginnings until today. Readings in English from authors such as Aeschylus, Sophocles, Euripides, Aristophanes, Menander, Plautus, Terence, Seneca. Course may cover performance, theories of comedy and tragedy, recent and current expressions of the comic and tragic in film and other media. Meets International Perspectives Requirement.

CLST 3730: Heroes of Greece, Rome, and Today

Credits: 3. Contact Hours: Lecture 3.

Cultural and political significance of ancient epic, especially in Greece and Rome. Course may include study of the heroic code in antiquity and its modern expressions including in film. Readings in English from authors such as Homer and Vergil. Meets International Perspectives Requirement.

CLST 3730H: Heroes of Greece, Rome, and Today: Honors

Credits: 4. Contact Hours: Lecture 3, Discussion 1.

Prereq: Membership in the University Honors Program

Cultural and political significance of ancient epic, especially in Greece and Rome. Course may include study of the heroic code in antiquity and its modern expressions including in film. Readings in English from authors such as Homer and Vergil. Meets International Perspectives Requirement.

CLST 3740: Sex, Gender, and Culture in the Ancient Mediterranean World

(Cross-listed with HIST 3740/ WGS 3740).

Credits: 3. Contact Hours: Lecture 3.

Survey of the roles of women and others on the margins and the issues that impacted them in the ancient Greek and Roman worlds. Evidence from literature, the visual arts, and archaeology. Contemporary approaches to studying women, gender, and sexuality in ancient history. Intersections of gender categories with ideas of slave and free status, citizenship, and ethnicity. Readings from ancient and modern sources. Meets International Perspectives Requirement.

CLST 3760A: Classical Archeology: Bronze Age and Early Iron Age Greece

(Cross-listed with ANTHR 3760A).

Credits: 3. Contact Hours: Lecture 3.

An examination of the material culture of Bronze Age and Early Iron Age Greece (ca 3000-700 BCE) and the role of archaeological context in understanding the varied aspects of the cultures that flourished in the region. Primary focus on the urbanized palatial centers that emerged on the island of Crete (Minoan) and in mainland Greece (Mycenaean). Topics include the emergence of social complexity, cultural and technological changes, religious systems, and methods of interpretation. Meets International Perspectives Requirement.

CLST 3760B: Classical Archeology: Archaic through Hellenistic Greece (ca 700-30 BCE)

(Cross-listed with ANTHR 3760B).

Credits: 3. Contact Hours: Lecture 3.

An examination of the material culture of ancient Greece from ca. 700-30 BCE and the role of archaeological context in understanding the varied aspects of Greek culture found in cities, rural areas, and sanctuaries during the Archaic, Classical, and Hellenistic periods. Topics include urbanization and the rise of the polis, sanctuaries and their offerings, engagement with the wider Mediterranean, and developments in the ways that the Greeks conceptualized and represented their world. Meets International Perspectives Requirement.

CLST 3760C: Classical Archaeology: Roman Archaeology (ca 1000 BCE-400 CE)

(Cross-listed with ANTHR 3760C).

Credits: 3. Contact Hours: Lecture 3.

An examination of major developments in architecture, sculpture, painting, and other arts of the ancient Roman world and the role of archaeological context in understanding various aspects of Roman culture. Topics include art in the service of social ideology and political propaganda; interactions between the Etruscans, Greeks, and Romans; and the relationship between Rome and its provinces. Meets International Perspectives Requirement.

CLST 3780X: The Ancient Mediterranean World in Film and Popular Culture

(Cross-listed with WFS 3780X).

Credits: 3. Contact Hours: Lecture 3.

Examination of the representation of ancient Greece, Rome, Egypt, and other Mediterranean cultures in film and popular culture, in the U.S. and internationally; and methods of interpretation and analysis. (Typically Offered: Fall)

CLST 3830: Greek and Roman Art

(Cross-listed with ARTH 3830).

Credits: 3. Contact Hours: Lecture 3.

Greek art from Neolithic to Hellenistic periods. Roman art from the traditional founding to the end of the empire in the West.

CLST 3830H: Greek and Roman Art: Honors

(Cross-listed with ARTH 3830H).

Credits: 3-4. Contact Hours: Lecture 3.

Prereq: Membership in the University Honors Program

Greek art from Neolithic to Hellenistic periods. Roman art from the traditional founding to the end of the empire in the West.

CLST 3840: Roman Italy: An Introduction

(Cross-listed with HIST 3840).

Credits: 2. Contact Hours: Lecture 2.

Repeatable.

Prereq: Instructor Permission for Course

Introduction to the topography, history, archaeology, monuments, and art of Rome from the 8th century BCE to the 5th century CE; attention given to the culture of modern Italy, preparatory to study abroad in Rome. Enrollment limited to students participating in CLST 3850/HIST 3850. Meets International Perspectives Requirement. (Typically Offered: Spring)

CLST 3850: Study Abroad: Roman Italy: Building the Empire

(Cross-listed with HIST 3850).

Credits: 3. Repeatable, maximum of 6 credits.

Prereq: CLST 3840/HIST 3840, Instructor Permission Required

Supervised on-site instruction in the history, archaeology, monuments, and art of Rome and environs from the 8th century BCE to the 5th century CE; attention given to the culture of modern Italy. Meets International Perspectives Requirement. (Typically Offered: Summer)

CLST 3940: The Archaeology of Greece: An Introduction

Credits: 2. Contact Hours: Lecture 2.

Repeatable, maximum of 4 credits.

Prereq: Instructor Permission for Course

Introduction to the topography, history, archaeology, monuments and art of Greece from the Bronze Age through the Ottoman period; attention given to the culture of modern Greece, preparatory to study abroad in Greece (CLST 3950). Enrollment limited to students participating in CLST 3950. Meets International Perspectives Requirement. (Typically Offered: Spring)

CLST 3950: Study Abroad: The Archaeology of Greece

Credits: 2-6. Contact Hours: Lecture 2.

Repeatable, maximum of 9 credits.

Prereq: CLST 3940; Instructor Permission Required

Supervised on-site instruction in the archaeology, monuments, and art of Greece from the Bronze Age through the Ottoman period; attention given to the culture of modern Greece. Meets International Perspectives Requirement. (Typically Offered: Summer)

CLST 4020: Greek Civilization

(Cross-listed with HIST 4020).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Ancient Greece from the Bronze Age to the Hellenistic period; evolution of the Greek polis and its cultural contributions, with a particular emphasis on the writings of Herodotus and Thucydides.

CLST 4030: Roman Civilization

(Cross-listed with HIST 4030).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Ancient Rome from the Regal Period to the fall of the Western Empire; evolution of Roman institutions and Rome's cultural contributions studied through original sources.

CLST 4100: Soul, Mind, and World in Ancient Greek Philosophy

(Cross-listed with PHIL 4100).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 6 credits in PHIL or CLST, or Permission of Instructor

Prominent theories of soul and mind developed by Greek philosophers in the classical period, roughly 500 BCE-200 CE, and how the philosophers located these theories within their general metaphysical views. Relationship between mind and body and the roles of reason, desire, and emotion. Philosophers to be studied include Plato, Aristotle, and selected others. (Typically Offered: Spring)

CLST 4300: Foundations of Western Political Thought

(Dual-listed with POLS 5300/ CLST 5300). (Cross-listed with POLS 4300).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 6 credits in POLS, HIST, or PHIL

Study of original texts in political thought ranging from the classical period to the renaissance. Topics such as justice, freedom, virtue, the allocation of political power, the meaning of democracy, human nature, and natural law. (Typically Offered: Fall, Spring, Summer)

CLST 4800: Seminar in Classical Studies

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Prereq: Permission of Program Director

Advanced study of a selected topic in Classical Studies. Research paper or project selected by the student.

CLST 4900: Independent Study

Credits: 1-6. Repeatable, maximum of 9 credits.

Prereq: 7 credits in CLST at the 2000-level or higher; Permission of the Program Chair

Designed to meet the needs of students who wish to study specific topics in classical civilization in areas where courses are not offered, or to pursue such study beyond the limits of existing courses at the advanced level.

Courses primarily for graduate students, open to qualified undergraduates:

CLST 5120A: Readings Seminar in European History: Ancient

(Cross-listed with HIST 5120A).

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Readings in European history.

CLST 5300: Foundations of Western Political Thought

(Dual-listed with POLS 4300/ CLST 4300). (Cross-listed with POLS 5300).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Study of original texts in political thought ranging from the classical period to the renaissance. Topics such as justice, freedom, virtue, the allocation of political power, the meaning of democracy, human nature, and natural law. (Typically Offered: Fall, Spring, Summer)

CLST 5940A: Research Seminar in European History: Ancient

(Cross-listed with HIST 5940A).

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Topics vary each time offered.

Communication Studies (COMST)

Courses primarily for undergraduates:

COMST 1010: Introduction to Communication Studies

Credits: 3. Contact Hours: Lecture 3.

An introduction to communication theory, the development and functions of communication, and a survey of verbal, nonverbal, interpersonal, small group, organizational, and intercultural communication.

COMST 1040: Orientation to Communication Studies

Credits: 1. Contact Hours: Lecture 1.

Prereq: Major in Communication Studies

Orientation to Communication Studies discipline, program requirements and career opportunities. Required of communication studies majors. Offered on a satisfactory-fail basis only.

COMST 2100: Communication and U.S. Diversity

Credits: 3. Contact Hours: Lecture 3.

Introduction to the role of diversity in communication. Developing competent communication with diverse social groups within interpersonal and organizational contexts in the United States. Topics may include structured reflection of one's role in diverse communication experiences, cultural variations in communication mores, impacts of racial/ethnic/gender identities on communication, workplace policies regarding cultural diversity, the intersection of communication and cultural privilege, communication practices that can reduce prejudice/discrimination, and communication characteristics of advocates for diversity. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall, Spring, Summer)

COMST 2110: Interpersonal Communication

Credits: 3. Contact Hours: Lecture 3.

Apply interpersonal communication theory and concepts to daily interactions. Develop knowledge and skills such as listening and responding, conversation management, using and interpreting nonverbals, conflict resolution, among others. Build skills leading to effective interactions in friendships, romances, families, and the workplace. .

COMST 2140: Professional Communication

Credits: 3. Contact Hours: Lecture 3.

Develop verbal and nonverbal communication competence in organizational settings, with a particular emphasis on interpersonal skills, salary negotiation, team and meeting facilitation, informational interviewing, and team presentations. (Typically Offered: Fall, Spring, Summer)

COMST 2180: Communication and Conflict Management

Credits: 3. Contact Hours: Lecture 3.

Interactive discussion and application of interpersonal conflict with an understanding of the theories and practices associated with effective conflict management. Major topics include conflict climate, power dynamics, negotiation, mediation, creativity, forgiveness, reconciliation, and workplace conflict. .

COMST 3010: Communication Theories

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMST 1010

Examination and application of several major theories in the Communication discipline, with particular emphasis on theories underlying interpersonal, small group, organizational, gender, and intercultural communication.

COMST 3030: Introduction to Communication Research Methods

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMST 1010; 3 additional credits in COMST

An introduction to evaluating, analyzing, and conducting communication research. Provides an overview of quantitative and qualitative approaches to communication research that are beneficial to learn communication concepts and solve communication issues.

COMST 3100: Intercultural Communication

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMST 1010

Examines the theories, principles and research on intercultural communication to enhance cultural sensitivity and to recognize, accept, and adapt to cultural diversity. Interactive assignments. Meets International Perspectives Requirement.

COMST 3110: Relational Communication

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMST 1010

Examines foundational and contemporary interpersonal communication theories and research on initiating, developing, maintaining, and dissolving close relationships. .

COMST 3130: Leadership Communication Theories

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMST 1010

Exploration of the role that communication plays in the leadership process, by using theories of leadership and communication. Key topics include impact of communication on leadership results and the communication dynamics of the leader-follower dyad. Special focus on leaders who are recognized as innovators and/or entrepreneurs in their respective fields, including leaders from the U.S. as well as other nations. (Typically Offered: Fall, Spring)

COMST 3140: Organizational Communication

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMST 1010

Explores the centrality of communication in organizational successes and failures. Provides strategies for assessing and improving individual and organizational communication effectiveness. Addresses issues such as leadership, technology, diversity, work-life negotiation, conflict, emotion, conflict, socialization, and organizational culture. .

COMST 3170: Small Group Communication

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMST 1010

Apply communication theories and concepts to enhance small group and team functioning. Provides insights into how to improve individual and group communication dynamics. Explores topics such as teamwork, group formation, leadership, group member roles, cohesion, and decision-making.

COMST 3190: Communication Training and Development

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMST 1010

Application of adult learning and communication theories to training and development of communication skills and concepts. Focus on: developing expertise in communication skills; designing and presenting face-to-face, synchronous, and asynchronous training sessions; and preparing training assessments. .

COMST 3250: Nonverbal Communication

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMST 1010

Examination of the way nonverbal behavior influences communication processes. Development of observation, analysis, and interpretation skills related to nonverbal communication. Emphasis on both theory and practical application.

COMST 3270: Persuasion and Social Influence

(Cross-listed with PSYCH 3270).

Credits: 3. Contact Hours: Lecture 3.

Examination of theories and research in persuasive communication, including attitudes and social influence. Emphasis on persuasive communication strategies in everyday social settings that influence changes in attitudes and actions. (Typically Offered: Fall, Spring, Summer)

COMST 3300: Communication in a Digital World

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMST 1010

Examines historical backgrounds and current discussions/research regarding digital communication platforms such as email, texting, social media, video conferencing, and newer technologies such as AI and virtual reality. Students apply theories related to online communication to current, real-life situations and gain understandings of the use and impact of communication technologies in relationships and organizations. .

COMST 4040: Research Seminar

(Dual-listed with COMST 5040).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Prereq: (COMST 3010 AND COMST 3030) AND 3 courses in COMST 3100, COMST 3110, COMST 3130, COMST 3140, COMST 3170, COMST 3190, COMST 3250, COMST 3300, COMST 4500, or SP CM 3230

Capstone course for Communication Studies majors. Students examine communication concepts within an organization of their choice. Students collect and analyze survey, interview, observation, and/or textual data and present their results in a final paper and presentation.

(Typically Offered: Fall, Spring, Summer)

COMST 4110X: Family Communication Dynamics

(Dual-listed with COMST 5110X/ HDFS 5110X). (Cross-listed with HDFS 4110X).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMST 1010 or HDFS 2700

Examine theory and research on communication dynamics across a variety of family relationships and structures. Topics include storytelling, affection, conflict, privacy, socialization, stress, and resilience. Students will gain an understanding of the communication behaviors that improve (or detract from) family functioning. (Typically Offered: Fall, Spring)

COMST 4120: Health Communication

(Dual-listed with COMST 5120).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior standing or Permission of Instructor

Examines health communication theories and concepts, with an emphasis on how messages from interpersonal, organizational, cultural, and health informatics sources affect health beliefs and behaviors. Major topics include social interactions in health care settings; emergent communication issues in the management of health care organizations; the relationships among health informatics, ehealth, and the individuals who use them; and the design and evaluation of effective messages in public health promotion campaigns. . (Typically Offered: Fall, Spring)

COMST 4500A: Special Topics in Communication Studies: General

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Junior standing or Permission of Instructor

Research and theory related to special topics and issues in communication studies. Offered irregularly. (Typically Offered: Fall, Spring)

COMST 4900: Independent Study

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: 9 credits in COMST; Junior classification; Permission of Instructor

Application must be submitted for approval the semester prior to the independent study. (Typically Offered: Fall, Spring, Summer)

COMST 4910: Research Practicum

Credits: 1-30. Repeatable, maximum of 6 credits.

Prereq: COMST 2030; COMST 3010; Permission of Instructor

Providing research assistance on projects conducted by Communication Studies faculty. (Typically Offered: Fall, Spring, Summer)

COMST 4970: Professional Internship

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: COMST 2030; COMST 3010; 1 additional 3000-level COMST course; Junior classification; Department Permission

100 hours of on-site professional work per credit hour plus completion of the academic requirement set by the internship committee. Application should be submitted in the term prior to the term in which the internship will be served. Internship cannot be used to meet degree requirement in Communication Studies. (Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

COMST 5040: Research Seminar

(Dual-listed with COMST 4040).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Prereq: Graduate Standing or Permission of Instructor

Capstone course for Communication Studies majors. Students examine communication concepts within an organization of their choice. Students collect and analyze survey, interview, observation, and/or textual data and present their results in a final paper and presentation. (Typically Offered: Fall, Spring, Summer)

COMST 5110X: Family Communication Dynamics

(Dual-listed with COMST 4110X/HDFS 4110X). (Cross-listed with HDFS 5110X).

Credits: 3. Contact Hours: Lecture 3.

Examine theory and research on communication dynamics across a variety of family relationships and structures. Topics include storytelling, affection, conflict, privacy, socialization, stress, and resilience. Students will gain an understanding of the communication behaviors that improve (or detract from) family functioning. (Typically Offered: Fall, Spring)

COMST 5120: Health Communication

(Dual-listed with COMST 4120).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Examines health communication theories and concepts, with an emphasis on how messages from interpersonal, organizational, cultural, and health informatics sources affect health beliefs and behaviors. Major topics include social interactions in health care settings; emergent communication issues in the management of health care organizations; the relationships among health informatics, ehealth, and the individuals who use them; and the design and evaluation of effective messages in public health promotion campaigns. . (Typically Offered: Fall, Spring)

COMST 5900: Special Topics

Credits: 1-4. Repeatable.

Prereq: Instructor Permission for Course

Application must be submitted for approval the semester prior to the independent study. (Typically Offered: Fall, Spring, Summer)

Community and Regional Planning (CRP)

Courses primarily for undergraduates:

CRP 2010: The North American Metropolis

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Examination of the evolution of American urban centers from the colonial era to the present. Considers the demographic changes and social movements underway in urban America and explores how an understanding of the history of cities provides us with knowledge that we can use to improve our cities today. (Typically Offered: Fall, Spring)

CRP 2110: Digital Design Methods for Landscape Architecture

(Cross-listed with LA 2110).

Credits: 3. Contact Hours: Lecture 3.

Foundational knowledge and basic skills in 2D, 3D, and 4D computer applications used for design development and communication, with emphasis on 3D modeling and workflow interoperability. (Typically Offered: Spring)

CRP 2510: Fundamentals of Geographic Information Systems

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Fundamentals of the concepts, models, functions and operations of Geographic Information Systems (GIS). Principals of spatial problems, spatial questions and hypotheses and their solutions based on spatial data, GIS tools and techniques. Integration of concepts and applications through lectures and facilitated labs. Applications from a variety of areas including design; physical, social, and human science; engineering; agriculture; business and medicine, landscape architecture, architecture, urban planning, geology, forestry, biology, and ecology. (Typically Offered: Fall)

CRP 2910: World Cities and Globalization

Credits: 3. Contact Hours: Lecture 3.

World cities and globalization in developed and developing countries. Topics include globalization, world cities and regions, uneven economic development, the international division of labor, multinational corporations, international environmentalism, tourism, popular culture and place-based identity. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

CRP 2930: Environmental Planning

(Cross-listed with ENVS 2930).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Comprehensive overview of the field of environmental relationships and the efforts being made to organize, control, and coordinate environmental, aesthetic, and cultural characteristics of land, air, and water. (Typically Offered: Fall, Spring)

CRP 3010: Urban Analytical Methods

Credits: 4. Contact Hours: Lecture 3, Studio 2.

Prereq: STAT 1010

An introduction to the methods and analytical techniques used by planners to study community change. Course includes identification of key sources of planning information and data. Students learn to use quantitative methods for analysis of population, land use, economic and transportation data. Students learn to apply basic analytic methods to community problems and learn the art of effective written, graphic, and oral presentation of data. (Typically Offered: Spring)

CRP 3020: Plan Analysis and the Development Process

Credits: 3. Contact Hours: Lecture 3.

Prereq: CRP 3010

Course introduces how to read and understand different types of plans, including land use plans, comprehensive plans, transportation plans, parks and recreation plans, housing plans, neighborhood plans, downtown plans, climate action plans. Students will learn plan analysis, staff report writing, presentations to the public and elected officials, and the development proposal process.

CRP 3200: Urban Geography

Credits: 3. Contact Hours: Lecture 3.

An introduction to urban geography. Study of urban centers, including people and infrastructure. Investigation of the origin and evolution of urban areas and the processes that shape urban change. Topics include urban form, and the social, economic, political, cultural, and institutional factors that shape cities. (Typically Offered: Fall, Spring)

CRP 3250: Introduction to Housing

Credits: 3. Contact Hours: Lecture 3.

Introduction to issues related to the topic of housing in the United States. Particular focus on the social and spatial segmentation of housing in the U.S. and the role of policy in housing production and regulation. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Spring)

CRP 3300: Practicum

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: Major in CRP

Structured work experience under close supervision of a professional planner. Practical planning experience; relationships between theory and practice, professional responsibilities, and the scope of various planning roles. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

CRP 3310: Professional Practice Seminar

Credits: 2. Contact Hours: Lecture 2.

Prereq: CRP 3010 and Junior classification

Preparation for working as a planning professional; development of resume and portfolio; discussion of professional ethics and expectations of employers and clients; presentations from planning professionals, and discussion of the range of career choices within the planning profession. (Typically Offered: Fall)

CRP 3510: Geospatial Analysis and Visualization

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: CRP 2510

Intermediate GIS course for students who are interested in learning advanced functions and operations of Geographic Information Systems. Principles of spatial problem types and solutions, geographical concepts and tools and techniques will be shared during lecture and several ESRI ArcGIS Pro software components will be used in a facilitated lab setting. Emphasis will be on regional planning and transportation studies, as well as environmental, social and sustainable practices and related applications. Latest GIS applications will be integrated in the coursework to allow visualizing city plans and projects in one place for collaboration among stakeholders. (Typically Offered: Fall, Spring)

CRP 3760: Rural, Urban and Regional Economics

(Cross-listed with ECON 3760).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 1010

Firm location with respect to regional resources, transport, scale economies, externalities, and policies. Measures of local comparative advantage and specialization. Spatial markets. Population location considering jobs, wages, commuting, and local amenities. Business, residential, and farm land use and value. Migration. Other topics may include market failure, regulation, the product cycle, theories of rural and urban development, developmental policy, firm recruiting, local public goods and public finance, schools, poverty, segregation, and crime.

CRP 3830: Theory of the Planning Process

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior classification

The nature of planning and its relation to social and economic planning; levels of planning, place of planning in decision making; steps in the planning process, uses and limitation of knowledge in planning, relation of facts and values. (Typically Offered: Fall)

CRP 3910: Field Travel

Credits: 1-2. Repeatable.

Prereq: Major in CRP

Observation of professional practice and community or regional problems and issues. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

CRP 4100: Professional Work Experience

Credits: Required. Repeatable.

Prereq: Instructor Permission for Course

Approved professional work experience. (Typically Offered: Fall, Spring, Summer)

CRP 4160: Urban Design and Practice

(Dual-listed with CRP 5160).

Credits: 6.

Prereq: CRP 3010

Principles of urban design and their application to residential and commercial development in studio projects. (Typically Offered: Spring)

CRP 4170: Urban Revitalization

(Dual-listed with CRP 5170).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior classification

Planning methods available to further revitalization and preservation efforts, with particular attention to housing and neighborhoods. Relationship between neighborhood change and urban development process; public policy implications. (Typically Offered: Spring)

CRP 4210: Financing Historic Preservation Projects

Credits: 3. Contact Hours: Lecture 3.

Investigation of the financial tools and incentives used to promote the rehabilitation and redevelopment of historic buildings and neighborhoods in cities and towns. Study of broader economic and social impacts on communities. Examinations of completed preservation projects around the United States. (Typically Offered: Fall)

CRP 4290: Planning in Developing Countries

(Dual-listed with CRP 5290).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior classification

Introduction to issues in planning and governance in developing countries. Problems and strategies may include population movement and change, economic globalization, rural development, urban growth, sustainable development, and housing. (Typically Offered: Fall, Spring)

CRP 4320: Community Planning Studio

Credits: 4-6.

Prereq: (CRP 2010, CRP 3010, and CRP 3830) OR Permission of Instructor

Integration of planning methods and theory in dealing with a community planning problem. Analysis of problem and formulation of strategies for implementation. Preparation of a community planning report. (Typically Offered: Fall, Spring)

CRP 4350: Planning in Small Towns

(Dual-listed with CRP 5350).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior classification

Contemporary planning problems in small towns and the design of viable strategies to enhance their social and economic position in today's society. (Typically Offered: Fall)

CRP 4360: Community Economic Development

(Dual-listed with CRP 5360).

Credits: 3. Contact Hours: Lecture 3.

The nature and process of economic development in the context of community development. Recent changes and trends and their implications for local and regional development. Selected case studies and applications. Contemporary community economic development issues. Offered odd-numbered years. (Typically Offered: Fall)

CRP 4370: Public Participation in Planning

Credits: 3. Contact Hours: Lecture 3.

Rationale and need for public participation in community planning and development. Techniques used to garner participation, and the ability to integrate techniques into a broader participatory process. Techniques covered will include public hearings, public meetings, social action construct, advisory committees, scenario building, social media and asset mapping. Students will also work with a community to demonstrate skills learned. (Typically Offered: Spring)

CRP 4420: Site Development

(Dual-listed with CRP 5420).

Credits: 3. Contact Hours: Lecture 3.

Introduction to site development including site review. Studio project integrating concept, finance, selection, analysis, and design. (Typically Offered: Spring)

CRP 4450: Transportation Policy and Planning

(Dual-listed with CRP 5450).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior classification

Comprehensive overview of key policy issues related to transportation planning and investment in the United States and abroad. Policy issues explored include safety, environmental impact, sustainable communities, and economic development. Policy analysis and planning are studied in conjunction with each policy issue explored. Issues of concern to state, metropolitan, and local governments. (Typically Offered: Fall)

CRP 4490: Geodesign: Planning for Sustainable Futures

(Dual-listed with CRP 5490).

Credits: 3. Contact Hours: Lecture 3.

Prereq: CRP 2510

Geodesign combines design creativity with scientific thinking based on spatial data. Special focus on sustainable development of future neighborhoods, communities, cities and/or countries. Students learn the geodesign process and implement a set of techniques and technologies that enable project conceptualization, data collection and visualization, spatial analysis, design creation, impact evaluation and stakeholder participation. Final project involves developing cases for analysis using GIS software.

CRP 4510: Introduction to Geographic Information Systems

Credits: 3.

Introduction to geographic information systems, including discussions of GIS hardware, software, data structures, data acquisition, data conversion, data presentation, analytical techniques, and implementation procedures. Laboratory emphasizes practical applications and uses of GIS. (Typically Offered: Fall, Spring, Summer)

CRP 4520: Geographic Data Management and Planning Analysis

(Dual-listed with CRP 5520).

Credits: 3.

Prereq: CRP 3510

Extensive coverage of geo-relational database concept and design, GIS database creation and maintenance, geographic data manipulation and analysis. GIS output generation and geographic data presentation. Laboratory emphasizes practical applications and uses of GIS. (Typically Offered: Fall, Spring)

CRP 4540: Fundamentals of Remote Sensing and Spatial Analysis

(Dual-listed with CRP 5540/ LA 5540). (Cross-listed with LA 4540).

Credits: 3. Contact Hours: Lecture 3.

Prereq: CRP 3510 or AGRON 2700 or NREM 3450 or GEOL 4520 or LA 3020 or CRP 5510 or GEOL 5520

Introduction to image processing techniques needed for analysis of optical remote sensing imagery, including filtering, enhancement, and classification. Analysis of elevation surfaces, hydrology, distance, overlays and visual programming with Model Builder. Practical applications in a variety of topics to understand how to analyze imagery. (Typically Offered: Spring)

CRP 4550: Smart and Sustainable Cities

(Dual-listed with CRP 5550).

Credits: 3. Contact Hours: Lecture 3.

Introduction to concepts of smart and sustainable cities. Study of novel technologies for smart and sustainable cities, including sustainable energy, innovative tools for citizens' engagement, improved safety, smart mobility, and happy living. Examples of national and international smart cities. Students may gain experience with ArcGIS Online, ArcUrban and/or other emerging software.

CRP 4560: GIS Programming and Automation

(Dual-listed with ABE 5560/ CRP 5560).

Credits: 3. Contact Hours: Lecture 3.

Prereq: CRP 3510 or AGRON 2700 or NREM 3450 or GEOL 4520 or LA 3020 or CRP 5510 or GEOL 5520

Introduction to automated geoprocessing in Geographic Information Systems using Python. Focus on learning scripting language and object-oriented programming, automation of custom-designed geoprocessing scripts, and application toward student research and/or interests. (Typically Offered: Fall)

CRP 4570: Geogames for Civic Engagement

(Dual-listed with CRP 5570).

Credits: 3. Contact Hours: Lecture 3.

Explore, design, and implement participatory geospatial games; define GeoGames; learn about different types of GeoGames and their formal and dramatic elements; design GeoGames for civic engagement, community visioning, and community planning. (Typically Offered: Spring)

CRP 4600: Social Justice and Planning

(Dual-listed with CRP 5600).

Credits: 3. Contact Hours: Lecture 3.

Investigation of the topic of social justice as it relates to the challenge of planning more socially just urban societies, emphasizing the importance of social justice issues to planning in a globalized world. Includes a range of issues and case studies of local social justice initiatives, both US and global. Students will complete individual service learning projects as part of the course requirement. Offered even-numbered years. (Typically Offered: Spring)

CRP 4710: Real Estate Development

Credits: 3. Contact Hours: Lecture 3.

Summary of the process to develop real property. Using case studies, examine how the development process differs between residential, office, retail and mixed-use projects. Study the development process using a diverse set of analytical tools including market research, planning and legal analysis, and the discounted cash flow method. (Typically Offered: Spring)

CRP 4750: Grant Writing

(Dual-listed with CRP 5750).

Credits: 1. Contact Hours: Lecture 1.

A short introduction to effective grant writing for the public and non-profit sectors. Includes identifying appropriate funding sources for an organization, identifying goals and objectives, and budgeting. (Typically Offered: Fall)

CRP 4790: Public Finance and Planning

(Dual-listed with CRP 5790).

Credits: 3. Contact Hours: Lecture 3.

Overview of public finance theory, particularly in how it relates to local governments and the work of planning and community development. Concepts include theories of taxation, challenges unique to local public finance, collective action, and a survey of the different revenue sources used to fund local government. (Typically Offered: Spring)

CRP 4840: Sustainable Communities

(Dual-listed with CRP 5840). (Cross-listed with ENVS 4840).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior classification

The history and theory of sustainable community planning. Procedural and substantive dimensions. Case studies of communities engaged in sustainability planning. Use and development of indicators. (Typically Offered: Spring)

CRP 4900: Independent Study

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Investigation of an approved topic commensurate with student's interest and ability. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

CRP 4900H: Independent Study: Honors

Credits: 1-3. Repeatable.

Prereq: Permission of Instructor; Membership in the University Honors Program

Investigation of an approved topic commensurate with student's interest and ability. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

CRP 4910: Environmental Law and Planning

(Dual-listed with CRP 5910/ LA 5910). (Cross-listed with ENVS 4910/ LA 4910).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 6 credits natural sciences or permission of instructor

Environmental law and policy as applied in planning at the local and state levels. Brownfields, environmental justice, water quality, air quality, wetland and floodplain management, and local government involvement in ecological protection through land use planning and other programs. (Typically Offered: Spring)

CRP 4920: Planning Law, Administration and Implementation

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior classification

The basis in constitutional, common, and statutory law for the powers of plan implementation. Problems of balancing public and private interests as revealed in the study of leading court cases. Administration of planning agencies and programs. (Typically Offered: Fall)

CRP 4940: Senior Seminar in Planning

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable, maximum of 2 times.

Prereq: Senior classification

An advanced forum for seniors that focuses upon recent trends and important issues affecting planning today. Topics addressed will vary. A demonstration of understanding of current issues and their effects upon planning applications is expected. (Typically Offered: Fall, Spring)

Courses primarily for graduate students, open to qualified undergraduates:

CRP 5010: The Practice of Planning

Credits: 1. Contact Hours: Lecture 1.

Prereq: Graduate Standing or Permission of Instructor

Exploration of the practice of planning in the United States. Discussion of the role of professional planning; field trips to meet practicing planners; learn about local government structure, functions and key issues confronting Iowa and US communities; examination of career paths within the planning profession. (Typically Offered: Fall)

CRP 5100: Professional Work Experience

Credits: Required. Repeatable.

Prereq: Instructor Permission for Course

Approved professional work experience. (Typically Offered: Fall, Spring, Summer)

CRP 5110: Documenting the Historic Built Environment

Credits: 3-4. Contact Hours: Lecture 4.

Prereq: Graduate Standing or Permission of Instructor

Principals and methods for researching, identifying, recording, and analyzing buildings, districts, and sites that are historically or architecturally significant. Classroom and fieldwork components will use real-world historic places as case studies. (Typically Offered: Fall)

CRP 5160: Urban Design Practice

(Dual-listed with CRP 4160).

Credits: 6.

Prereq: Graduate Standing or Permission of Instructor

Principles of urban design and their application to residential and commercial development in studio project. (Typically Offered: Spring)

CRP 5170: Urban Revitalization

(Dual-listed with CRP 4170).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Planning methods available to further revitalization and preservation efforts, with particular attention to housing and neighborhoods. Relationship between neighborhood change and urban development process; public policy implications. (Typically Offered: Spring)

CRP 5210: Historic Preservation Planning: Theory and Practice

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to the history, theory, and practice of historic preservation and cultural resource management. Cases exploring preservation in US and global contexts; politics of preservation; preservation technologies; and relationship of preservation to other community issues. (Typically Offered: Spring)

CRP 5260: Real Estate Development

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Overview of the real estate development process. Topics include the history of real estate development, roles of planning and market forces in real estate development, and financial management of real estate development. Projects involve analysis of market niches, market penetration rates, lease rates, synergism and tenant mix, and the go/no go decision applied to residential, commercial, and mixed-use development.

CRP 5270: Sustainable Community Development

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduces the central principles of sustainable community design and its implementation in the residential and commercial real estate development sectors. Topics include current practices and regulatory mandates, with a focus on the importance of private participation in the development of sustainable communities.

CRP 5280: Financing Historic Preservation Projects and Revitalizing Communities

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Investigation of the financial tools and incentives used to promote the rehabilitation and redevelopment of historic buildings and neighborhoods in cities and towns. Study of broader economic and social impacts on communities. Examinations of completed preservation projects around the United States.

CRP 5290: Planning in Developing Countries

(Dual-listed with CRP 4290).

Credits: 3. Contact Hours: Lecture 3.

Introduction to issues in planning and governance in an international setting. Problems and strategies may include population movement and change, economic globalization, urban growth, rural development, and housing. (Typically Offered: Fall, Spring)

CRP 5300: Practicum

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: Graduate Standing or Permission of Instructor

Practical planning experience. Structured work in range of tasks under close supervision of a professional planner. Relationships between theory and practice, exposure to variety of roles in functioning specialties. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

CRP 5320: Community Planning Studio

Credits: 4-6.

Prereq: Graduate Standing or Permission of Instructor

Comprehension and analysis of various geographic contexts pertinent to community planning and the use of planning theory, tools and techniques in an applied setting. Process of making a community plan: historical patterns, current conditions and strategies for planning. (Typically Offered: Fall)

CRP 5350: Planning in Small Towns

(Dual-listed with CRP 4350).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Contemporary planning problems in small towns and the design of viable strategies to enhance their social and economic position in today's society. Offered even-numbered years. (Typically Offered: Fall)

CRP 5360: Community Economic Development

(Dual-listed with CRP 4360).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

The nature and process of economic development in the context of community development. Recent changes and trends and their implications for local and regional development. Selected case studies and applications. Contemporary community economic development issues. Offered odd-numbered years. (Typically Offered: Fall)

CRP 5420: Site Development

(Dual-listed with CRP 4420).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to site development, including site review. Studio project integrating concept, finance, selection, analysis, and design. (Typically Offered: Spring)

CRP 5450: Transportation Policy and Planning

(Dual-listed with CRP 4450).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Comprehensive overview of key policy issues related to transportation planning and investment in the United States and abroad. Policy issues explored include safety, environmental impact, sustainable communities, and economic development. Policy analysis and planning are studied in conjunction with each policy issue explored. Issues of concern to state, metropolitan, and local governments. (Typically Offered: Fall)

CRP 5490: Geodesign: Planning for Sustainable Futures

(Dual-listed with CRP 4490).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Geodesign combines design creativity with scientific thinking based on spatial data. Special focus on sustainable development of future neighborhoods, communities, cities and/or countries. Students learn the geodesign process and implement a set of techniques and technologies that enable project conceptualization, data collection and visualization, spatial analysis, design creation, impact evaluation and stakeholder participation. Final project involves developing cases for analysis using GIS software.

CRP 5500: Making Resilient Environments

(Cross-listed with SUSE 5500).

Credits: 3. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Major theories and ideas revolving around the concept of resilience. Assessing the social and political processes associated with policy making for resilience. Application of the concept of resilience in order to understand and evaluate environments. Evaluate the different approaches toward resilience and develop an understanding of the relationship between sustainability and resilience. Case studies of communities that proactively prepare for, absorb, recover from, and adapt to actual or potential future adverse events. (Typically Offered: Spring)

CRP 5510: Introduction to Geographic Information Systems

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Introduction to geographic information systems, including discussions of GIS hardware, software, data structures, data acquisition, data conversion, data presentation, analytical techniques, and implementation procedures. Laboratory emphasizes practical applications and uses of GIS. (Typically Offered: Fall, Spring, Summer)

CRP 5520: Geographic Data Management and Planning Analysis

(Dual-listed with CRP 4520).

Credits: 3.

Prereq: Graduate Standing or Permission of Instructor

Extensive coverage of geo-relational database concept and design, GIS database creation and maintenance, geographic data manipulation and analysis. GIS output generation and geographic data presentation. Laboratory emphasizes practical applications and uses of GIS. (Typically Offered: Fall, Spring)

CRP 5530: Analytical Planning/GIS

Credits: 3.

Prereq: Graduate Standing or Permission of Instructor

Integration of exploratory, participatory and predictive spatial analyses and 3D visualization into the planning process. GIS tools and techniques are used to automate decision analysis and facilitate future planning in analyzing and visualizing planning actions. Laboratory emphasizes practical uses of GIS tools and techniques. (Typically Offered: Fall)

CRP 5540: Fundamentals of Remote Sensing and Spatial Analysis

(Dual-listed with CRP 4540/ LA 4540). (Cross-listed with LA 5540).

Credits: 3. Contact Hours: Lecture 3.

Introduction to image processing techniques needed for analysis of optical remote sensing imagery, including filtering, enhancement, and classification. Analysis of elevation surfaces, hydrology, distance, overlays and visual programming with Model Builder. Practical applications in a variety of topics to understand how to analyze imagery. (Typically Offered: Spring)

CRP 5550: Smart and Sustainable Cities

(Dual-listed with CRP 4550).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to concepts of smart and sustainable cities. Study of novel technologies for smart and sustainable cities, including sustainable energy, innovative tools for citizens' engagement, improved safety, smart mobility, and happy living. Examples of national and international smart cities. Students may gain experience with ArcGIS Online, ArcUrban and/or other emerging software.

CRP 5560: GIS Programming and Automation

(Dual-listed with CRP 4560). (Cross-listed with ABE 5560).

Credits: 3. Contact Hours: Lecture 3.

Prereq: CRP 3510 or AGRON 2700 or NREM 3450 or GEOL 4520 or LA 3020 or CRP 5510 or GEOL 5520

Introduction to automated geoprocessing in Geographic Information Systems using Python. Focus on learning scripting language and object-oriented programming, automation of custom-designed geoprocessing scripts, and application toward student research and/or interests. (Typically Offered: Fall)

CRP 5570: Geogames for Civic Engagement

(Dual-listed with CRP 4570).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Explore, design, and implement participatory geospatial games; define GeoGames; learn about different types of GeoGames and their formal and dramatic elements; design GeoGames for civic engagement, community visioning, and community planning. (Typically Offered: Spring)

CRP 5580: Web Mapping and Spatial Data Visualization

(Cross-listed with LA 5580).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Use and development of online mapping tools and coding to support participatory GIS, Volunteered Geographic Information, information sharing, geodesign, and decision-making actions. Geoprocessing, spatial data science, and user interface design. Laboratory emphasis on practical applications and uses of Web GIS.

CRP 5600: Social Justice and Planning

(Dual-listed with CRP 4600).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Investigation of the topic of social justice as it relates to the challenge of planning more socially just urban societies, emphasizing the importance of social justice issues to planning in a globalized world. Includes a range of issues and case studies of local social justice initiatives, both US and global. Students will complete individual service learning projects as part of the course requirement. Offered even-numbered years. (Typically Offered: Spring)

CRP 5610: Planning Theory

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Use and development of theory/action relationship in planning practice. Competing normative theories of planning and their evolution, key components and fundamental critiques. Exploration of planning frameworks and approaches, including comprehensive planning; incrementalism; advocacy; communicative rationality; and others. (Typically Offered: Spring)

CRP 5630: Planning the American Metropolis

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Focus on the historical role of planning in the shaping of American cities and regions, from the beginning of the Republic to the present. Examine the legacy of planning by exploring the intersection of design, politics and policy. Investigate the factors and the processes that produce the built environment. (Typically Offered: Fall)

CRP 5640: Introduction to Analytical Methods for Planning

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Applications of analytical methods in planning with emphasis on the collection, description, analysis, presentation, and interpretation of planning data. Introduction to descriptive statistics. Sources of planning information and data including primary and secondary data types and sources. Demographic analysis, population projection techniques for planning at local and regional levels. (Typically Offered: Fall)

CRP 5660: Policy Analysis and Planning

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Principles and methods for analyzing community problems and policies including forecasting, efficiency and equity measures, cost/benefit, political feasibility, and sensitivity analysis. Examination of social, political, economic, and environmental values and their manifestation in decision making methods used in planning. Application of tools used to analyze planning problems, project evaluation and public policies. (Typically Offered: Fall)

CRP 5680: Planning and Development

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Exploration and evaluation of the techniques, processes, and professional skills required to effectively manage land use change at various scales. Land classification systems; land supply and needs inventory for residential uses and commercial and employment centers; capacity and needs analysis for public infrastructure. Includes land use planning project(s) designed to apply the methods explored in this and other courses. (Typically Offered: Spring)

CRP 5730: Contemporary Issues in Global Housing

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Investigation of broader social and economic processes around the globe from the housing perspective. Case study approach to shelter struggles and the various policy and design responses related to them, as a means of understanding a range of issues important to urban systems including poverty, development, urbanization, migration, social movements and citizenship. (Typically Offered: Fall)

CRP 5750: Grant Writing

(Dual-listed with CRP 4750).

Credits: 1. Contact Hours: Lecture 1.

Prereq: Graduate Standing or Permission of Instructor

A short introduction to effective grant writing for the public and non-profit sectors. Includes identifying appropriate funding sources for an organization, identifying goals and objectives, and budgeting. (Typically Offered: Fall)

CRP 5780: MRED Capstone Project

(Cross-listed with FIN 5780).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Enrollment in Master of Real Estate Development

Refinement of students' problem-solving, communication and negotiation skills. Students work on an actual case. Teams will apply knowledge acquired in the classroom to some aspect of a current development on-the-ground and in-process project.

CRP 5790: Public Finance and Planning

(Dual-listed with CRP 4790).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Overview of public finance theory, particularly in how it relates to local governments and the work of planning and community development. Concepts include theories of taxation, challenges unique to local public finance, collective action, and a survey of the different revenue sources used to fund local government. (Typically Offered: Spring)

CRP 5840: Sustainable Communities

(Dual-listed with CRP 4840/ ENVS 4840).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

The history and theory of sustainable community planning. Procedural and substantive dimensions. Case studies of communities engaged in sustainability planning. Use and development of indicators. (Typically Offered: Spring)

CRP 5900A: Special Topics: Planning Law, Administration and Implementation

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

CRP 5900B: Special Topics: Economic Development

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

CRP 5900C: Special Topics: Urban Design

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

CRP 5900D: Special Topics: Housing and Urban Revitalization

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

CRP 5900H: Special Topics: Environmental Planning

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

CRP 5900I: Special Topics: Land Use and Transportation Planning

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

CRP 5900N: Special Topics: International Planning

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

CRP 5900O: Special Topics: Spatial Analytical Methods

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

CRP 5900P: Special Topics: Planning in Small Towns

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

CRP 5900Q: Special Topics: Diversity and Equity in Planning

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

CRP 5900R: Special Topics: Geographic Information Systems

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

CRP 5910: Environmental Law and Planning

(Dual-listed with CRP 4910/ ENVS 4910/ LA 4910). (Cross-listed with LA 5910).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Environmental law and policy as applied in planning at the local and state levels. Brownfields, environmental justice, water quality, air quality, wetland and floodplain management, and local government involvement in ecological protection through land use planning and other programs. (Typically Offered: Spring)

CRP 5920: Land Use and Development Regulation Law

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

An in-depth analysis of the legal constructs that shape the practice of planning and plan implementation in the United States. An exploration of how land use regulations are applied to reconcile the competing needs and diverse uses of land. The positive and negative consequences of developing and implementing regulatory controls will be addressed. (Typically Offered: Fall)

CRP 5930X: Field Travel

Credits: 1-2. Contact Hours: Lecture 2.

Repeatable.

Prereq: Senior or graduate classification

Field travel, either domestic or international, to observe and analyze local professional planning practices and to provide firsthand exposure to the destination community and its residents. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

CRP 5950: Seminar in GIS Applications/Research

Credits: 1. Contact Hours: Lecture 1.

Prereq: Graduate Standing or Permission of Instructor

Discussion and demonstration of current GIS applications and research in multiple disciplines. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

CRP 5980X: Comprehensive Exam Preparation

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Preparation to complete the capstone requirement for the MCRP program, which is a comprehensive exam that will be administered as part of this course. Material based on content of required courses and electives as well as study and test-taking strategies. Ideally taken in the Fall semester of a student's second academic year immediately prior to graduation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

CRP 5990: Professional Planning Report

Credits: 1-30. Contact Hours: Laboratory 30.

Repeatable.

Prereq: Instructor Permission for Course

Independent planning project with practical application, including research element. Offered on a satisfactory-fail basis only.

Courses for graduate students:**CRP 6990: Research**

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Offered on a satisfactory-fail basis only.

Community Development (COMDV)

Courses primarily for graduate students, open to qualified undergraduates:

COMDV 5020: Theories and Constructs of Community Change

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Examines the principles and practices of community change. Use of case studies to relate development approaches to conceptual models. Constructs defining community include community capitals, community field and interactionism, human ecology, social identity, community conflict, communitarianism, and central place theory.

COMDV 5030: Community Development Methods

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to research methods relevant to community development. Topics include research design and methods of data collection. Conceptual frameworks are used to develop research questions and analyze data. Strategies for reporting research results as a means of community action are examined.

COMDV 5040: Creating Community Change

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Examines the role of civil society in community planning efforts and a comparative approach to planning theories and approaches. Focuses on change within communities and the roles of government, planners, and citizens in reacting to or shaping change. Explores the relationship of community planning to community development as community responses to change.

COMDV 5050: Analysis of the Community Economy

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to theories of community economic growth. Examines drivers of economic growth, community economic base, sources of growth or decline, roles of local government and institutions, analytical tools, and strategies for local economic development. Explores use of data in community economic development and local and regional development action.

COMDV 5300: Community Development Practicum

Credits: 3.

Prereq: Graduate Standing or Permission of Instructor

Practical community development experience. Structured work in range of tasks under close supervision of a professional community developer. Exploration of relationships between theory and practice, exposure to variety of professional roles in community development, and demonstration of the ability to design community development programming. Demonstrate applications of knowledge gained from previous coursework.

Community Development GPIDEA (CDEV)

Courses primarily for graduate students, open to qualified undergraduates:

CDEV 5020: Community and Natural Resource Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Detailed introduction to community resource management. Theoretical frameworks, methodological investigation, applied practices.

Enhancement of ability of community development professionals to work with communities to plan, develop and monitor conservation and development of natural resources with multiple functions.

CDEV 5030: Principles and Strategies of Community Change

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Analysis of principles and practices of community change and development. Use of case studies to relate community development approaches to conceptual models from diverse disciplines. Exploration of professional practice principles, and student construction of their personal framework for practicing community development.

CDEV 5040: Community Analysis: Introduction to Methods

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to research methods relevant to community development. Formulate and begin a research effort, methods of data collection and how conceptual frameworks are used to develop the questions and analyze data. Emphasis on strategies for reporting findings and applying findings in community action and methods of evaluating the entire research process. Significant attention paid to issues of research ethics and inclusiveness.

CDEV 5050: Organizing for Community Change

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Examines role of civil society in community planning efforts. Comparative approach to planning theories and approaches. Focus on change within communities and the roles of government, planners, and citizens in reacting to or shaping change. Dimensions of social capital and the context of change covered.

CDEV 5060: Community and Regional Economic Analysis I

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to concepts of communities and regions, theories of economic growth, drivers of economic growth, the economic base of a community, sources of growth or decline in the community, roles of local government and institutions, and analytical tools. Strategies for local economic development will also be explored.

CDEV 5070: Introduction to Native Communities

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

A base knowledge course. For students currently working within, in partnership with, or considering working with Native communities. Basic understanding within the context of community development of the diversity of the tribal structures and cultures and the unique history and jurisdictional considerations of these nations. Working with tribes, Federal and Indian relations, and governance and cultural issues.

CDEV 5080: Ecological Economics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Approaches economy and community by looking at the inherent interdependence, jointness, and potential complementarity between ecology and economy (utility) of a place.

CDEV 5090: Building Native Community and Economic Capacity

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Focus on non-western approaches to helping Native communities build their capacity. Students will learn to take a participatory, culture-centered, and strength-based approach to development.

CDEV 5100: Indian Country Agriculture and Natural Resources

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to the historical and contemporary issues related to natural resource management on Native American lands. Philosophical and economic arguments concerning natural resource conservation, preservation and extraction will be explored.

CDEV 5120: Sustainable Communities

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Students will learn the conceptual relationships among Community and Sustainable Development and Sustainable Communities and examine the social, environmental, and economic aspects of sustainable communities. The course includes analysis of public policy impacts on community sustainability, practical actions for enhancing sustainability, and changing power dynamics and reward structures involved in incorporating sustainability into Community Development.

CDEV 5130: Economic Development Strategies and Programs

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Course explores theories of local economic development and addresses the development issues faced by communities in the 21st century. Students will understand and apply concepts from economic development planning, economic analysis, business development, human resource development, community-based development, and high-technology development.

CDEV 5200: Community Development Orientation

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Introduction to the Community Development program. Focus on on-line delivery methods, graduate level research and writing, technology skills.

CDEV 5210: Housing and Development

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Review and evaluation of historical and current housing issues, production, and financial systems, including consideration of racial, ethnic, income, and gender issues as they relate to the role of housing developments and programs in community development. (Typically Offered: Spring)

CDEV 5220: Community Leadership and Capacity Building

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Defining leadership and applying it to the workplace. Understanding of potential link between leadership and community capacity. Identifying strategies for leadership development in communities.

CDEV 5230: Grantwriting for Community Development Professionals

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Basic Grant Development and Management will introduce students to the grant-getting process and provide an overview of what happens after a project is funded. The following topics will be covered: researching funding sources, generating cutting edge ideas, assessing needs, planning a project, establishing credibility, formulating a sustainable budget, designing an evaluation plan, managing the funded project, and disseminating project results.

CDEV 5240: Non-Profit Management in Community Development

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Understanding of how non-profit organizations are run in order that they may participate more fully in community development efforts. Learning skills necessary to assist organizations to manage community development projects and programs, such as, budgeting, planning, personnel, facilities, volunteer management, and fundraising.

CDEV 5250: Role of Tribal Colleges in Economic Development

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Focus on role of tribally-chartered colleges and universities in economic development within Native communities. Social capital analytic framework to examine and evaluate tribal college model of economic development.

CDEV 5260: Immigration and Community Inclusion

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Mechanisms for community inclusion and exclusion in relation to immigration will be examined. Aspects of ethnicity, religion, occupation and transnationalism are addressed in terms of community mechanism for incorporating immigrants as community assets.

CDEV 5270: Public and Non-Profit Budgeting

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to the fundamental theories and practices of budgeting in the public and non-profit sectors. Topics covered include overview of budgeting and budget reform, taxation, expenditures, budget preparation and adoption, budget implementation, and performance budgeting. (Typically Offered: Summer)

CDEV 5280: Evaluation of Organizations and Programs

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to the philosophy, techniques, and methodologies of organizational and program evaluation. Overview of program evaluation and theory, techniques to evaluate program processes and performance, evaluation designs, assessing program efficiency, models to diagnose organizations, and methods to assess organizational performance.

CDEV 5300: Toward Ethical Engagement

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Understanding what ethics are and identify ethical dimensions of a problem. Ability to employ ethical analysis and engagement strategies in public problem-solving.

CDEV 5320: Community and Regional Economic Analysis II

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Substantive grounding in the theories and practice of measuring community economic dynamics; build solid foundation skills for applied community economic analysis.

CDEV 5900: Special Topics in Community Development

Credits: 1-3. Repeatable, maximum of 4 times.

Prereq: Graduate Standing or Permission of Instructor

Special topics in Community Development. Independent Study, must get instructor approval. (Typically Offered: Fall, Spring, Summer)

CDEV 5990: Creative Component

Credits: 1-30. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Students work with major professor to conduct research and carry out work on their creative component. Instructor permission required. (Typically Offered: Fall, Spring, Summer)

Courses for graduate students:**CDEV 6990: Thesis Research**

Credits: 1-6. Repeatable.

Thesis Research. (Typically Offered: Fall, Spring, Summer)

Computer Engineering (CPRE)

Courses primarily for undergraduates:**CPRE 1310: Introduction to Computer Security Literacy**

(Cross-listed with CYBSC 1310).

Credits: 1. Contact Hours: Lecture 1.

Basic concepts of practical computer and Internet security: passwords, firewalls, antivirus software, malware, social networking, surfing the Internet, phishing, and wireless networks. This class is intended for students with little or no background in information technology or security. Basic knowledge of word processing required. Offered on a satisfactory-fail basis only.

CPRE 1610: Programming Practice for Engineers

Credits: 1. Contact Hours: Lecture 1.

Applied introduction to computer programming for engineering students. Topics include variables and objects, control flow, iteration and looping, string processing, and file input/output. Modern software development practices, tooling, and testing. Individual programming assignments and projects. (Typically Offered: Fall, Spring, Summer)

CPRE 1660: Professional Programs Orientation

(Cross-listed with EE 1660).

Credits: Required. Contact Hours: Lecture 1.

(1-0) Overview of the nature and scope of electrical engineering and computer engineering professions. Overview of portfolios. Departmental rules, advising center operations, degree requirements, program of study planning, career options, and student organizations. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

CPRE 1840: Computer Engineering Learning Community

Credits: 1. Contact Hours: Lecture 1.

Integration of first-year students into the Computer Engineering program. Assignments and activities involving teamwork, academic preparation, study skills, and preparation for entry into the Computer Engineering profession. Completed both individually and in learning teams under the direction of faculty and peer mentors. (Typically Offered: Fall)

CPRE 1850: Introduction to Computer Engineering and Problem Solving I

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: (MATH 1430 or satisfactory scores on mathematics placement examinations) OR (MATH 1650 or satisfactory scores on mathematics placement examinations)

Introduction to Computer Engineering. Project based examples from computer engineering. Individual interactive skills for small and large groups. Computer-based projects. Solving engineering problems and presenting solutions through technical reports. Solution of engineering problems using a programming language. Satisfactory placement scores can be found at: <https://math.iastate.edu/academics/undergraduate/aleks/placement/>. Graduation Restriction: Only one of ENGR 1600, ABE 1600, AERE 1600, BME 1600, CE 1600, CHE 1600, CPRE 1850, EE 1850, IE 1480, ME 1600, and SE 1850 may count towards graduation.

CPRE 1860: Introduction to Computer Engineering and Problem Solving II

Credits: 1. Contact Hours: Laboratory 2.

Prereq: CPRE 1850

Project based examples from computer engineering. Group skills needed to work effectively in teams. Group problem solving. Computer based projects. Technical reports and presentations. Students will work on 2 or 3 self-directed team based projects that are representative of problems faced by computer engineers. (Typically Offered: Spring)

CPRE 2300: Cyber Security Fundamentals

(Cross-listed with CYBE 2300).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: COMS 2270 or EE 2850 or MIS 2070

Introduction to computer and network infrastructures used to support cyber security. Basic concepts of computer and network configuration used to secure environments. Computer virtualization, network routing and address translation, computer installation and configuration, network monitoring, in a virtual environment. Laboratory experiments and exercises including secure computer and network configuration and management. (Typically Offered: Fall)

CPRE 2310: Cyber Security Concepts and Tools

(Cross-listed with CYBE 2310).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: CPRE 2300 or CYBE 2300

Basic concepts of practical computer and Internet security and the tools used to protect and attack systems and networks. Computer and network security methods including: user authentication, access control, firewalls, intrusion detection, use of vulnerability assessment tools and methods, and penetration testing. Ethics and legal issues in cyber security will also be covered. Laboratory experiments and exercises including evaluating systems for vulnerabilities, understanding potential exploits of the systems, and defenses for the systems. (Typically Offered: Spring)

CPRE 2320: Professional and Ethical Issues in Electrical and Computer Engineering

(Cross-listed with EE 2320).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 2270 or EE 2850

Professional and ethical issues in electrical and computer engineering. Soft skills, including communication and leadership skills, and how they relate to the engineering profession. Case studies illustrating ethical decision making in an engineering context and differentiating between moral and professional ethics. Issues of diversity, equity, and inclusion in the engineering profession.

CPRE 2340: Legal, Professional, and Ethical Issues in Cyber Systems

(Cross-listed with CYBE 2340).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 2270 or EE 2850 or MIS 2070

Emphasizes legal, ethical, and professional issues in cyber systems. Other topics include privacy, government regulation, and compliance as applied to professional practice. Guest lecturer from government and industry, as well as discussions including current legal and ethical issues found in the main stream. (Typically Offered: Spring)

CPRE 2610: Transfer Orientation

(Cross-listed with EE 2610).

Credits: Required. Contact Hours: Lecture 1.

Introduction to the College of Engineering and the engineering profession specifically for transfer students. Information concerning university and college policies, procedures, and resources. Offered on a satisfactory-fail basis only.

CPRE 2810: Digital Logic

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: Sophomore classification

Number systems and representation. Boolean algebra and logic minimization. Combinational and sequential logic design. Arithmetic circuits and finite state machines. Use of programmable logic devices. Introduction to computer-aided schematic capture systems, simulation tools, and hardware description languages. Design of simple digital systems. (Typically Offered: Fall, Spring)

CPRE 2870: Cyber-Physical System Fundamentals

Credits: 3. Contact Hours: Laboratory 2, Lecture 2.

Prereq: ENGR 1600

Fundamentals of cyber-physical systems, including introduction to digital systems design, embedded platforms and programming, sensing and actuation, and performance analysis. Introduction to data communication concepts, including systems-level view of signal processing and electronic circuits, networking standards and protocols. Laboratory exercises with embedded circuits, signals, and measurement applications. (Typically Offered: Fall)

CPRE 2880: Embedded Systems I: Introduction

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: CPRE 2810, COMS 2070 or COMS 2270 or EE 2850

Embedded C programming. Interrupt handling. Memory mapped I/O in the context of an application. Elementary embedded design flow/ methodology. Timers, scheduling, resource allocation, optimization, state machine based controllers, real time constraints within the context of an application. Applications laboratory exercises with embedded devices. (Typically Offered: Fall, Spring)

CPRE 2940: Program Discovery

(Cross-listed with EE 2940).

Credits: Required. Contact Hours: Lecture 1.

Prereq: CPRE 1660 or EE 1660

The roles of professionals in computer and electrical engineering. Relationship of coursework to industry and academic careers. Issues relevant to today's world. Offered on a satisfactory-fail basis only.

CPRE 3080: Operating Systems: Principles and Practice

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: COMS 3210 or CPRE 3810

Operating system concepts, processes, threads, synchronization between threads, process and thread scheduling, deadlocks, memory management, file systems, I/O systems, security, Linux-based lab experiments. (Typically Offered: Fall, Spring)

CPRE 3100: Theoretical Foundations of Computer Engineering

Credits: 3. Contact Hours: Lecture 2, Discussion 1.

Prereq: COMS 2280

Propositional logic and methods of proof; basic discrete structures; mathematical induction and recurrence relations; functions and relations; and counting; trees and graphs; applications in computer engineering. (Typically Offered: Fall, Spring)

CPRE 3290: Software Project Management

(Cross-listed with SE 3290).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 3090

Process-based software development. Capability Maturity Model (CMM). Project planning, cost estimation, and scheduling. Project management tools. Factors influencing productivity and success. Productivity metrics. Analysis of options and risks. Version control and configuration management. Inspections and reviews. Managing the testing process. Software quality metrics. Modern software engineering techniques and practices.

CPRE 3300: Integrated Electronics

(Cross-listed with EE 3300).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: CPRE 2810; EE 2010; credit or concurrent enrollment in EE 2300

Semiconductor technology for integrated circuits. Modeling of integrated devices including diodes, BJTs, and MOSFETs. Physical layout. Circuit simulation. Digital building blocks and digital circuit synthesis. Analysis and design of analog building blocks. Laboratory exercises and design projects with CAD tools and standard cells.

CPRE 3310: Application of Cryptographic Concepts to Cyber Security

(Cross-listed with CYBE 3310).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: CPRE 2310 or CYBE 2310

Basic cryptographic underpinnings used in modern cyber security encryption suites. Encryption benefits to cyber security and its use in protocols. Topics include cryptographically secure hash functions and pseudorandom numbers, key distribution techniques, secure authentication including single sign on. Detection and prevention of security threats such as covert communication, malicious code, and other security threats in protocols are included. In addition to laboratory experiments and exercises, students complete a project focused on cyber security problem and solution. Graduation Restriction: Only one of CPRE/ CYBE 3310 and CPRE 4310 may count towards graduation. (Typically Offered: Fall, Spring)

CPRE 3320: Cyber Defense Competition

(Cross-listed with CYBSC 3320).

Credits: 1. Contact Hours: Laboratory 2.

Repeatable.

Participation in cyber defense competition driven by scenario-based network design. Includes computer system setup, risk assessment and implementation of security systems, as well as defense of computer and network systems against trained attackers. Team based. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

CPRE 3390: Software Architecture and Design

(Cross-listed with SE 3390).

Credits: 3. Contact Hours: Lecture 3.

Prereq: SE 3190

Modeling and design of software at the architectural level. Architectural styles. Basics of model-driven architecture. Object-oriented design and analysis. Iterative development and unified process. Design patterns. Design by contract. Component based design. Product families. Measurement theory and appropriate use of metrics in design. Designing for qualities such as performance, safety, security, reliability, reusability, etc. Analysis and evaluation of software architectures. Introduction to architecture definition languages. Basics of software evolution, reengineering, and reverse engineering. Case studies. Introduction to distributed system software.

CPRE 3810: Computer Organization and Assembly Level Programming

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: CPRE 2880

Introduction to computer organization, evaluating performance of computer systems, instruction set design. Assembly level programming: arithmetic operations, control flow instructions, procedure calls, stack management. Processor design. Datapath and control, scalar pipelines, introduction to memory and I/O systems. (Typically Offered: Fall, Spring)

CPRE 3880: Embedded Systems II: Mobile Platforms

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: CPRE 2880

Contemporary programming techniques for event driven systems. Mobile platforms and operating systems. Location and motion sensors based user interfaces. Threading and scheduling. Resource management - measurement and control techniques - for memory and energy. Client-server application design. Distributed applications. Laboratory includes exercises based on a mobile platform.

CPRE 3940: Program Exploration

(Cross-listed with EE 3940).

Credits: Required. Contact Hours: Lecture 1.

Prereq: CPRE 2940 or EE 2940

Exploration of academic and career fields for electrical and computer engineers. Examination of professionalism in the context of engineering and technology with competencies based skills. Introduction to professional portfolio development and construction. Offered on a satisfactory-fail basis only.

CPRE 4120: Formal Methods in Software Engineering

(Dual-listed with COMS 5120). (Cross-listed with COMS 4120/ SE 4120).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 3110; (STAT 3050 or STAT 3300 or STAT 3410)

A study of formal techniques for model-based specification and verification of software systems. Topics include logics, formalisms, graph theory, numerical computations, algorithms and tools for automatic analysis of systems. Graduate credit requires in-depth study of concepts.

CPRE 4140: Introduction to Software Systems for Big Data Analytics

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: COMS 3630 or CPRE 3150 or CPRE 3080 or COMS 3110 or COMS 3520

Introduction to different perspectives of the "data universe" and trade-offs when choosing an appropriate perspective. Impact of the concept(s) of analytics – from raw data, through its storage/representation, to interacting and querying (linguistic/interface issues). Focused studies on 3-4 different domains, followed by generalization of the concepts/abstractions and preparing the students for the next course in this realm, targeting different domains/problems. Understanding the dependencies between problem-domain needs and the data properties, and their impact on choosing appropriate analytics tools (and how/why those tools were developed and exist in the manners that they do). In addition, the students will be exposed to (limited selection of) internals of such tools. (Typically Offered: Fall)

CPRE 4160: Software Evolution and Maintenance

(Cross-listed with SE 4160).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 3090

Practical importance of software evolution and maintenance, systematic defect analysis and debugging techniques, tracing and understanding large software, impact analysis, program migration and transformation, refactoring, tools for software evolution and maintenance, experimental studies and quantitative measurements of software evolution. Written reports and oral presentation.

CPRE 4180: High Speed System Engineering Measurement and Testing

(Cross-listed with EE 4180).

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: EE 2300, EE 3110

Measurement of high speed systems and mixed signal systems. Measurement accuracy and error. Network analysis and spectrum analysis used in high speed measurement and testing. Test specification process and parametric measurement. Sampling and digital signal processing concepts. Design for testability. Testing equipment. Applications. (Typically Offered: Fall)

CPRE 4190: Software Tools for Large Scale Data Analysis

(Cross-listed with SE 4190).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: COMS 3630 or COMS 3520 or CPRE 3080; COMS 2280

Software tools for managing and manipulating large volumes of data, external memory processing, large scale parallelism, and stream processing, data interchange formats. Weekly programming labs that involve the use of a parallel computing cluster.

CPRE 4210: Software Analysis and Verification for Safety and Security

(Cross-listed with SE 4210).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (COMS 2300 or CPRE 3100); (COMS 3090 or SE 3090)

Significance of software safety and security; various facets of security in cyber-physical and computer systems; threat modeling for software safety and security; and categorization of software vulnerabilities. Software analysis and verification: mathematical foundations, data structures and algorithms, program comprehension, analysis, and verification tools; automated vs. human-on-the-loop approach to analysis and verification; and practical considerations of efficiency, accuracy, robustness, and scalability of analysis and verification. Cases studies with application and systems software; evolving landscape of software security threats and mitigation techniques. Understanding large software, implementing software analysis and verification algorithms. (Typically Offered: Fall, Spring)

CPRE 4240: Introduction to High Performance Computing

(Cross-listed with COMS 4240/ MATH 4240).

Credits: 3.

Prereq: (MATH 2650; [MATH 2070 OR MATH 3170]) or permission of instructor

Unix, serial programming of scientific applications, OpenMP for shared-memory parallelization. No Unix, Fortran or C experience required.

(Typically Offered: Fall)

CPRE 4250: High Performance Computing for Scientific and Engineering Applications

(Cross-listed with COMS 4250).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: COMS 3110 and ENGL 2500 and SPCM 2120

Introduction to high performance computing platforms including parallel computers and workstation clusters. Discussion of parallel architectures, performance, programming models, and software development issues.

Sample applications from science and engineering. Practical issues in high performance computing will be emphasized via a number of programming projects using a variety of programming models and case studies. Oral and written reports.

CPRE 4260: Introduction to Parallel Algorithms and Programming

(Dual-listed with CPRE 5260/ COMS 5260). (Cross-listed with COMS 4260).

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: CPRE 3080 or COMS 3210 and CPRE 3150 or COMS 3110

Models of parallel computation, performance measures, basic parallel constructs and communication primitives, parallel programming using MPI, parallel algorithms for selected problems including sorting, matrix, tree and graph problems, fast Fourier transforms. (Typically Offered: Fall)

CPRE 4300: Network Protocols and Security

(Dual-listed with CPRE 5300/ CYBSC 5300). (Cross-listed with CYBSC 4300).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (CPRE 3080 or COMS 2520 or COMS 3520) OR CPRE 2880

Detailed examination of networking standards, protocols, and their implementation. TCP/IP protocol suite, network application protocols. Network security issues, attack and mitigation techniques. Emphasis on laboratory experiments.

CPRE 4310: Basics of Information System Security

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or enrollment in CPRE 3810 or COMS 3210

Introduction to and application of basic mechanisms for protecting information systems from accidental and intentional threats. Basic cryptography use and practice. Computer security issues including authentication, access control, and malicious code. Network security mechanisms such as intrusion detection, firewalls, SSL/TLS, and related protocols. Ethics and legal issues in information security. Wireless security. Programming and system configuration assignments. Graduation Restriction: This course can not be used towards any requirements for the Cyber Security Degree or Minor. Only one of CPRE/ CYBE 3310 and CPRE 4310 may count towards graduation.

CPRE 4350: Analog VLSI Circuit Design

(Cross-listed with EE 4350).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: EE 3300

Basic analog integrated circuit and system design including design space exploration, performance enhancement strategies, operational amplifiers, references, integrated filters, and data converters. (Typically Offered: Spring)

CPRE 4360: Digital Forensics

(Cross-listed with CYBE 4360).

Credits: 3. Contact Hours: Lecture 3.

Prereq: CPRE/CYBE 3310

Introduction to forensics techniques used to investigate and analyze compromises in computers, networks, devices, and media. Focus on gathering, analyzing, and reporting on the collected evidence. Emphasis is on hands-on homework which include incident detection, response actions, compromise investigation, data collection, and after action reports.

CPRE 4370: Introduction to Wireless Security

(Cross-listed with CYBE 4370).

Credits: 3. Contact Hours: Lecture 3.

With communication and network services and applications increasingly leveraging wireless media, the importance of information and network security in the wireless domain continues to grow. The challenges of providing secure communication and network services are considerably more difficult in wireless environments than in traditional wired systems (e.g., the Internet), so the focus of the course will be purely wireless covering both networking issues and security aspects of modern wireless environments. Fundamentals of mobile LANs and WANs, ad hoc, sensor networks/internet of things and cloud, mobile IP/TCP, confidentiality, key establishment, authentication, broadcasting, RFIDs, and rogue attacks. Graduation Restriction: Only One Of CPRE 4370 And CPRE 5370 May Count Toward Graduation For Undergraduate Students.

CPRE 4400: Operating System Security

(Cross-listed with CYBE 4400).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 3520 or CPRE 3080

Focus on fundamentals and advanced topics in operating system (OS) security. Design issues, principles, mechanisms, and good practice for design and implementation of secure computer/OS systems. Threat models, vulnerabilities, attacks compromise security, and advanced OS-level techniques for achieving security. Topics include OS security concepts and principles, seminal security in Multics, vulnerabilities in ordinary systems, secure capability systems, information flow control, mandatory access control, security kernels, memory protection, file system, virtual machine systems, hardware/architecture support (e.g., Intel SGX) for OS security, secure microkernel OSes (e.g., seL4, QNX), modern mobile operating systems (e.g., Android and iOS), and security from end-user perspective. Assignments include labs exploring and implementing the technologies in the context of the Linux, Android, and seL4 systems (some involving kernel programming). (Typically Offered: Spring)

CPRE 4500: Distributed Systems and Middleware

(Dual-listed with CPRE 5500).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 3520 or CPRE 3080

Fundamentals of distributed computing, software agents, naming services, distributed transactions, security management, distributed object-based systems, web-based systems, Blockchain, middleware-based application design and development, case studies of middleware and internet applications.

CPRE 4540: Fundamentals of Remote Sensing and Spatial Analysis

(Dual-listed with COMS 5540/ CPRE 5540). (Cross-listed with COMS 4540).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 3110 and COMS 3520 or CPRE 3080

Introduction to image processing techniques needed for analysis of optical remote sensing imagery, including filtering, enhancement, and classification. Analysis of elevation surfaces, hydrology, distance, overlays and visual programming with Model Builder. Practical applications in a variety of topics to understand how to analyze imagery. (Typically Offered: Spring)

CPRE 4580: Real Time Systems

(Dual-listed with CPRE 5580).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 3520 or CPRE 3080

Fundamental concepts in real-time systems. Real time task scheduling paradigms. Resource management in uniprocessor, multiprocessor, and distributed real-time systems. Energy management in real-time systems and sensor networks. Fault-tolerance and overload handling in real-time systems. Real-time channel, QoS routing, traffic policing, packet scheduling, and real-time LAN protocols. Case study of real-time and IoT applications. Term project in real-time systems and networks.

CPRE 4590X: Security and Privacy in Cloud Computing

(Dual-listed with COMS 5590/ CPRE 5590). (Cross-listed with COMS 4590X).

Credits: 3. Contact Hours: Lecture 3.

Introduction to cloud computing concepts and systems. Security and privacy threats in cloud computing. Practical techniques for cloud computing security. Theoretical and practical solutions for secure outsourcing of data and computation. Oral presentations and research projects. (Typically Offered: Fall)

CPRE 4650: Digital VLSI Design

(Cross-listed with EE 4650).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: EE 3300

Digital design of integrated circuits employing very large scale integration (VLSI) methodologies. Technology considerations in design. High level hardware design languages, CMOS logic design styles, area-energy-delay design space characterization, datapath blocks: arithmetic and memory, architectures and systems on a chip (SOC) considerations. VLSI chip hardware design project. (Typically Offered: Fall)

CPRE 4800: Graphics Processing and Architecture

(Dual-listed with CPRE 5800).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: COMS 3210 or CPRE 3810

Introduction to hardware architectures for computer graphics and their programming models. System-level view, including framebuffers, video output devices, displays, 2D and 3D graphics acceleration, and device interfacing. Architectural design of GPUs, from 2D and 3D sprite engines to 3D rendering pipelines to unified shader architectures. Computing models for graphics processors. GPGPU and GPU computing. (Typically Offered: Spring)

CPRE 4870: Hardware Design for Machine Learning

(Dual-listed with CPRE 5870).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: COMS 3210 or CPRE 3810

Introduction to hardware architectures for machine learning. Full system view – machinelearning frameworks to hardware interface to hardware architecture. General purpose CPU extensions for machine learning. GPU extensions for machine learning. Spatial architectures for machine learning. Performance, energy, and accuracy trade-offs. Hardware design optimizations for machine learning, including quantization, data re-use, SIMD, and SIMT. Lab section will culminate with the design and evaluation of an application-specific machinelearning accelerator.

CPRE 4880: Embedded Systems Design

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: COMS 3210 or CPRE 3810

Embedded microprocessors, embedded memory and I/O devices, component interfaces, embedded software, program development, basic compiler techniques, platform-based FPGA technology, hardware synthesis, design methodology, real-time operating system concepts, performance analysis and optimizations.

CPRE 4890: Computer Networking and Data Communications

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: CPRE 2880 or COMS 3270

Modern computer networking and data communications concepts. OSI reference model, TCP/IP architecture. Sockets programming. Protocols at the physical layer, data link layer, network layer, transport layer, and application layer. Software-defined networking. (Typically Offered: Fall, Spring)

CPRE 4900: Independent Study

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Investigation of an approved topic.

CPRE 4900H: Independent Study: Honors

Credits: 1-30. Repeatable.

Prereq: Senior classification in computer engineering; Instructor Permission for Course; Membership in the University Honors Program

Investigation of an approved topic.

CPRE 4910: Senior Design Project I and Professionalism

(Cross-listed with EE 4910/ SE 4910).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: [(EE, CPRE, or CYBE MAJOR) AND (CPRE 3940 or EE 3940 or CPRE 2320 or EE 2320 or CPRE 2340 or CYBE 2340) AND (ENGL 3090 or ENGL 3140 or ENGL 3240H) AND (Credit or enrollment in CPRE 3080 or EE 3220)] OR [(SE MAJOR) AND (ENGL 3090 or ENGL 3140 or ENGL 3140H) AND (SE 3390) AND (Credit or enrollment in COMS 3520 or CPRE 3080)]

Preparing for entry to the workplace. Selected professional topics. Use of technical writing skills in developing project plan and design report; design review presentation. First of two-semester team-oriented, project design and implementation experience. (Typically Offered: Fall, Spring)

CPRE 4920: Senior Design Project II

(Cross-listed with EE 4920/ SE 4920).

Credits: 2. Contact Hours: Lecture 1, Laboratory 3.

Prereq: CPRE 4910 or EE 4910

Second semester of a team design project experience. Emphasis on the successful implementation and demonstration of the design completed in EE 4910, CPRE 4910, or SE 4910 and the evaluation of project results. Technical writing of final project report; oral presentation of project achievements; project poster. (Typically Offered: Fall, Spring)

CPRE 4940: Portfolio Assessment

(Cross-listed with EE 4940).

Credits: Required. Contact Hours: Lecture 1.

Prereq: CPRE 2320 or EE 2320 or CYBE 2340; credit or concurrent enrollment in CPRE 4910 or EE 4910

Portfolio update and evaluation. Portfolios as a tool to enhance career opportunities. Offered on a satisfactory-fail basis only.

Courses primarily for graduate students, open to qualified undergraduates:

CPRE 5110: Design and Analysis of Algorithms

(Cross-listed with COMS 5110).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 3110 or Graduate Classification

A study of algorithm design and analysis techniques. Network flows and linear programming. Randomized algorithms. NP-completeness. Approximation algorithms. Fixed-parameter algorithms.

CPRE 5130: Program Analysis

(Dual-listed with COMS 4130/ SE 4130). (Cross-listed with COMS 5130).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (COMS 3270 or CPRE 2880); COMS 3420 or Graduate Classification
Algorithms, AI techniques and tools for automatically reasoning about code and program executions. Theory and foundations related to control flow analysis, dataflow analysis, abstract interpretation, and symbolic execution. Applications of program analysis to bug detection, test input generation, debugging, program repair, specification inference and trustworthy AI engineering. Concepts, algorithms, tools, benchmarks, methodologies for solving problems using program analysis and for preparing research in program analysis.

CPRE 5220: Cognitive Radio Networks

(Cross-listed with EE 5220).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Topics on cognitive radio networks: Cognitive Radio Networks Architecture; Software Defined Radio Architecture; Spectrum Sensing; Spectrum management; Spectrum Sharing; Spectrum Mobility; Applications of Cognitive Radio Networks. Offered irregularly. (Typically Offered: Fall)

CPRE 5250: Numerical Analysis of High Performance Computing

(Cross-listed with COMS 5250/ MATH 5250).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to parallelization techniques and numerical methods for distributed memory high performance computers. A semester project in an area related to each student's research interests is required. (Typically Offered: Spring)

CPRE 5260: Introduction to Parallel Algorithms and Programming

(Dual-listed with CPRE 4260/ COMS 4260). (Cross-listed with COMS 5260).

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Models of parallel computation, performance measures, basic parallel constructs and communication primitives, parallel programming using MPI, parallel algorithms for selected problems including sorting, matrix, tree and graph problems, fast Fourier transforms. (Typically Offered: Fall)

CPRE 5270: High-Performance Deep Learning

(Cross-listed with COMS 5270).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 3520 or CPRE 3080

Fundamentals and advances in HPC in the context of GPUs, TPUs, multicore and HPC systems with specific focus on parallel programming models. Discussing of high-performance computing, GPGPU, scaling deep neural network training and machine learning algorithms, high-performance deep learning, intersection of HPC and AI for HPC, distributed parallel training, engineering parallel software and parallel design patterns.

CPRE 5280: Probabilistic Methods in Computer Engineering

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

The application of randomization and probabilistic methods in the design of computer algorithms, and their efficient implementation. Discrete random variables in modeling algorithm behavior, with applications to sorting, selection, graph algorithms, hashing, pattern matching, cryptography, distributed systems, and massive data set algorithmics.

CPRE 5290: Data Analytics in Electrical and Computer Engineering

(Cross-listed with EE 5290).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduces a variety of data analytics techniques - particularly those relevant for electrical and computer engineers - from a foundational perspective. Topics to be covered include techniques for classification, visualization, and parameter estimation, with applications to signals, images, matrices, and graphs. Emphasis will be placed on rigorous analysis as well as principled design of such techniques. (Typically Offered: Spring)

CPRE 5300: Network Protocols and Security

(Dual-listed with CPRE 4300/ CYBSC 4300). (Cross-listed with CYBSC 5300).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Detailed examination of networking standards, protocols, and their implementation. TCP/IP protocol suite, network application protocols. Network security issues, attack and mitigation techniques. Emphasis on laboratory experiments.

CPRE 5310: Information System Security

(Cross-listed with CYBSC 5310).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Computer, software, and data security: basic cryptography, security policies, multilevel security models, attack and protection mechanisms, legal and ethical issues.

CPRE 5320: Information Warfare

(Cross-listed with CYBSC 5320).

Credits: 3. Contact Hours: Lecture 3.

Prereq: CPRE 4300 or 5300

Computer system and network security: implementation, configuration, testing of security software and hardware, network monitoring. Authentication, firewalls, vulnerabilities, exploits, countermeasures. Study and use of attack tools. Ethics in cyber security. Emphasis on laboratory experiments. (Typically Offered: Spring)

CPRE 5330: Cryptography

(Cross-listed with CYBSC 5330/ MATH 5330).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 3010 OR CPRE 310 OR COMS 230

Basic concepts of secure communication, DES and AES, public-key cryptosystems, elliptic curves, hash algorithms, digital signatures, applications. Relevant material on number theory and finite fields. (Typically Offered: Spring)

CPRE 5340: Legal and Ethical Issues in Cyber Security

(Cross-listed with POLS 5340/ CYBSC 5340).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Legal and ethical issues in computer security. State and local codes and regulations. Privacy issues. (Typically Offered: Spring)

CPRE 5350: Steganography and Digital Image Forensics

(Cross-listed with MATH 5350/ CYBSC 5350).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Basic principles of covert communication, steganalysis, and forensic analysis for digital images. Steganographic security and capacity, matrix embedding, blind attacks, image forensic detection and device identification techniques. Related material on coding theory, statistics, image processing, pattern recognition. (Typically Offered: Spring)

CPRE 5360: Computer and Network Forensics

(Cross-listed with CYBSC 5360).

Credits: 3. Contact Hours: Lecture 3.

Prereq: CPRE 4890 OR CPRE 4300 OR CPRE 5300

Fundamentals of computer and network forensics, forensic duplication and analysis, network surveillance, intrusion detection and response, incident response, anonymity and pseudonymity, privacy-protection techniques, cyber law, computer security policies and guidelines, court testimony and report writing, and case studies. Emphasis on hands-on experiments.

CPRE 5370: Wireless Network Security

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to the physical layer and special issues associated with the security of wireless networks. The basics of wireless communication systems (antennas and propagation, modulation, multiple access, channel modeling, specific security issues of the wireless link), jamming and countermeasures (spread spectrum technologies, channel coding, interleaving), authentication and confidentiality (basics of classic cryptography, common authentication and encryption algorithms). Detailed case studies on authentication, encryption and privacy flaws, and good practices based on the most common wireless technologies, including WiFi, GSM/3G, Bluetooth, and RFID. Individual or team-based class projects. (Typically Offered: Spring)

CPRE 5380: Reverse Engineering and Security Testing

(Cross-listed with CYBSC 5380).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Techniques and tools for understanding the behavior of software/hardware systems based on reverse engineering. Flaw hypothesis, black, grey, and white box testing as well as other methods for testing the security of software systems. Discussion of counter-reverse engineering techniques. (Typically Offered: Spring)

CPRE 5390: Cyber Physical System Security for the Smart Grid

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to cyber security, cyber physical system (CPS), and smart grid automation technologies; supervisor control and data acquisition (SCADA) systems; cyber risk modeling, vulnerability analysis, impact analysis, defense and mitigation techniques; cyber security of wide-area monitoring, protection, and control (WAMPAC); security and privacy in advanced metering infrastructure (AMI), cyber security compliance and industry best practices, CPS security test-beds and attack-defense hands-on laboratory experiments. (Typically Offered: Spring)

CPRE 5410: High-Performance Communication Networks

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Computer architectures and protocols designed for high-performance networking environments; software defined networking (SDN) and supporting protocols; cloud and data center networks; network traffic management and congestion control strategies; quality of service; high-speed access network protocols.

CPRE 5420: Optical Communication Networks

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Optical components and interfaces; optical transmission and reception techniques; wavelength division multiplexing; network architectures and protocol for first generation, single and multihop optical network; routing and wavelength assignment in second generation wavelength routing networks; traffic grooming, optical network control; survivability; access networks; metro networks. (Typically Offered: Spring)

CPRE 5430: Wireless Network Architecture

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to the protocol architecture of the data link layer, network layer and transport layer for wireless networking. Operation and management of Medium Access Control in Wireless Local Area Networks (WLAN) and Wireless Metropolitan Area Networks (WMAN); recent developments in IEEE 802.11 & 802.16 and Bluetooth; Mobile IP; Mobile TCP.

CPRE 5440: Fundamentals of Bioinformatics

(Cross-listed with BCB 5440/ COMS 5440/ GDCB 5440).

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

A practical, hands-on overview of how to apply bioinformatics to biological research. Recommended for biologists desiring to gain computational molecular biology skills. Topics include: sequence analysis, genomics, proteomics, phylogenetic analyses, ontology enrichment, systems biology, data visualization and emergent technologies. Offered odd-numbered years. (Typically Offered: Fall)

CPRE 5450: Fault-Tolerant Systems

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Faults and their manifestations, errors, and failures; fault detection, location and reconfiguration techniques; time, space, and information (coding) redundancy management; design for testability; self-checking and fail-safe circuits; system-level fault diagnosis; Byzantine agreement; stable storage and RAID; clock synchronization; fault-tolerant networks; fault tolerance in real-time systems; reliable software design; checkpointing and rollback recovery; atomic actions; replica management protocols; and reliability evaluation techniques and tools.

CPRE 5460: Wireless and Sensor Networks

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Fundamental and well-known protocols for wireless ad hoc and sensor networks at various layers, including physical layer issues, MAC (medium access control) layer protocols, routing protocols for wireless ad hoc and sensor networks, data management in sensor networks, coverage and connectivity, localization and tracking, security and privacy issues. Introduction to TinyOS and the nesC language. Hands-on experiments with Crossbow Mote sensor devices.

CPRE 5470: Resource Allocation in Communication Networks

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Analytical approach to resource allocation on communication networks (e.g. the Internet, multihop wireless networks, etc.). Network utility maximization and the internet congestion control algorithm. Layering as optimization decomposition: a cross-layer design approach in multihop wireless networks. Capacity of ad hoc wireless networks.

CPRE 5480: Cyber-Physical Systems Networking

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Cyber-physical systems applications in smart agriculture, transportation, power grid, manufacturing, public safety, health systems, etc.; field area and control networks; industrial Ethernet; time-triggered communication; real-time wireless networks; wireless industrial networks; safety and security of industrial networks; systems platforms for cyber-physical systems networks; team-based learning/projects.

CPRE 5500: Distributed Systems and Middleware

(Dual-listed with CPRE 4500).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Fundamentals of distributed computing, software agents, naming services, distributed transactions, security management, distributed object-based systems, web-based systems, Blockchain, middleware-based application design and development, case studies of middleware and internet applications.

CPRE 5540: Fundamentals of Remote Sensing and Spatial Analysis

(Dual-listed with COMS 4540/ CPRE 4540). (Cross-listed with COMS 5540).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 3110 and (COMS 3520 or CPRE 3080) or Graduate Classification

Introduction to image processing techniques needed for analysis of optical remote sensing imagery, including filtering, enhancement, and classification. Analysis of elevation surfaces, hydrology, distance, overlays and visual programming with Model Builder. Practical applications in a variety of topics to understand how to analyze imagery. (Typically Offered: Spring)

CPRE 5560: Scalable Software Engineering

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Design and analysis techniques scalable to large software, project-based learning of problem solving techniques, automation tools for high productivity and reliability of software, analysis-based measurement and estimation techniques for predictable software engineering.

CPRE 5570: Computer Graphics and Geometric Modeling

(Cross-listed with COMS 5570/ ME 5570).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Fundamentals of computer graphics technology. Data structures. Parametric curve and surface modeling. Solid model representations. Applications in engineering design, analysis, and manufacturing. Offered odd-numbered years. (Typically Offered: Fall)

CPRE 5580: Real Time Systems

(Dual-listed with CPRE 4580).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Fundamental concepts in real-time systems. Real time task scheduling paradigms. Resource management in uniprocessor, multiprocessor, and distributed real-time systems. Energy management in real-time systems and sensor networks. Fault-tolerance and overload handling in real-time systems. Real-time channel, QoS routing, traffic policing, packet scheduling, and real-time LAN protocols. Case study of real-time and IoT applications. Term project in real-time systems and networks.

CPRE 5590: Security and Privacy in Cloud Computing

(Dual-listed with COMS 4590X/ CPRE 4590X). (Cross-listed with COMS 5590).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to cloud computing concepts and systems. Security and privacy threats in cloud computing. Practical techniques for cloud computing security. Theoretical and practical solutions for secure outsourcing of data and computation. Oral presentations and research projects.

CPRE 5600: Data-Driven Security and Privacy

(Cross-listed with COMS 5600/ CYBSC 5600).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Examination of applications of machine learning and big data techniques to various security and privacy problems, as well as secure and privacy-preserving machine learning algorithms. Offered irregularly. (Typically Offered: Spring)

CPRE 5620: Secure Software Engineering

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Fundamentals and techniques to design and implement software systems. Assessment of security vulnerabilities in software systems, exploitation of software vulnerabilities, and methods to secure vulnerable software. Secure coding practices, data analytics for security, microservices and cloud services security. Reverse engineering and security assessment of cyber-physical systems. (Typically Offered: Fall, Spring)

CPRE 5630: Advanced Data Storage Systems

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Focus on how to keep valuable digital data (e.g., scientific computations, financial transactions, family photos) safely in modern computer systems. Fundamentals of data storage technologies including state of the art. Topics include storage hardware, Linux file systems, and warehouse-scale big data storage, with an emphasis on the design tradeoffs for robustness and security. Team projects based on high-impact open-source systems.

CPRE 5660: Physical Design of VLSI Systems

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Physical design of VLSI systems. Partitioning algorithms. Placement and floorplanning algorithms. Routing-global and detailed. Layout compaction. Physical design of FPGA's and MCM's. Performance-driven layout synthesis.

CPRE 5670: Bioinformatics Algorithms

(Cross-listed with BCB 5670/ COMS 5670).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Biology as an information science. A review of the algorithmic principles that are driving the advances in bioinformatics and computational biology.

CPRE 5690: Structural Bioinformatics

(Cross-listed with BCB 5690/ COMS 5690/ BBMB 5690/ GDCB 5690).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Molecular structures including genes and gene products: protein, DNA and RNA structure. Structure determination methods, structural refinement, structure representation, comparison of structures, visualization, and modeling. Molecular and cellular structure from imaging. Analysis and prediction of protein secondary, tertiary, and higher order structure, disorder, protein-protein and protein-nucleic acid interactions, protein localization and function, bridging between molecular and cellular structures. Molecular evolution. (Typically Offered: Fall)

CPRE 5700: Systems Biology

(Cross-listed with COMS 5700/ BCB 5700/ GDCB 5700/ STAT 5700).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Algorithmic and statistical approaches in computational functional genomics and systems biology. Analysis of high throughput biological data obtained using system-wide measurements. Topological analysis, module discovery, and comparative analysis of gene and protein networks. Modeling, analysis, and inference of transcriptional regulatory networks, protein-protein interaction networks, and metabolic networks. Dynamic systems and whole-cell models. Ontology-driven, network based, and probabilistic approaches to information integration. (Typically Offered: Spring)

CPRE 5750: Computational Perception

(Cross-listed with COMS 5750/ HCI 5750).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

This class covers statistical and algorithmic methods for sensing, recognizing, and interpreting the activities of people by a computer. This semester we will focus on machine perception techniques that facilitate and augment human-computer interaction. The main goal of the class is to introduce computational perception on both theoretical and practical levels. Participation in small groups to design, implement, and evaluate a prototype of a human-computer interaction system that uses one or more of the techniques covered in the lectures. (Typically Offered: Spring)

CPRE 5800: Graphics Processing and Architecture

(Dual-listed with CPRE 4800).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to hardware architectures for computer graphics and their programming models. System-level view, including framebuffers, video output devices, displays, 2D and 3D graphics acceleration, and device interfacing. Architectural design of GPUs, from 2D and 3D sprite engines to 3D rendering pipelines to unified shader architectures. Computing models for graphics processors. GPGPU and GPU computing. (Typically Offered: Spring)

CPRE 5810: Computer Systems Architecture

(Cross-listed with COMS 5810).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Quantitative principles of computer architecture design, instruction set design, processor architecture: pipelining and superscalar design, instruction level parallelism, memory organization: cache and virtual memory systems, multiprocessor architecture, cache coherency, interconnection networks and message routing, I/O devices and peripherals. CPRE 3810 or equivalent computer architecture or computer organization course required. Note that this implies you have a familiarity with ISAs, basic computer organization, memory systems, digital logic design, basic programming (C and assembly), and command-line Linux. (Typically Offered: Fall)

CPRE 5820: Computer Systems Performance

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Review of probability and stochastic processes concepts; Markovian processes; Markovian queues; renewal theory; semi-Markovian queues; queueing networks, applications to multiprocessor architectures, computer networks, and switching systems.

CPRE 5830: Reconfigurable Computing Systems

(Cross-listed with COMS 5830).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to reconfigurable computing, FPGA technology and architectures, spatial computing architectures such as systolic and bit serial adaptive network architectures, static and dynamic rearrangeable interconnection architectures, processor architectures incorporating reconfigurability.

CPRE 5840: Models and Techniques in Embedded Systems

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Industry-standard tools and optimization strategies; practical embedded platforms and technology (reconfigurable platforms, multi-core platforms, low-power platforms); instruction augmentation, memory-mapped accelerator design, embedded software optimization. Students will be encouraged to compete as teams in an embedded system design competition.

CPRE 5850: Developmental Robotics

(Cross-listed with HCI 5850).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

An introduction to the emerging interdisciplinary field of Developmental Robotics, which crosses the boundaries between robotics, artificial intelligence, developmental psychology, and philosophy. The main goal of this field is to create autonomous robots that are more intelligent, more adaptable, and more useful than the robots of today, which can only function in very limited domains and situations. Offered odd-numbered years. (Typically Offered: Spring)

CPRE 5860: Pervasive Computing

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Fundamentals of pervasive computing, including location and context awareness, mobile and location services, ubiquitous data access, low power computing and energy management, middleware, security and privacy issues.

CPRE 5870: Hardware Design for Machine Learning

(Dual-listed with CPRE 4870).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to hardware architectures for machine learning. Full system view – machinelearning frameworks to hardware interface to hardware architecture. General purpose CPU extensions for machine learning. GPU extensions for machine learning. Spatial architectures for machine learning. Performance, energy, and accuracy trade-offs. Hardware design optimizations for machine learning, including quantization, data re-use, SIMD, and SIMT. Lab section will culminate with the design and evaluation of an application-specific machinelearning accelerator.

CPRE 5880: Embedded Computer Systems

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Hardware/software systems and codesign. Models of computation for embedded systems. System-level design. Modeling, specification, synthesis, and verification. Hardware/software implementation. Design space exploration. Performance analysis and optimization. Multiprocessor system on chip. Platform-based design. Design methodologies and tools. Case studies and design projects.

CPRE 5900: Special Topics

Credits: 1-6. Repeatable.

Prereq: Instructor Permission for Course

Formulation and solution of theoretical or practical problems in computer engineering.

CPRE 5920: Seminar in Computer Engineering

Credits: 1-4. Contact Hours: Lecture 4.

Repeatable.

Prereq: Instructor Permission for Course

Seminar in Computer Engineering.

CPRE 5950: Independent Study

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

Investigation of an approved topic commensurate with the student's prerequisites. (Typically Offered: Fall, Spring, Summer)

CPRE 5980: Electrical and Computer Engineering Learning Community Seminar

(Cross-listed with EE 5980).

Credits: Required. Contact Hours: Lecture 1.

Prereq: Graduate Standing or Permission of Instructor

Introduction to graduate study in Electrical and Computer Engineering at Iowa State University. Building networks, introduction to core requirements, and tools and techniques for success. Graduation Restriction: ECpE. Offered on a satisfactory-fail basis only.

CPRE 5990: Creative Component

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Courses for graduate students:**CPRE 6260: Parallel Algorithms for Scientific Applications**

(Cross-listed with COMS 6260).

Credits: 3. Contact Hours: Lecture 3.

Algorithm design for high-performance computing. Parallel algorithms for multidimensional tree data structures, space-filling curves, random number generation, graph partitioning and load balancing. Applications to grid and particle-based methods and computational biology.

CPRE 6310: Cyber Security Operations Practicum

(Cross-listed with CYBSC 6310).

Credits: 3. Contact Hours: Lecture 1.

Repeatable.

Practical experience in cyber operations. Cyber security threat analysis, malware analysis, and intrusion detection management. Cyber security data analysis methods. Pen testing tools and techniques. Weekly threat analysis briefings. Offered on a satisfactory-fail basis only.

CPRE 6320: Cyber Security Capstone Design

(Cross-listed with CYBSC 6320).

Credits: 3. Contact Hours: Lecture 3.

Capstone design course which integrates the security design process. Design of a security policy. Creation of a security plan. Implementation of the security plan. The students will attack each other's secure environments in an effort to defeat the security systems. Students evaluate the security plans and the performance of the plans. Social, political and ethics issues. Student self-evaluation, journaling, final written report.

CPRE 6490: Advanced Topics in Computational Biology

(Cross-listed with COMS 6490).

Credits: 3. Contact Hours: Lecture 3.

Design and analysis of algorithms for applications in computational biology, pairwise and multiple sequence alignments, approximation algorithms, string algorithms including in-depth coverage of suffix trees, semi-numerical string algorithms, algorithms for selected problems in fragment assembly, phylogenetic trees and protein folding. No background in biology is assumed. Also useful as an advanced algorithms course in string processing.

CPRE 6810: Advanced Topics in Computer Architecture

(Cross-listed with COMS 6810).

Credits: 3. Contact Hours: Lecture 3.

Current topics in computer architecture design and implementation. Advanced pipelining, cache and memory design techniques. Interaction of algorithms with architecture models and implementations. Tradeoffs in architecture models and implementations. Offered odd-numbered years. (Typically Offered: Spring)

CPRE 6970: Engineering Internship

(Cross-listed with EE 6970).

Credits: Required. Repeatable.

One semester and one summer maximum per academic year professional work period. Offered on a satisfactory-fail basis only.

CPRE 6990: Research

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Computer Science (COMS)

Courses primarily for undergraduates:**COMS 1010: Orientation**

Credits: Required. Contact Hours: Discussion 1, Lecture 1.

Required orientation class for all incoming students in the Computer Science major. Topics include academic planning and policies, campus resources, and supports. Opportunity to connect with other computer science peers, faculty, alumni, and employers. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

COMS 1030: Computer Literacy and Applications

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Introduction to computer literacy and applications. Literacy: Impact of computer technology in today's societies, hardware, software, software programming, database and information systems, communication and networks, digital media technology, computer security and safety, ethics and privacy. Applications: In-depth hands-on experience with the operating systems, Microsoft word processing, spreadsheets, database management and presentation software. No prior computer experience necessary. Offered online only. (Typically Offered: Fall, Spring, Summer)

COMS 1040: Brief Introduction to Computer Programming for Non-Majors

Credits: 2. Contact Hours: Lecture 1.5, Discussion 0.5.

Offered first 8 weeks and last 8 weeks. Use of personal computer and workstation and beginning programming. Project-oriented approach to computer operation and programming, including use of tools to aid in programming. Topics from computer history, using basic Windows and MacOS tools, program structure, expression, variables, decision and logic, and iteration. No prior computer experience necessary. (Typically Offered: Fall, Spring)

COMS 1050A: Short Course in Computer Programming: Perl

Credits: 2. Contact Hours: Lecture 1, Laboratory 2.

Prereq: COMS 1040

8-week course in programming using Perl.

COMS 1050B: Short Course in Computer Programming: MATLAB

Credits: 2. Contact Hours: Lecture 2.

Prereq: COMS 1040

8-week course in programming using MATLAB.

COMS 1060: Introduction to Web Programming

Credits: 3. Contact Hours: Lecture 3.

Introduction to web programming basics. Fundamentals of developing web pages using a comprehensive web development life cycle. Learn to design and code practical real-world homepage programs and earn adequate experience with current web design techniques such as HTML5 and cascading style sheets. Students also learn additional programming languages including JavaScript, jQuery, PHP, SQL, and MySQL. Strategies for accessibility, usability and search engine optimization. No prior computer programming experience necessary. (Typically Offered: Fall, Spring)

COMS 1070: Windows Application Programming

Credits: 3. Contact Hours: Lecture 3.

Introduction to computer programming for non-majors using a language such as the Visual Basic language. Basics of good programming and algorithm development. Graphical user interfaces. (Typically Offered: Fall, Spring)

COMS 1130: Introduction to Spreadsheets and Databases

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Using Microsoft Excel spreadsheets and Microsoft Access databases to input, store, process, manipulate, query, and analyze data for business and industrial applications. Graduation Restriction: Credit in COMS 1130 may not be applied toward graduation in the SE and CPRE majors. (Typically Offered: Fall, Spring, Summer)

COMS 1270: Introduction to Computer Programming

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Credit or concurrent enrollment in MATH 1400 or higher

Introduction to computer programming with an emphasis on problem-solving. Topics include: program structures, expressions, variables, decision and logic, iteration, collections, input, and output. Program construction and testing. Programming assignments including games and applications. No prior programming experience necessary. (Typically Offered: Fall, Spring)

COMS 1920: Explorations in Computing Research I

Credits: 1. Contact Hours: Discussion 0.5.

Repeatable, maximum of 2 credits.

Explore research opportunities for undergraduate students in Computer Science; understanding the nature of research and development process; reviewing the literature; development of writing, presentation, and data reporting skills; rotation under different research labs; group work. (Typically Offered: Fall, Spring)

COMS 2030: Careers in Computer Science

Credits: Required. Contact Hours: Lecture 1.5.

Computer science as a profession. Introduction to career fields open to computer science majors. Relationship of coursework to careers. Presentations by computer science professionals. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

COMS 2070: Fundamentals of Computer Programming

Credits: 3. Contact Hours: Lecture 3, Discussion 1.

Prereq: MATH 1500 or credit or enrollment in MATH 1400 or higher

An introduction to computer programming using an object-oriented programming language. Emphasis on the basics of good programming techniques and style. Extensive practice in designing, implementing, and debugging small programs. Use of variable, if-statement, looping, method, and class. Interactive and file I/O. This course is not designed for computer science, software engineering, and computer engineering majors. Graduation Restriction: Credit may not be applied toward graduation for both COMS 2070 and COMS 2270. (Typically Offered: Fall, Spring, Summer)

COMS 2270: Object-oriented Programming

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: Credit or concurrent enrollment in MATH 1430 or higher; (COMS 1270 or CPRE 1850 or SE 1850 or EE 2850)

Computer programming using objects as the mechanism for modularity, abstraction, and code reuse. Instance variables, methods, and encapsulation. Review of control structures for conditionals and iteration. Developing algorithms on strings, arrays, and lists. Recursion, searching, and sorting. Text parsing and file I/O. Interfaces, inheritance, polymorphism, and abstract classes. Exception handling. Tools for unit testing and debugging. Emphasis on a disciplined approach to specification, code development, and testing. Course intended for majors in computer science and related fields. Graduation Restriction: Credit may not be applied toward graduation for both COMS 2070 and 2270. (Typically Offered: Fall, Spring, Summer)

COMS 2280: Introduction to Data Structures

Credits: 3. Contact Hours: Lecture 3, Discussion 1.

Prereq: Minimum of C- in COMS 2270; credit or concurrent enrollment in MATH 1650

An object-oriented approach to data structures and algorithms. Object-oriented analysis, design, and programming, with emphasis on data abstraction, inheritance and subtype polymorphism, and generics. Abstract data type specification and correctness. Collections including lists, stacks, queues, trees, heaps, maps, hash tables, and graphs. Big-O notation and algorithm analysis. Searching and sorting. Graph search and shortest path algorithms. Emphasis on object-oriented design, writing and documenting medium-sized programs. This course is designed for majors. (Typically Offered: Fall, Spring, Summer)

COMS 2300: Discrete Computational Structures

(Cross-listed with MATH 2300).

Credits: 3. Contact Hours: Lecture 3, Discussion 1.

Prereq: Minimum of C- in COMS 2270 and MATH 1650; ENGL 1500

Concepts in discrete mathematics as applied to computer science. Logic, set theory, functions, relations, cardinality of sets, combinatorics, graph theory and number theory. Proof techniques, induction and recursion.

(Typically Offered: Fall, Spring, Summer)

COMS 2520: Linux Operating System Essentials

Credits: 3. Contact Hours: Lecture 3.

Prereq: CPRE 1850 or SE 1850 or COMS 1270 or COMS 2070 or COMS 2270

Introduction to installation, utilization, and administration of Linux systems. Topics include open-source software, package installation and management, shell programming and command-line utilities, process and service management, account management, network configuration, file sharing, interoperability with other computers and operating systems, automation, and system security. (Typically Offered: Fall)

COMS 2900: Independent Study

Credits: 1-30. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

Graduation Restriction: No more than 6 credits of COMS 2900 or COMS 2900H may be counted toward graduation. (Typically Offered: Fall, Spring, Summer)

COMS 2900H: Independent Study: Honors

Credits: 1-30. Repeatable, maximum of 6 credits.

Prereq: Permission of Instructor; Membership in the University Honors Program

Graduation Restriction: No more than 6 credits of COMS 2900 or COMS 2900H may be counted toward graduation. (Typically Offered: Fall, Spring)

COMS 2950: Programming-Based Problem Solving Practices

Credits: 1. Contact Hours: Lecture 1.

Repeatable, maximum of 3 times.

Prereq: COMS 2070 or COMS 2270

Basics of problem solving using programming techniques. Development and implementation of simple to advanced data structures and algorithms, evaluation of problem difficulty, design and implementation of solutions, debugging, and working under time pressure. (Typically Offered: Fall, Spring)

COMS 3090: Software Development Practices

(Cross-listed with SE 3090).

Credits: 3. Contact Hours: Lecture 3, Discussion 1.

Prereq: Minimum of C- in (COMS 2280; MATH 1650)

Practical introduction to methods for managing software development.

Software engineering concepts, practices and tools. Requirements analysis, structured and object-oriented design, coding, testing, and maintenance. Software process models, software tools and environments. Programming projects that provide exposure to information management techniques, client/server model, networking and communication. (Typically Offered: Fall, Spring)

COMS 3110: Introduction to the Design and Analysis of Algorithms

Credits: 3. Contact Hours: Lecture 3, Discussion 1.

Prereq: Minimum of C- in (COMS 2280; MATH 1660, ENGL 1500); (COMS 2300 or CPRE 3100)

Basic techniques for design and analysis of algorithms. Sorting, searching, graph algorithms, string matching, algorithms for secure computing such as RSA, and NP-completeness. Design techniques such as dynamic programming, divide and conquer, greedy method, and approximation. Asymptotic, worst-case, average-case and amortized analyses. Topics from advanced data structures such as balanced trees and hashing. Programming projects. (Typically Offered: Fall, Spring, Summer)

COMS 3190: Construction of User Interfaces

(Cross-listed with SE 3190).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 2280

Overview of user interface design. Evaluation and testing of user interfaces. Review of principles of object orientation, object oriented design and analysis using UML in the context of user interface design. Design of windows, menus and commands. Developing Web and Windows-based user-interfaces. Event-driven programming. Introduction to Frameworks and APIs for the construction of user interfaces. (Typically Offered: Fall, Spring)

COMS 3210: Introduction to Computer Architecture and Machine-Level Programming

Credits: 3. Contact Hours: Lecture 3.

Prereq: Minimum of C- in (COMS 2280 and MATH 1650); (COMS 2300 or CPRE 2810); ENGL 2500

Introduction to computer architecture and organization. Emphasis on evaluation of performance, instruction set architecture, datapath and control, memory-hierarchy design, and pipelining. Assembly language programming. (Typically Offered: Fall, Spring)

COMS 3260: C for Programmers

Credits: 1. Contact Hours: Lecture 1.

Prereq: Minimum of C- in (COMS 2280; [COMS 2300 or CPRE 3100])

Half-semester course. Design and implementation of libraries and applications in C, for students with prior programming background.

Emphasis on differences between C and other languages, including file I/O, string processing, memory management, and buffer overruns. Using build systems, debuggers, and other development tools. Programming projects. (Typically Offered: Fall, Spring)

COMS 3270: Advanced Programming Techniques

Credits: 3. Contact Hours: Lecture 3.

Prereq: Minimum of C- in COMS 2280 and MATH 1650

Object-oriented programming experience using a language suitable for exploring advanced topics in programming. Topics include memory management, parameter passing, inheritance, compiling, debugging, and maintaining programs. Significant programming projects. (Typically Offered: Fall, Spring)

COMS 3310: Theory of Computing

(Cross-listed with LING 3310).

Credits: 3. Contact Hours: Lecture 3, Discussion 1.

Prereq: Minimum of C- in (COMS 2280; MATH 1660; ENGL 2500); (COMS 2300 or CPRE 3100)

Models of computation: finite state automata, pushdown automata and Turing machines. Study of grammars and their relation to automata. Limits of digital computation, unsolvability and Church-Turing thesis. Relations between classes of languages. (Typically Offered: Fall, Spring)

COMS 3360: Introduction to Computer Graphics

Credits: 3. Contact Hours: Lecture 3.

Prereq: (COMS 3270 or CPRE 2880) AND [credit or concurrent enrollment in (MATH 2070 or MATH 2650 or MATH 3170)]

Programming interactive computer graphics systems using standard low-level libraries (such as OpenGL or DirectX) with an emphasis on 3D rendering. The graphics pipeline and programmable shaders. Coordinate systems and transformations in two and three dimensions. Homogeneous coordinates, viewing transformations and perspective. Euler angles and quaternions. Visible surface algorithms. Lighting models and shading. Texture mapping, bump mapping, reflection, elementary ray tracing. Offscreen buffers, render-to-texture and related techniques. (Typically Offered: Fall)

COMS 3420: Principles of Programming Languages

(Cross-listed with SE 3420).

Credits: 3. Contact Hours: Lecture 3, Discussion 1.

Prereq: Minimum of C- in COMS 2280 and MATH 1650; COMS 2300 or CPRE 3100

Study of concepts in programming languages, especially functional programming concepts. Overview of major programming paradigms, their relationship, and tradeoffs among paradigms enabling sound choices of programming language for application-specific development. Programming projects. (Typically Offered: Fall, Spring)

COMS 3500: Number Theory

(Cross-listed with MATH 3500).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 2300 or CPRE 3100 or MATH 2010

Divisibility, integer representations, primes and divisors, linear diophantine equations, congruences, and multiplicative functions. Applications to cryptography. Additional topics, chosen at the discretion of the instructor. (Typically Offered: Spring)

COMS 3520: Introduction to Operating Systems

Credits: 3. Contact Hours: Lecture 3, Discussion 1.

Prereq: (COMS 3210 or CPRE 3810); (COMS 3270 or CPRE 2880); ENGL 2500

Survey of operating systems; process management including scheduling and multithreading; memory management including virtual memory and paging; concurrency including mutual exclusion, synchronization, and deadlocks; persistent storage and file systems; principles and practices of secure computing including threats and access control; networking and distributed systems; virtualization. Programming projects. (Typically Offered: Fall, Spring)

COMS 3620: Object-Oriented Analysis and Design

(Cross-listed with SE 3620).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500 and Minimum of C- in COMS 2280 and MATH 1650

Object-oriented requirements analysis and systems design. Analysis and design methodologies including use case and Unified Modeling Language (UML). Design principles, heuristics, and patterns. Architectural patterns and alternative programming paradigms. Group design and programming project. (Typically Offered: Fall, Spring)

COMS 3630: Introduction to Database Management Systems

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500 and Minimum of C- in COMS 2280 and MATH 1650

Data models and database design using entity relationship model. Database implementation with relational and graph database management systems (DBMS) and query languages. DBMS internals including basic concepts of database storage, indexing, query optimization, and concurrent control. Database application development. Programming Projects. (Typically Offered: Fall, Spring)

COMS 3980: Cooperative Education

Credits: Required. Repeatable.

Prereq: Department Permission for Course

Required of all cooperative education students. Students must register for this course prior to commencing each work period. (Typically Offered: Fall, Spring, Summer)

COMS 3990X: Special Topics

Credits: 3. Contact Hours: Lecture 3.

Special Topics in Computer Science.

COMS 4010: Bioinformatics of Sequences

(Cross-listed with BIOL 4010/ BCBIO 4010/ GEN 4010).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BCBIO 3220; (COMS 1270 OR COMS 2270); (MATH 1600 or MATH 1650); (MATH 1660 or STAT 3010); (STAT 1010 or STAT 1040 or STAT 3300) or Permission of Instructor

Application of computer science and statistics to molecular biology with a significant problem-solving component, including hands-on programming using Python to solve a variety of biological problems. String algorithms, sequence alignments, homology search, pattern discovery, genotyping, genome assembly, genome annotation, comparative genomics, protein structure. Offered odd-numbered years. (Typically Offered: Fall)

COMS 4020A: Computer Science Senior Project: Multimedia and Computer Gaming I

Credits: 2-3. Contact Hours: Studio 3.

Repeatable, maximum of 6 credits.

Prereq: COMS 3090, COMS 3110, COMS 3210, COMS 3310, COMS 4370 and Senior classification

Students conceive, plan, architect and design a computer game. Student registered in this course will work with students in ARTIS 4090. Oral and written reports. Graduation Restriction: No more than 6 credits of 4020A, 4020B, and 4020C may be used toward graduation. (Typically Offered: Fall)

COMS 4020B: Computer Science Senior Project: Multimedia and Computer Gaming II

Credits: 2-3. Contact Hours: Studio 3.

Repeatable, maximum of 6 credits.

Prereq: COMS 4020A and Senior classification

Students implement, test, and present a completed production computer game. Students in this class will work with students in ARTIS 4090. Oral and written reports. Graduation Restriction: No more than 6 credits of 4020A, 4020B, and 4020C may be used toward graduation. (Typically Offered: Spring)

COMS 4020C: Computer Science Senior Project: Project in Computer Science

Credits: 3. Contact Hours: Studio 6.

Prereq: COMS 3090, COMS 3110, COMS 3210, COMS 3310 and Senior classification

Students work as individuals and teams to complete the planning, design, and implementation of a significant project in the topic area. Oral and written reports. Recommended final semester Senior year. Graduation Restriction: No more than 6 credits of 4020A, 4020B, and 4020C may be used toward graduation. (Typically Offered: Fall, Spring)

COMS 4060: Bioinformatics of OMICS

(Cross-listed with BIOL 4060/ BCBIO 4060/ GEN 4060).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2120

Introduction to cutting edge OMICS analyses including transcriptome, proteome, metabolome, DNA-protein interactome, protein-protein interactome and methylome. Genomic analysis including transcriptome analysis, cancer genomics, comparative genomics, and regulatory network analysis. (Typically Offered: Spring)

COMS 4070: Applied Formal Methods

(Dual-listed with AERE 5070/ COMS 5070). (Cross-listed with AERE 4070).

Credits: 3. Contact Hours: Lecture 3.

Prereq: AERE 3610 for AERE majors. COMS 3110 for COMS majors.

AERE 3610 or COMS 3110, or an equivalent course, plus instructor permission for other majors.

Introduction to the fundamentals of formal methods, a set of mathematically rigorous techniques for the formal specification, validation, and verification of safety- and security-critical systems. Tools, techniques, and applications of formal methods with an emphasis on real-world use-cases such as enabling autonomous operation. Build experience in writing mathematically analyzable specifications from English operational concepts for real cyberphysical systems, such as aircraft and spacecraft. Review capabilities and limitations of formal methods in the design, verification, and system health management of today's complex systems. (Typically Offered: Spring)

COMS 4090: Software Requirements Engineering

(Dual-listed with COMS 5090). (Cross-listed with SE 4090).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 3090

The requirements engineering process including elicitation, requirements analysis fundamentals, requirements specification and communication, and requirements evaluation. Modeling of functional requirements and nonfunctional requirements, traceability, and requirements change management. Case studies and software projects.

COMS 4100: Distributed Development of Software

(Dual-listed with COMS 5100).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 3090; (COMS 3270 or CPRE 2880)

Teams of students develop software applications in a modern software engineering environment. Importance, effective processes pertaining to team organization, management and communication, and cultural issues of distributed development. Graduate credit requires in-depth study of concepts and oral presentations.

COMS 4120: Formal Methods in Software Engineering

(Dual-listed with COMS 5120). (Cross-listed with CPRE 4120/ SE 4120).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 3110; (STAT 3050 or STAT 3300 or STAT 3410)

A study of formal techniques for model-based specification and verification of software systems. Topics include logics, formalisms, graph theory, numerical computations, algorithms and tools for automatic analysis of systems. Graduate credit requires in-depth study of concepts.

COMS 4130: Program Analysis

(Dual-listed with COMS 5130/ CPRE 5130). (Cross-listed with SE 4130).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (COMS 3270 or CPRE 2880); COMS 3420

Algorithms, AI techniques and tools for automatically reasoning about code and program executions. Theory and foundations related to control flow analysis, dataflow analysis, abstract interpretation, and symbolic execution. Applications of program analysis to bug detection, test input generation, debugging, program repair, specification inference and trustworthy AI engineering. Concepts, algorithms, tools, benchmarks, methodologies for solving problems using program analysis and for preparing research in program analysis.

COMS 4140: Gerontechnology in Smart Home Environments

(Dual-listed with COMS 5140).

Credits: 3. Contact Hours: Lecture 3.

Interdisciplinary course designed for students interested in assistive technology, pervasive computing, mobile computing and principles of universal and inclusive design for end users, in particular, the elderly population. Students work in semester-long projects as interdisciplinary teams to apply knowledge obtained from lectures and mutual presentations. Research report and oral presentation required for graduate credit.

COMS 4150: Software System Safety

(Dual-listed with COMS 5150).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 3090 or COMS 3110

An introduction to the hazard analysis, safety requirements, design, and verification of software for safety-critical and high-dependability systems. Safety analysis techniques, fault identification and recovery, and certification issues. Emphasizes a case-based and systematic approach to software's role in safe systems.

COMS 4170: Software Testing

(Cross-listed with SE 4170).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 3090; (COMS 2300 or CPRE 3100); ENGL 2500

An introduction to software testing principles and techniques. Test models, test design, test adequacy criteria; regression, integration, and system testing; and software testing tools.

COMS 4180: Introduction to Computational Geometry

(Dual-listed with COMS 5180).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 3110

Introduction to data structures, algorithms, and analysis techniques for computational problems that involve geometry. Convex hulls, line segment intersection, polygon triangulation, 2D linear programming, range queries, point location, arrangements and duality, Voronoi diagrams, Delaunay triangulations, geometric data structures, robot motion planning, visibility graphs. Other selected topics. Programming assignments. Scholarly report required for graduate credit.

COMS 4190X: Trustworthy Healthcare Software

(Dual-listed with COMS 5190X).

Credits: 3. Contact Hours: Lecture 3.

Introduction to healthcare software used for health diagnosis or treatment. Focus on software as part of a medical device, the emerging use of software as a medical device, and on mobile healthcare applications. Topics include: discovering and verifying usability, reliability, and safety requirements; design and verification of trustworthy healthcare software; assurance cases for healthcare software in a regulatory environment. (Typically Offered: Spring)

COMS 4210: Logic for Mathematics and Computer Science

(Cross-listed with MATH 4210).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 2300 or CPRE 3100 or MATH 2070 or MATH 3010 or MATH 3170

Propositional and predicate logic. Topics selected from Horn logic, equational logic, resolution and unification, foundations of logic programming, reasoning about programs, program specification and verification, model checking and binary decision diagrams, temporal logic and modal logic.

COMS 4240: Introduction to High Performance Computing

(Cross-listed with MATH 4240/ CPRE 4240).

Credits: 3.

Prereq: (MATH 2650; [MATH 2070 OR MATH 3170]) or permission of instructor

Unix, serial programming of scientific applications, OpenMP for shared-memory parallelization. No Unix, Fortran or C experience required. (Typically Offered: Fall)

COMS 4250: High Performance Computing for Scientific and Engineering Applications

(Cross-listed with CPRE 4250).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: COMS 3110 and ENGL 2500 and SPCM 2120

Introduction to high performance computing platforms including parallel computers and workstation clusters. Discussion of parallel architectures, performance, programming models, and software development issues. Sample applications from science and engineering. Practical issues in high performance computing will be emphasized via a number of programming projects using a variety of programming models and case studies. Oral and written reports.

COMS 4260: Introduction to Parallel Algorithms and Programming

(Dual-listed with CPRE 5260/ COMS 5260). (Cross-listed with CPRE 4260).

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: CPRE 3080 or COMS 3210 and CPRE 3150 or COMS 3110

Models of parallel computation, performance measures, basic parallel constructs and communication primitives, parallel programming using MPI, parallel algorithms for selected problems including sorting, matrix, tree and graph problems, fast Fourier transforms. (Typically Offered: Fall)

COMS 4300: Concurrent Programming in Practice

Credits: 3. Contact Hours: Lecture 3, Discussion 1.

Prereq: COMS 3110 and COMS 3620 or COMS 3630 and ENGL 2500 and SPCM 2120

A practical course in concepts, techniques, languages, and frameworks for concurrent and asynchronous systems. Concurrency fundamentals: threads, synchronization locks, waiting and notification, memory visibility. Immutability and thread confinement. Concurrent data structures and utilities, thread pools. Asynchronous programming with callbacks, futures, and message passing. Issues of aliasing, ownership and borrowing. Transactional memory, immutable and versioned data structures. Alternatives to threads and locks: event-driven systems, the actor model, CSP, coroutines. Students will investigate several non-mainstream languages supporting different concurrency models. Oral and written reports.

COMS 4330: Molecular Programming of Nanoscale Devices and Processes

(Dual-listed with COMS 5330).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Minimum of C- in COMS 3310 or Permission of Instructor

Programming, modeling, and analysis of natural and engineered systems at the nanoscale. Topics include chemical reaction networks, strand displacement systems, models of self-assembly, biomolecular origami, and molecular robotics. Emphasis on mathematical methods of describing, simulating, programming, and assessing the computational power of such systems. Graduate credit requires a written or oral report on current research.

COMS 4340: Quantum Information and Complexity

(Dual-listed with COMS 5340).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (COMS 3310 or PHYS 4220 or PHYS 5220); (MATH 2070 or MATH 3170)

An exploration of quantum information and computation from a theoretical computer science perspective. Topics include quantum circuits, axioms of quantum mechanics, quantum entanglement, quantum teleportation, nonlocal games, quantum entropies, quantum information theory, quantum computational complexity, interactive proof systems, and quantum supremacy. (Typically Offered: Fall)

COMS 4350: Algorithms for Large Data Sets: Theory and Practice

(Dual-listed with COMS 5350).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 3110 or Permission of Instructor

Algorithmic challenges involved in solving computational problems on massive data sets. Probabilistic data structures, Curse of Dimensionality and dimensionality reduction, locality sensitive hashing, similarity measures, matrix decompositions. Optimization problems in massive data analysis. Computational problems that arise in the context of web search, social network analysis, online advertising etc. Practical aspects include implementation and performance evaluation of the algorithms on real world data sets. Graduate credit requires a written report on current research.

COMS 4370: Computer Game and Media Programming

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 3360

Video game programming using current game engine interfaces with real hardware. Particular attention is paid to the development environment, tool chains, 2D graphics, 3D graphics, controllers, memory management, and audio systems.

COMS 4400: Principles and Practice of Compiling

(Dual-listed with COMS 5400). (Cross-listed with SE 4400).

Credits: 3. Contact Hours: Laboratory 1, Lecture 3.

Prereq: COMS 3310 or COMS 3420 and COMS 3090 and ENGL 2500

Theory of compiling and implementation issues of programming languages. Programming projects leading to the construction of a compiler. Projects with different difficulty levels will be given for 4400 and 5400. Topics include: lexical, syntactic and semantic analyses, syntax-directed translation, code generation, runtime environment and library support.

COMS 4410: Programming Languages

(Dual-listed with COMS 5410).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 3420 or COMS 4400

Survey of the goals and problems of language design. Formal and informal studies of a wide variety of programming language features including type systems. Creative use of functional and declarative programming paradigms.

COMS 4530: Privacy Preserving Algorithms and Data Security

(Dual-listed with COMS 5530X).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COM S 3110; (STAT 3050 or STAT 3300 or STAT 3410 or STAT 3470)

Latest online threats on identity theft, fundamentals of privacy preserving algorithms, techniques, and mechanisms to minimize disclosure of sensitive information while maintaining availability. Theory and fundamentals underpinning measures to evaluate the privacy and availability of data; implementation and deployment of privacy-preserving data operations including pre- and post-randomization techniques, homomorphisms, and secure function evaluation protocols. (Typically Offered: Spring)

COMS 4540: Fundamentals of Remote Sensing and Spatial Analysis

(Dual-listed with COMS 5540/ CPRE 5540). (Cross-listed with CPRE 4540).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 3110 and COMS 3520 or CPRE 3080

Introduction to image processing techniques needed for analysis of optical remote sensing imagery, including filtering, enhancement, and classification. Analysis of elevation surfaces, hydrology, distance, overlays and visual programming with Model Builder. Practical applications in a variety of topics to understand how to analyze imagery. (Typically Offered: Spring)

COMS 4550: Simulation: Algorithms and Implementation

(Dual-listed with COMS 5550).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 3110 and (STAT 3050, STAT 3300 or STAT 3410) and ENGL 2500

Introduction to discrete-event simulation with a focus on computer science applications, including performance evaluation of networks and distributed systems. Overview of algorithms and data structures necessary to implement simulation software. Discrete and continuous stochastic models, random number generation, elementary statistics, simulation of queuing and inventory systems, Monte Carlo simulation, point and interval parameter estimation. Graduate credit requires additional in-depth study of concepts.

COMS 4590X: Security and Privacy in Cloud Computing

(Dual-listed with COMS 5590/ CPRE 5590). (Cross-listed with CPRE 4590X).

Credits: 3. Contact Hours: Lecture 3.

Introduction to cloud computing concepts and systems. Security and privacy threats in cloud computing. Practical techniques for cloud computing security. Theoretical and practical solutions for secure outsourcing of data and computation. Oral presentations and research projects. (Typically Offered: Fall)

COMS 4610: Principles and Internals of Database Systems

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 3110 and ENGL 2500 and SPCM 2120

Database design including entity-relationship model, relational data model, and non-relational data models, data dependency, and normalization. Database management including physical storage, access methods, query processing, and transaction management. Database systems of special purposes such as spatial databases, mobile object databases, and multimedia databases. Introduction to current database research such as cloud data management and Internet information retrieval.

COMS 4630X: Healthcare Data Privacy, Security and Confidentiality: Principles and Algorithms

(Dual-listed with COMS 5630X).

Credits: 3. Contact Hours: Lecture 3.

Introduction to types of healthcare data, complexities of privacy, confidentiality and security within healthcare. Key laws and regulations specific to healthcare such as HIPAA and the European Data Protection Directive 95/46/EC. Types of data sources and data elements utilized in healthcare. Algorithms for privacy, security and confidentiality of electronic health records. Role-based access control in healthcare. (Typically Offered: Spring)

COMS 4640X: AI for Healthcare

(Dual-listed with COMS 5640X).

Credits: 3. Contact Hours: Lecture 3.

Introduction to use of AI techniques in healthcare. Topics may include: AI techniques for medical diagnosis, prognosis and treatment, AI techniques for diagnosis of lung and brain disorders from 2D medical imaging data, classification models of 2D medical images, AI techniques for 3D medical imaging data, use of multi-modal imaging data in disease detection and diagnosis. Programming projects.

COMS 4720: Principles of Artificial Intelligence

(Dual-listed with COMS 5720).

Credits: 3. Contact Hours: Lecture 3, Discussion 1.

Prereq: COMS 3110; STAT 3300 or STAT 3050 or STAT 3410 or STAT 3470; MATH 1650; ENGL 2500

Basic principles, techniques, and applications of artificial intelligence. Specification, design, implementation, and applications of intelligent agents. Computational models of intelligent behavior, including problem solving, knowledge representation and reasoning, planning, decision making, learning, perception, and communication. Artificial intelligence programming. Term project and written report for graduate credit.

COMS 4740: Introduction to Machine Learning

(Dual-listed with COMS 5740).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 3110; STAT 3300 or STAT 3050 or STAT 3410 or STAT 3470; MATH 1650; ENGL 2500

Introduction to concepts, tools and techniques of machine learning for applications. Selected machine learning algorithms in practical data mining tasks such as classification, regression, and clustering, e.g., association rules, decision trees, linear models, Bayesian learning, support vector machines, artificial neural networks, instance-based learning, probabilistic graphical models, ensemble learning, and clustering algorithms. Selected applications in data mining and pattern recognition.

COMS 4760: Motion Planning for Robotics and Autonomous Systems

(Dual-listed with COMS 5760).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 3110; ENGL 2500

Recent techniques for developing algorithms that automatically generate continuous motions while satisfying geometric constraints. Applications in areas such as robotics and autonomous systems. Discrete planning, kinematics, configuration space, collision detection, sampling-based motion planning, nonholonomic systems and differential constraints. Implementation of software that computes motion plans in Python. Written reports. (Typically Offered: Fall, Spring, Summer)

COMS 4770: Foundations of Robotics and Computer Vision

(Dual-listed with COMS 5770).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 2280; COMS 2300 or CPRE 3100; MATH 2070 or MATH 3170, or consent of the instructor

Selected topics from applied mathematics, algorithms, geometry, and mechanics that are fundamental to robotics and computer vision, and are also applied in computer graphics, geometric modeling and visualization, to me a few. Homogeneous coordinates and transformations, perspective projection, camera calibration, rotations and quaternions, roots of polynomials and polynomial systems, solution of linear and nonlinear equations, parametric and algebraic curves, curvature, torsion, Frenet formulas, surfaces, fundamental forms, principal curvatures, Gaussian and mean curvatures, geodesics, approximation, Fourier series and fast Fourier transform, nonlinear optimization, Lagrange multipliers, least squares, surface fitting and calculus of variations. Programming components. Scholarly report required for graduate credit.

COMS 4810: Numerical Methods for Differential Equations

(Dual-listed with MATH 5810). (Cross-listed with MATH 4810).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 2650 and one of MATH 2660, MATH 2670

First order Euler method, high order Runge-Kutta methods, and multistep methods for solving ordinary differential equations. Finite difference and finite element methods for solving partial differential equations. Local truncation error, stability, and convergence for finite difference method. Numerical solution space, polynomial approximation, and error estimate for finite element method. Computer programming required. (Typically Offered: Spring)

COMS 4870: Introduction to Network Programming and Cloud Computing

(Dual-listed with COMS 5870).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 3520 or CPRE 3080

Introduction to network programming: protocols, programming suites, and applications. Introduction to cloud computing: concepts and case study with AWS. Introduction to selected research issues in networking and cloud computing. Graduate credit requires written report and oral presentation.

COMS 4880: Computer Networks

(Dual-listed with COMS 5880).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 3520 or CPRE 3080

Fundamental concepts in the design and implementation of computer communication in both wired and wireless networks, their protocols, and applications. Topics include the layered network architecture in the Internet, applications, transport, network, and data link layers and their protocols, Socket API, software-defined networking, and network security. Lectures organized in a top-down approach to cover the layers of network design. (Typically Offered: Fall, Spring)

COMS 4900: Independent Study

Credits: 1-30. Repeatable, maximum of 9 credits.

Prereq: 6 credits in COMS; Permission of Instructor

Graduation Restriction: No more than 9 credits of COMS 4900 or COMS 4900H may be counted toward graduation. (Typically Offered: Fall, Spring, Summer)

COMS 4900H: Independent Study: Honors

Credits: 1-30. Repeatable, maximum of 9 credits.

Prereq: 6 credits in COMS; Permission of Instructor; Membership in the University Honors Program

Graduation Restriction: No more than 9 credits of COMS 4900 or COMS 4900H may be counted toward graduation. (Typically Offered: Fall, Spring)

COMS 4990X: Special Topics

Credits: 3. Contact Hours: Lecture 3.

Special Topics in Computer Science.

Courses primarily for graduate students, open to qualified undergraduates:

COMS 5010X: Computational Methods I

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Design of data structures and algorithms with an object-oriented programming methodology. Abstract data type specification and correctness. Collections including lists, stacks, queues, trees and hash tables. Searching and Sorting. Discrete mathematics concepts as applied to computer science. Basics of logic, set theory, functions, relations, combinatorics. Proof techniques such as induction and recursion. Background in Math and Computer Science equivalent to MATH 1650 and COMS 2270 required.

COMS 5040X: Computational Methods II

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Basics of graph theory, number theory and discrete probability. Big O Notation and algorithm analysis. Analysis of sorting and searching algorithms. Algorithm design techniques such as divide and conquer, greedy method and dynamic programming. Graph algorithms.

COMS 5070: Applied Formal Methods

(Dual-listed with AERE 4070/ COMS 4070). (Cross-listed with AERE 5070).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to the fundamentals of formal methods, a set of mathematically rigorous techniques for the formal specification, validation, and verification of safety- and security-critical systems. Tools, techniques, and applications of formal methods with an emphasis on real-world use-cases such as enabling autonomous operation. Build experience in writing mathematically analyzable specifications from English operational concepts for real cyberphysical systems, such as aircraft and spacecraft. Review capabilities and limitations of formal methods in the design, verification, and system health management of today's complex systems. (Typically Offered: Spring)

COMS 5090: Software Requirements Engineering

(Dual-listed with COMS 4090/ SE 4090).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 3090 or Graduate Classification

The requirements engineering process including elicitation, requirements analysis fundamentals, requirements specification and communication, and requirements evaluation. Modeling of functional requirements and nonfunctional requirements, traceability, and requirements change management. Case studies and software projects.

COMS 5100: Distributed Development of Software

(Dual-listed with COMS 4100).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Teams of students develop software applications in a modern software engineering environment. Importance, effective processes pertaining to team organization, management and communication, and cultural issues of distributed development. Graduate credit requires in-depth study of concepts and oral presentations.

COMS 5110: Design and Analysis of Algorithms

(Cross-listed with CPRE 5110).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 3110 or Graduate Classification

A study of algorithm design and analysis techniques. Network flows and linear programming. Randomized algorithms. NP-completeness. Approximation algorithms. Fixed-parameter algorithms.

COMS 5120: Formal Methods in Software Engineering

(Dual-listed with COMS 4120/ CPRE 4120/ SE 4120).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

A study of formal techniques for model-based specification and verification of software systems. Topics include logics, formalisms, graph theory, numerical computations, algorithms and tools for automatic analysis of systems. Graduate credit requires in-depth study of concepts.

COMS 5130: Program Analysis

(Dual-listed with COMS 4130/ SE 4130). (Cross-listed with CPRE 5130).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (COMS 3270 or CPRE 2880); COMS 3420 or Graduate Classification
Algorithms, AI techniques and tools for automatically reasoning about code and program executions. Theory and foundations related to control flow analysis, dataflow analysis, abstract interpretation, and symbolic execution. Applications of program analysis to bug detection, test input generation, debugging, program repair, specification inference and trustworthy AI engineering. Concepts, algorithms, tools, benchmarks, methodologies for solving problems using program analysis and for preparing research in program analysis.

COMS 5140: Gerontechnology in Smart Home Environments

(Dual-listed with COMS 4140).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ARTGR 2710 or COMS 2070 or COMS 2270 or GERON 3770 or Graduate Classification

Interdisciplinary course designed for students interested in assistive technology, pervasive computing, mobile computing and principles of universal and inclusive design for end users, in particular, the elderly population. Students work in semester-long projects as interdisciplinary teams to apply knowledge obtained from lectures and mutual presentations. Research report and oral presentation required for graduate credit.

COMS 5150: Software System Safety

(Dual-listed with COMS 4150).

Credits: 3. Contact Hours: Lecture 3.

Prereq: [(COMS 3090 or COMS 3110) and Permission of Instructor] OR Graduate Classification

An introduction to the hazard analysis, safety requirements, design, and verification of software for safety-critical and high-dependability systems. Safety analysis techniques, fault identification and recovery, and certification issues. Emphasizes a case-based and systematic approach to software's role in safe systems.

COMS 5160: Artificial Intelligence in Software Engineering

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Application of artificial intelligence (AI) techniques used to solve problems in software engineering and the use of software engineering techniques to improve AI. AI techniques such as optimization/search, classification, natural language processing, and deep learning to address software engineering problems will be included. Offered even-numbered years. (Typically Offered: Spring)

COMS 5180: Introduction to Computational Geometry

(Dual-listed with COMS 4180).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to data structures, algorithms, and analysis techniques for computational problems that involve geometry. Convex hulls, line segment intersection, polygon triangulation, 2D linear programming, range queries, point location, arrangements and duality, Voronoi diagrams, Delaunay triangulations, geometric data structures, robot motion planning, visibility graphs. Other selected topics. Programming assignments. Scholarly report required for graduate credit.

COMS 5190X: Trustworthy Healthcare Software

(Dual-listed with COMS 4190X).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to healthcare software used for health diagnosis or treatment. Focus on software as part of a medical device, the emerging use of software as a medical device, and on mobile healthcare applications. Topics include: discovering and verifying usability, reliability, and safety requirements; design and verification of trustworthy healthcare software; assurance cases for healthcare software in a regulatory environment.

COMS 5250: Numerical Analysis of High Performance Computing

(Cross-listed with MATH 5250/ CPRE 5250).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to parallelization techniques and numerical methods for distributed memory high performance computers. A semester project in an area related to each student's research interests is required. (Typically Offered: Spring)

COMS 5260: Introduction to Parallel Algorithms and Programming

(Dual-listed with CPRE 4260/ COMS 4260). (Cross-listed with CPRE 5260).

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Models of parallel computation, performance measures, basic parallel constructs and communication primitives, parallel programming using MPI, parallel algorithms for selected problems including sorting, matrix, tree and graph problems, fast Fourier transforms. (Typically Offered: Fall)

COMS 5270: High-Performance Deep Learning

(Cross-listed with CPRE 5270).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 3520 or CPRE 3080

Fundamentals and advances in HPC in the context of GPUs, TPUs, multicore and HPC systems with specific focus on parallel programming models. Discussing of high-performance computing, GPGPU, scaling deep neural network training and machine learning algorithms, high-performance deep learning, intersection of HPC and AI for HPC, distributed parallel training, engineering parallel software and parallel design patterns.

COMS 5310: Theory of Computation

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 3310 or Graduate Classification

A systematic study of the fundamental models and analytical methods of theoretical computer science. Computability, the Church-Turing thesis, decidable and undecidable problems. Computational resources such as time, space, and nonuniformity. Complexity classes, computational intractability and completeness. Selected topics from randomness, algorithmic information theory, and logic.

COMS 5330: Molecular Programming of Nanoscale Devices and Processes

(Dual-listed with COMS 4330).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Programming, modeling, and analysis of natural and engineered systems at the nanoscale. Topics include chemical reaction networks, strand displacement systems, models of self-assembly, biomolecular origami, and molecular robotics. Emphasis on mathematical methods of describing, simulating, programming, and assessing the computational power of such systems. Graduate credit requires a written or oral report on current research.

COMS 5340: Quantum Information and Complexity

(Dual-listed with COMS 4340).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (COMS 3310 or PHYS 4220 or PHYS 5220); (MATH 2070 or MATH 3170)

An exploration of quantum information and computation from a theoretical computer science perspective. Topics include quantum circuits, axioms of quantum mechanics, quantum entanglement, quantum teleportation, nonlocal games, quantum entropies, quantum information theory, quantum computational complexity, interactive proof systems, and quantum supremacy.

COMS 5350: Algorithms for Large Data Sets: Theory and Practice

(Dual-listed with COMS 4350).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 3110 or equivalent; graduate standing or permission of instructor

Algorithmic challenges involved in solving computational problems on massive data sets. Probabilistic data structures, Curse of Dimensionality and dimensionality reduction, locality sensitive hashing, similarity measures, matrix decompositions. Optimization problems in massive data analysis. Computational problems that arise in the context of web search, social network analysis, online advertising etc. Practical aspects include implementation and performance evaluation of the algorithms on real world data sets. Graduate credit requires a written report on current research.

COMS 5400: Principles and Practice of Compiling

(Dual-listed with COMS 4400/ SE 4400).

Credits: 3. Contact Hours: Lecture 3, Laboratory 1.

Prereq: Graduate Standing or Permission of Instructor

Theory of compiling and implementation issues of programming languages. Programming projects leading to the construction of a compiler. Projects with different difficulty levels will be given for 4400 and 5400. Topics include: lexical, syntactic and semantic analyses, syntax-directed translation, code generation, runtime environment and library support.

COMS 5410: Programming Languages

(Dual-listed with COMS 4410).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 3420 or COMS 4400 or Graduate Classification

Survey of the goals and problems of language design. Formal and informal studies of a wide variety of programming language features including type systems. Creative use of functional and declarative programming paradigms.

COMS 5440: Fundamentals of Bioinformatics

(Cross-listed with BCB 5440/ GDCB 5440/ CPRE 5440).

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

A practical, hands-on overview of how to apply bioinformatics to biological research. Recommended for biologists desiring to gain computational molecular biology skills. Topics include: sequence analysis, genomics, proteomics, phylogenetic analyses, ontology enrichment, systems biology, data visualization and emergent technologies. Offered odd-numbered years. (Typically Offered: Fall)

COMS 5510: Genomic Data Science

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to a big data research area in bioinformatics. Focus on applying computational techniques to huge genomic sequence data. These techniques include finding optimal sequence alignments, generating genome assemblies, finding genes in genomic sequences, mapping short sequences onto a genome assembly, finding single-nucleotide and structural variations, building phylogenetic trees from genome sequences, and performing genome-wide association studies.

COMS 5520: Principles of Operating Systems

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Classification or Permission of Instructor

A comparative study of high-level language facilities for process synchronization and communication. Analysis of deadlock, concurrency control and recovery. Protection issues including capability-based systems, access and flow control, encryption, and authentication. Additional topics chosen from distributed operating systems, soft real-time operating systems, and advanced security issues. Programming and research projects.

COMS 5530X: Privacy Preserving Algorithms and Data Security

(Dual-listed with COMS 4530).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 3110; (STAT 3050 or STAT 3300 or STAT 3410 or STAT 3470)

Latest online threats on identity theft, fundamentals of privacy preserving algorithms, techniques, and mechanisms to minimize disclosure of sensitive information while maintaining availability. Theory and fundamentals underpinning measures to evaluate the privacy and availability of data; implementation and deployment of privacy-preserving data operations including pre- and post-randomization techniques, homomorphisms, and secure function evaluation protocols. (Typically Offered: Spring)

COMS 5540: Fundamentals of Remote Sensing and Spatial Analysis

(Dual-listed with COMS 4540/ CPRE 4540). (Cross-listed with CPRE 5540).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 3110 and (COMS 3520 or CPRE 3080) or Graduate Classification

Introduction to image processing techniques needed for analysis of optical remote sensing imagery, including filtering, enhancement, and classification. Analysis of elevation surfaces, hydrology, distance, overlays and visual programming with Model Builder. Practical applications in a variety of topics to understand how to analyze imagery. (Typically Offered: Spring)

COMS 5550: Simulation: Algorithms and Implementation

(Dual-listed with COMS 4550).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to discrete-event simulation with a focus on computer science applications, including performance evaluation of networks and distributed systems. Overview of algorithms and data structures necessary to implement simulation software. Discrete and continuous stochastic models, random number generation, elementary statistics, simulation of queuing and inventory systems, Monte Carlo simulation, point and interval parameter estimation. Graduate credit requires additional in-depth study of concepts.

COMS 5570: Computer Graphics and Geometric Modeling

(Cross-listed with ME 5570/ CPRE 5570).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Fundamentals of computer graphics technology. Data structures. Parametric curve and surface modeling. Solid model representations. Applications in engineering design, analysis, and manufacturing. Offered odd-numbered years. (Typically Offered: Fall)

COMS 5590: Security and Privacy in Cloud Computing

(Dual-listed with COMS 4590X/ CPRE 4590X). (Cross-listed with CPRE 5590).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to cloud computing concepts and systems. Security and privacy threats in cloud computing. Practical techniques for cloud computing security. Theoretical and practical solutions for secure outsourcing of data and computation. Oral presentations and research projects.

COMS 5600: Data-Driven Security and Privacy

(Cross-listed with CPRE 5600/ CYBSC 5600).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Examination of applications of machine learning and big data techniques to various security and privacy problems, as well as secure and privacy-preserving machine learning algorithms. Offered irregularly. (Typically Offered: Spring)

COMS 5610: Database Design, Management, and Research

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate classification

Database design including entity-relationship model, relational data model, and non-relational data models, data dependency, and normalization. Database management including physical storage, access methods, query processing, and transaction management. Database systems of special purposes such as spatial databases, mobile object databases, and multimedia databases. Introduction to current database research such as cloud data management and Internet information retrieval. Significant work on reading and presentation of research publications.

COMS 5630X: Healthcare Data Privacy, Security and Confidentiality: Principles and Algorithms

(Dual-listed with COMS 4630X).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to types of healthcare data, complexities of privacy, confidentiality and security within healthcare. Key laws and regulations specific to healthcare such as HIPAA and the European Data Protection Directive 95/46/EC. Types of data sources and data elements utilized in healthcare. Algorithms for privacy, security and confidentiality of electronic health records. Role-based access control in healthcare.

COMS 5640X: AI for Healthcare

(Dual-listed with COMS 4640X).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to use of AI techniques in healthcare. Topics may include: AI techniques for medical diagnosis, prognosis and treatment, AI techniques for diagnosis of lung and brain disorders from 2D medical imaging data, classification models of 2D medical images, AI techniques for 3D medical imaging data, use of multi-modal imaging data in disease detection and diagnosis. Programming projects.

COMS 5670: Bioinformatics Algorithms

(Cross-listed with BCB 5670/ CPRE 5670).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Biology as an information science. A review of the algorithmic principles that are driving the advances in bioinformatics and computational biology.

COMS 5680: Statistical Bioinformatics

(Cross-listed with BCB 5680/ GDCB 5680/ STAT 5680).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Statistical models for sequence data, including applications in genome annotation, motif discovery, variant discovery, molecular phylogeny, gene expression analysis, and metagenomics. Statistical topics include model building, inference, hypothesis testing, and simple experimental design, including for big data/complex models. (Typically Offered: Spring)

COMS 5690: Structural Bioinformatics

(Cross-listed with BCB 5690/ BBMB 5690/ CPRE 5690/ GDCB 5690).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Molecular structures including genes and gene products: protein, DNA and RNA structure. Structure determination methods, structural refinement, structure representation, comparison of structures, visualization, and modeling. Molecular and cellular structure from imaging. Analysis and prediction of protein secondary, tertiary, and higher order structure, disorder, protein-protein and protein-nucleic acid interactions, protein localization and function, bridging between molecular and cellular structures. Molecular evolution. (Typically Offered: Fall)

COMS 5700: Systems Biology

(Cross-listed with BCB 5700/ CPRE 5700/ GDCB 5700/ STAT 5700).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Algorithmic and statistical approaches in computational functional genomics and systems biology. Analysis of high throughput biological data obtained using system-wide measurements. Topological analysis, module discovery, and comparative analysis of gene and protein networks. Modeling, analysis, and inference of transcriptional regulatory networks, protein-protein interaction networks, and metabolic networks. Dynamic systems and whole-cell models. Ontology-driven, network based, and probabilistic approaches to information integration. (Typically Offered: Spring)

COMS 5710X: Responsible AI: Risk Management in Data Driven Discovery

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate classification

Risk assessment and mitigation mechanisms of various stages of machine learning/data science lifecycles with the emphasis on the early stages: study design, data acquisition, exploratory data analysis, feature engineering, modeling and training, and model evaluation. Case studies of machine learning/data science lifecycles used in application domains along with methods for risk assessment and mitigation. DS 2020 recommended. (Typically Offered: Fall)

COMS 5720: Principles of Artificial Intelligence

(Dual-listed with COMS 4720).

Credits: 3. Contact Hours: Lecture 3, Discussion 1.

Prereq: COMS 3110; STAT 3300 or STAT 3050 or STAT 3410 or STAT 3470; ENGL 2500; graduate standing or permission of instructor

Basic principles, techniques, and applications of artificial intelligence. Specification, design, implementation, and applications of intelligent agents. Computational models of intelligent behavior, including problem solving, knowledge representation and reasoning, planning, decision making, learning, perception, and communication. Artificial intelligence programming. Term project and written report for graduate credit.

COMS 5730: Machine Learning

Credits: 3. Contact Hours: Lecture 4.

Prereq: Graduate Classification or Permission of Instructor

Basic principles, techniques, and applications of machine learning. Design, analysis, theoretical foundation, implementation, and applications of learning algorithms. Selected machine learning techniques in supervised learning, unsupervised learning, and reinforcement learning, including Bayesian decision theory, computational learning theory, decision trees, linear models, support vector machines, artificial neural networks, instance-based learning, probabilistic graphical models, ensemble learning, clustering algorithms, dimensionality reduction and feature selection. Selected applications in data mining and pattern recognition.

COMS 5740: Introduction to Machine Learning

(Dual-listed with COMS 4740).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 3110; STAT 3050 or STAT 3300 or STAT 3410 or STAT 3470; MATH 1650; ENGL 2500; Graduate standing or permission of instructor

Introduction to concepts, tools and techniques of machine learning for applications. Selected machine learning algorithms in practical data mining tasks such as classification, regression, and clustering, e.g., association rules, decision trees, linear models, Bayesian learning, support vector machines, artificial neural networks, instance-based learning, probabilistic graphical models, ensemble learning, and clustering algorithms. Selected applications in data mining and pattern recognition.

COMS 5750: Computational Perception

(Cross-listed with HCI 5750/ CPRE 5750).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

This class covers statistical and algorithmic methods for sensing, recognizing, and interpreting the activities of people by a computer. This semester we will focus on machine perception techniques that facilitate and augment human-computer interaction. The main goal of the class is to introduce computational perception on both theoretical and practical levels. Participation in small groups to design, implement, and evaluate a prototype of a human-computer interaction system that uses one or more of the techniques covered in the lectures. (Typically Offered: Spring)

COMS 5760: Motion Planning for Robotics and Autonomous Systems

(Dual-listed with COMS 4760).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 3110 and ENGL 2500 or Graduate Classification

Recent techniques for developing algorithms that automatically generate continuous motions while satisfying geometric constraints. Applications in areas such as robotics and autonomous systems. Discrete planning, kinematics, configuration space, collision detection, sampling-based motion planning, nonholonomic systems and differential constraints. Implementation of software that computes motion plans in Python. Proficiency with programming in Python expected. Written reports.

COMS 5770: Foundations of Robotics and Computer Vision

(Dual-listed with COMS 4770).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 2280 and COMS 2300 or CPRE 3100; MATH 2070 or MATH 3170, or Graduate Classification

Selected topics from applied mathematics, algorithms, geometry, and mechanics that are fundamental to robotics and computer vision, and are also applied in computer graphics, geometric modeling and visualization, to name a few. Homogeneous coordinates and transformations, perspective projection, camera calibration, rotations and quaternions, roots of polynomials and polynomial systems, solution of linear and nonlinear equations, parametric and algebraic curves, curvature, torsion, Frenet formulas, surfaces, fundamental forms, principal curvatures, Gaussian and mean curvatures, geodesics, approximation, Fourier series and fast Fourier transform, nonlinear optimization, Lagrange multipliers, least squares, surface fitting and calculus of variations. Programming components. Scholarly report required for graduate credit.

COMS 5780: Optimization for Machine Learning

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Advances in optimization theory and algorithms with evolving applications for machine learning. Theoretical foundations at the intersection of optimization and machine learning to conduct advanced research in machine learning and related fields. Emphasis on proof techniques for optimization algorithms in machine learning.

COMS 5790: Natural Language Processing

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to NLP and its connection with other branches of Artificial Intelligence, such as machine learning and knowledge representation. Text analysis including n-gram language models, stemming and lemmatization, part-of-speech (POS) tagging. Topic modeling, summarization, text classification, knowledge extraction, and text reasoning. Applications of deep learning in NLP including question answering, machine reading comprehension, word and sentence embedding. Research project required.

COMS 5810: Computer Systems Architecture

(Cross-listed with CPRE 5810).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Quantitative principles of computer architecture design, instruction set design, processor architecture: pipelining and superscalar design, instruction level parallelism, memory organization: cache and virtual memory systems, multiprocessor architecture, cache coherency, interconnection networks and message routing, I/O devices and peripherals. CPRE 3810 or equivalent computer architecture or computer organization course required. Note that this implies you have a familiarity with ISAs, basic computer organization, memory systems, digital logic design, basic programming (C and assembly), and command-line Linux. (Typically Offered: Fall)

COMS 5830: Reconfigurable Computing Systems

(Cross-listed with CPRE 5830).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to reconfigurable computing, FPGA technology and architectures, spatial computing architectures such as systolic and bit serial adaptive network architectures, static and dynamic rearrangeable interconnection architectures, processor architectures incorporating reconfigurability.

COMS 5870: Introduction to Network Programming and Cloud Computing
(Dual-listed with COMS 4870).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 3520 or CPRE 3080; graduate standing or permission of instructor

Introduction to network programming: protocols, programming suites, and applications. Introduction to cloud computing: concepts and case study with AWS. Introduction to selected research issues in networking and cloud computing. Graduate credit requires written report and oral presentation.

COMS 5880: Computer Networks

(Dual-listed with COMS 4880).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Fundamental concepts in the design and implementation of computer communication in both wired and wireless networks, their protocols, and applications. Topics include the layered network architecture in the Internet, applications, transport, network, and data link layers and their protocols, Socket API, software-defined networking, and network security. Lectures organized in a top-down approach to cover the layers of network design. (Typically Offered: Fall, Spring)

COMS 5900: Special Topics

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Special Topics in Computer Science.

COMS 5920: Graduate Studies in Computer Science

Credits: 1. Contact Hours: Lecture 1.

Prereq: Graduate classification

Introduction to Graduate program, Graduate Program Policies, Computing Resources, Faculty Research Areas, Reading Computer Science Research Articles, LaTeX, Research Writing and Presentation, Attend Research Colloquia. Offered on a satisfactory-fail basis only.

COMS 5930X: Experiential Learning in Responsible AI

Credits: 1. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Experience interacting with industry, government, or nonprofit organizations to learn AI/data science techniques in real-world settings. Explore risks to the trustworthiness of data science lifecycles in practice. (Typically Offered: Fall, Spring)

COMS 5980: Graduate Internship

Credits: Required. Repeatable.

Prereq: Graduate classification

Supervised internship working in professional settings appropriate to the student's degree program. Academic work under faculty supervision. Offered on a satisfactory-fail basis only.

COMS 5990: Creative Component

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Creative component for nonthesis option of Master of Science degree. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

Courses for graduate students:

COMS 6100: Seminar

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

Prereq: Instructor Permission for Course

Seminar in Computer Science. Offered on a satisfactory-fail basis only.

COMS 6110: Advanced Topics in Algorithms

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Advanced algorithm analysis and design techniques. Topics include, but are not limited to, graph algorithms, geometric algorithms, approximation algorithms, fixed-parameter algorithms, randomized algorithms and advanced data structures. Content varies by semester.

COMS 6120: Distributed Algorithms

Credits: 3. Contact Hours: Lecture 3.

The theory of distributed computation. Algorithms, lower bounds and impossibility results. Fundamental problems including consensus, leader election, mutual exclusion and clock synchronization. Synchronous, asynchronous and partially synchronous distributed systems models. Shared memory and message passing systems. Fault-tolerance and randomization. Wait-free object simulations. Distributed shared memory. Special topics vary from year to year.

COMS 6250: Advanced Topics in High Performance Computing

Credits: 3. Contact Hours: Lecture 3.

Parallel solutions of numerical and non-numerical problems, implementation of parallel programs on parallel machines, performance and other computational issues in parallel programming.

COMS 6260: Parallel Algorithms for Scientific Applications

(Cross-listed with CPRE 6260).

Credits: 3. Contact Hours: Lecture 3.

Algorithm design for high-performance computing. Parallel algorithms for multidimensional tree data structures, space-filling curves, random number generation, graph partitioning and load balancing. Applications to grid and particle-based methods and computational biology.

COMS 6310: Advanced Topics in Computational Complexity

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Advanced study in the quantitative theory of computation. Time and space complexity of algorithmic problems. The structure of P, NP, PH, PSPACE, and other complexity classes, especially with respect to resource-bounded reducibilities and complete problems. Complexity relative to auxiliary information, including oracle computation and relativized classes, randomized algorithms, advice machines, Boolean circuits. Kolmogorov complexity and randomness. Novel models of computation emerging in a rapidly changing field.

COMS 6330: Advanced Topics in Computational Randomness

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Classification or Permission of Instructor

Advanced study of the role of randomness in computation. Randomized algorithms, derandomization, and probabilistic complexity classes. Kolmogorov complexity, algorithmic information theory, and algorithmic randomness. Applications chosen from cryptography, interactive proof systems, computational learning, lower bound arguments, mathematical logic, and the organization of complex systems. Novel models of computation emerging in a rapidly changing field.

COMS 6340: Theory of Games, Knowledge and Uncertainty

Credits: 3. Contact Hours: Lecture 3.

Fundamentals of Game Theory: individual decision making, strategic and extensive games, mixed strategies, backward induction, Nash and other equilibrium concepts. Discussion of Auctions and Bargaining. Repeated, Bayesian and evolutionary games. Interactive Epistemology: reasoning about knowledge in multiagent environment, properties of knowledge, agreements, and common knowledge. Reasoning about and representing uncertainty, probabilities, and beliefs. Uncertainty in multiagent environments. Aspects and applications of game theory, knowledge, and uncertainty in other areas, especially Artificial Intelligence and Economics, will be discussed.

COMS 6410: Advanced Topics in Programming Language Semantics

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Operational and other mathematical models of programming language semantics. Type systems and their soundness. Applications of semantics on areas such as program correctness, language design or translation.

COMS 6490: Advanced Topics in Computational Biology

(Cross-listed with CPRE 6490).

Credits: 3. Contact Hours: Lecture 3.

Design and analysis of algorithms for applications in computational biology, pairwise and multiple sequence alignments, approximation algorithms, string algorithms including in-depth coverage of suffix trees, semi-numerical string algorithms, algorithms for selected problems in fragment assembly, phylogenetic trees and protein folding. No background in biology is assumed. Also useful as an advanced algorithms course in string processing.

COMS 6520: Advanced Topics in Distributed Systems

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: COMS 5520

Selected topics in the research of distributed systems, including but not limited to blockchain, cloud computing, cyber-physical systems, distributed learning, edge computing, Internet of things, mobile computing, as well as fairness, privacy, reliability and security in the systems.

COMS 6560: Advanced Topics in Verification

Credits: 3. Contact Hours: Lecture 3.

Advanced formal methods to specify and study correctness and timing properties of complex systems and software, with a particular focus on concurrent and distributed behavior. Topics include: Petri nets and related formalisms to describe discrete-state systems; decision diagram algorithms for state-space and reachability graph generation, symbolic model checking, and timing analysis; Markov models for exact and approximate probabilistic verification.

COMS 6570: Advanced Topics in Computer Graphics

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 2 times.

Modern lighting models: Rendering Equation, Spherical Harmonics, Lafortune, Cook-Torrance. Non-polygonal primitives: volumes, points, particles. Textures: filtering, reflections creation. Graphics hardware: pipeline, performance issues, programmability in vertex and fragment path. Per-pixel lighting. Nonphotorealistic rendering. Radiosity; Ray tracing.

COMS 6610: Advanced Topics in Database Systems

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Advanced topics chosen from the following: database design, data models, query systems, query optimization, incomplete information, logic and databases, multimedia databases; temporal, spatial and belief databases, semistructured data, concurrency control, parallel and distributed databases, information retrieval, data warehouses, wrappers, mediators, and data mining.

COMS 6650A: Advanced Topics in Software Engineering: Foundations

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: COMS 5110

Advanced topics on theoretical and technical foundations in Software Engineering. Content varies by semester. Graduation Restriction: Maximum 6 credits of COMS 6650 may apply toward graduation. Offered irregularly. (Typically Offered: Fall, Spring)

COMS 6650B: Advanced Topics in Software Engineering: Empirical

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Advanced topics on empirical studies on human factors and other software engineering topics. Content varies by semester. (Typically Offered: Fall, Spring, Summer)

COMS 6710X: Responsible AI: Advanced Topics in Risk Management in Data Driven Discovery

Credits: 3. Contact Hours: Lecture 3.

Selected topics in risk assessment and mitigation mechanisms on machine learning/data science lifecycles. Case studies of machine learning/data science lifecycles in application domains, along with risk assessment and mitigation methods. Content varies by semester. (Typically Offered: Spring)

COMS 6720: Advanced Topics in Artificial Intelligence

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Selected topics in probabilistic graphical models, causal inference, semantic web, information retrieval, natural language processing, knowledge representation and reasoning, deep learning, embedding, distributed learning, incremental learning, multi-task learning, multi-strategy learning, multi-relational learning, modeling the internet and the web, automated scientific discovery, neural and cognitive modeling. Advanced applications of artificial intelligence in bioinformatics, distributed systems, natural language, multimedia data, decision making, robotics, and more.

COMS 6730: Advanced Topics in Machine Learning

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: COMS 4720 or COMS 5720 or COMS 5730 or COMS 4740 or COMS 5740

Advanced topics in machine learning. Selected topics in computational learning theory, Bayesian and information theoretic models (ML, MAP, MDL, MML), probabilistic graphical models, statistical relational learning, reinforcement learning, and deep learning.

COMS 6760X: Advanced Topics in Autonomous Systems and Robotics

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 5720 or Permission of Instructor

Theoretical and practical issues in the design and analysis of autonomous and robotic systems, including self-driving cars. Topics include object detection, perception, mapping, localization, prediction, planning, decision-making, control, learning, kinematics and dynamics, specification, and model-based design and verification.

COMS 6810: Advanced Topics in Computer Architecture

(Cross-listed with CPRE 6810).

Credits: 3. Contact Hours: Lecture 3.

Current topics in computer architecture design and implementation. Advanced pipelining, cache and memory design techniques. Interaction of algorithms with architecture models and implementations. Tradeoffs in architecture models and implementations. Offered odd-numbered years. (Typically Offered: Spring)

COMS 6880AX: Advanced Topics in Computer Networks: Foundations

Credits: 3. Contact Hours: Lecture 3.

Theoretical aspects of computer networks. Topics include cross-layer congestion control, routing, and scheduling optimization for wireless networks, distributed network optimization algorithms, and networking for big data. (Typically Offered: Fall, Spring)

COMS 6880BX: Advanced Topics in Computer Networks: Systems

Credits: 3. Contact Hours: Lecture 3.

Topics can include Internet architecture, inter-domain routing, Internet topology, passive and active Internet measurements, and Internet data analysis. (Typically Offered: Fall, Spring)

COMS 6880CX: Advanced Topics in Computer Networks: Security/Privacy

Credits: 3. Contact Hours: Lecture 3.

Advanced topics in network security and privacy. Topics can include security and privacy issues in cloud data center networks, wireless networks, vehicular networks, sustainable sensor networks, and the Internet of Things (IoT) systems, dark web, The Onion Router (TOR), cybersecurity, criminal hackers, and virtual currency. (Typically Offered: Fall, Spring)

COMS 6990: Research

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Research. Offered on a satisfactory-fail basis only.

Construction Engineering (CONE)

Courses primarily for undergraduates:

CONE 1100: Leadership and Professionalism in Construction and Design

Credits: Required. Contact Hours: Lecture 1.

Prereq: Instructor Permission for Course

Orientation to the design and construction industry. Emphasis on teambuilding and professionalism, including teamwork, communication, career opportunities, leadership, and interacting with engineers in other disciplines. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

CONE 1210: Cornerstone Learning Community: Orientation to Academic Life

Credits: 1. Contact Hours: Laboratory 2.

Integration of first-year and transfer students into the engineering profession and the Construction Engineering program. Assignments and activities completed both individually and in learning teams involving teamwork, academic preparation, and study skills. Introduction to construction industry professionals. Teamwork topics include interdisciplinary teamwork, skills for academic success, diversity issues and leadership. Introduction to organization of program, department, college, and university. Overview of faculty, staff, policies, procedures and resources. (Typically Offered: Fall)

CONE 1220: Cornerstone Learning Community: Orientation to Professional Life

Credits: 1. Contact Hours: Laboratory 2.

Continuation of CONE 1210. Integration of first year and transfer students into the engineering profession. Career preparation, professional ethics, construction research, leadership. Introduction to construction industry professionals including how they interact with engineers in other disciplines. Continued introduction to program, department, college, and university organization. Overview of faculty, staff, policies, procedures and resources. (Typically Offered: Spring)

CONE 2220: Contractor Organization and Management of Construction

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Credit or concurrent enrollment in (CHEM 1670 or CHEM 1770); Credit or concurrent enrollment (ABE 1600 or AERE 1600 or BME 1600 or CE 1600 or CHE 1600 or CPRE 1850 or EE 1850 or ENGR 1600 or IE 1480 or ME 1600 or SE 1850); Credit or concurrent enrollment ENGL 1500; Credit or concurrent enrollment ENGR 1010; Credit or concurrent enrollment LIB 1600; Credit or concurrent enrollment MATH 1650 or MATH 1650H; Credit or concurrent enrollment MATH 1660 or MATH 1660H; Credit or concurrent enrollment PHYS 2310 or PHYS 2310H; Credit or concurrent enrollment PHYS 2310L

Entry level course for construction engineering: integration of significant engineering and management issues related to construction company operations. Company organization and operations; construction and project administration; construction contracts; project delivery systems; quality management; construction safety; contract and project documents. (Typically Offered: Fall, Spring)

CONE 2410: Construction Materials and Methods

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Engineering Basic Program Courses

Introduction to materials and methods of building construction and to construction drawings. Foundation, structural framing, floor, roof, and wall systems. Blueprint reading and quantity takeoff techniques. (Typically Offered: Fall, Spring)

CONE 2510: Mechanical/Electrical Materials and Methods

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Credit or enrollment in CONE 2410

Introduction to the materials and methods for mechanical and electrical construction systems and drawings. HVAC, water and waste water, power distribution, lighting, and fire protection. Blueprint reading and quantity takeoff. (Typically Offered: Fall, Spring)

CONE 3220: Construction Equipment and Heavy Construction Methods

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: CONE 2410; (CONE 2220 or CE 3060)

Selection and acquisition of construction equipment. Application of engineering fundamentals and economics to performance characteristics and production of equipment. Heavy construction methods and economic applications. (Typically Offered: Fall)

CONE 3400: Concrete and Steel Construction

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: EM 3240 and CONE 2220 or CE 3060

Planning and field engineering for concrete and steel construction. Design and applications of concrete formwork to construction. Erection of structural steel. Emerging industry themes. (Typically Offered: Fall, Spring)

CONE 3520: Mechanical Systems in Buildings

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: CONE 2220; CONE 2510; PHYS 2320; PHYS 2320L

Comprehensive coverage of mechanical systems, plumbing, fire protection. Analysis techniques and design principles for each system. Required comprehensive design project for a major building project. (Typically Offered: Fall, Spring)

CONE 3530: Electrical Systems in Buildings

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Credit or concurrent enrollment in CONE 3520; PHYS 2320 or PHYS 2320H; PHYS 2320L

Comprehensive coverage of building electrical systems including power, lighting, fire alarm, security and communications. Analysis techniques and design principles for each system. Required comprehensive design project for a major building project. (Typically Offered: Fall, Spring)

CONE 3540: Building Energy Performance

Credits: 3. Contact Hours: Lecture 3.

Prereq: CONE 3520 or Permission of Department

Energy performance of buildings, building shells, HVAC, electrical and other building systems. Analysis and evaluation of building performance, energy efficiency, environmental quality, first costs, and operating costs. Strategies to exceed energy code requirements through the ASHRAE Standard 90.1. (Typically Offered: Fall)

CONE 3800: Engineering Law

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior classification

Introduction to law and judicial procedure as they relate to the practicing engineer. Contracts, professional liability, professional ethics, licensing, bidding procedures, intellectual property, products liability, risk analysis. Emphasis on development of critical thinking process, abstract problem analysis and evaluation. (Typically Offered: Fall)

CONE 3810A: Bidding Construction Projects I: Heavy and Highway

Credits: 1. Contact Hours: Lecture 1.

Prereq: Instructor Permission for Course

Team development of construction process designs and cost estimates for transportation construction projects under closely simulated conditions. Examine project sites, consult with construction industry mentors, obtain subcontractor and supplier quotations, and submit bids. (Typically Offered: Fall)

CONE 4220: Construction Cost Estimating and Cost Engineering

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: CONE 2410 and CONE 2510

Conceptual and detailed cost estimating. Theory and practice of estimating construction costs of materials, labor, equipment, contingency, overhead and markup. Estimating competencies and bid ethics. Electronic quantity take off and pricing methods. Assemblies costs, unit costs, production rates. Analysis of project profitability, cost analysis and cost control methods. Value engineering. Life cycle cost analysis. (Typically Offered: Fall, Spring)

CONE 4410: Construction Planning, Scheduling, and Control

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Credit or enrollment in CONE 4220

Integration of previous construction coursework into the planning, scheduling, and management of time, costs, and other resources. Emphasis on preparation and analysis of network schedules. Comprehensive planning and scheduling project. Computer project management applications. (Typically Offered: Fall, Spring)

CONE 4810A: Bidding Construction Projects II: Heavy and Highway

Credits: 1. Contact Hours: Laboratory 2.

Prereq: Instructor Permission for Course

Similar to CONE 3810, except students with previous experience attempt projects with larger scope or lead students with less experience. (Typically Offered: Fall)

CONE 4870: Construction Engineering Design I

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: CONE 3400; CONE 3520; CONE 3530; CONE 4220; CONE 4410; Senior classification

The integrated delivery of project services as a team, including preliminary engineering design process, constructability review, interaction with the client, identification of engineering problems, developments of a proposal, identification of design criteria, cost estimating, planning and scheduling, application of codes and standards, development of feasible alternatives, selection of best alternative, and delivery of oral presentations. (Typically Offered: Fall, Spring)

CONE 4880: Construction Engineering Design II

Credits: 3.

Prereq: CONE 3400; CONE 3520; CONE 3530; CONE 4220; CONE 4410; within two semesters of graduation

Application of team design concepts to a construction engineering project. Project planning. Advanced construction and project management. (Typically Offered: Fall, Spring)

CONE 4900: Independent Study

Credits: 1-3. Repeatable.

Prereq: Department Permission for Course

Individual study in any phase of construction engineering. Pre-enrollment contract required. (Typically Offered: Fall, Spring, Summer)

Criminal Justice (CJ)

Courses primarily for undergraduates:

CJ 1200: The Criminal Justice League Learning Community Seminar

Credits: 1. Contact Hours: Lecture 1.

Orientation to academic program requirements, career awareness, strategies for successful transition to college. Topics include: University and LAS College requirements and procedures; occupational tracks and career options open to criminal justice; and introduction to career planning. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

CJ 1210: The Criminal Justice League Learning Community Seminar II

Credits: 1. Contact Hours: Lecture 1.

Foundations for student success in the criminal justice major. Students will examine current issues in crime and criminal justice and build career awareness and planning skills through guest speakers and field trips. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

CJ 2200: Introduction to Forensic Science

(Cross-listed with ENT 2200).

Credits: 3. Contact Hours: Lecture 3.

Study of fundamental forensic science techniques and procedures covering types of physical, chemical, and biological evidence and how this information is used in the legal system. Assessment of crime scenes and various forensic specialties will be introduced. (Typically Offered: Spring)

CJ 2400: Introduction to the U.S. Criminal Justice System

Credits: 3. Contact Hours: Lecture 3.

Provides systematic overview of law, police organization and behavior, prosecution and defense, sentencing, the judiciary, community corrections, penology, and capital punishment. The course demonstrates the role of discretion in all of these agencies as well as the sociological influences of age, race, gender, and social class on criminal justice system processes. (Typically Offered: Fall)

CJ 2410: Youth and Crime

(Cross-listed with SOC 2410).

Credits: 3. Contact Hours: Lecture 3.

An examination of delinquency that focuses on the relationship between youth as victims and as offenders, social and etiological features of delinquency, the role of the criminal justice system, delinquents' rights, and traditional and alternative ways of dealing with juvenile crime. (Typically Offered: Fall)

CJ 2420: Criminology

Credits: 3. Contact Hours: Lecture 3.

The nature of crime and criminology; the concept of crime; statistics and theories of criminality; major forms of crime; official responses to crime and control of crime. (Typically Offered: Fall)

CJ 3150X: Crime Victims and Victimization

Credits: 3. Contact Hours: Lecture 3.

Examination of the characteristics of victims of crime, victim-offender relationships, the interactions between victims and the criminal justice system, as well as the physical, emotional, and financial harm individuals suffer at the hands of offenders. In exploring these dynamics and connections, this course will address the theory, history, research, legislation, and policy implications related to victimization.

CJ 3200: American Judicial Process

(Cross-listed with POLS 3200).

Credits: 3. Contact Hours: Lecture 3.

An overview of the American judicial process. Emphasis on specific topics such as application of constitutional rights to the states (particularly the Fourth, Fifth, Sixth, and Fourteenth Amendments), mechanics of judicial opinions, constitutional philosophies of Supreme Court Justices, decisions of first impression, and the value and scope of precedent. (Typically Offered: Spring)

CJ 3250: Religion, Law, and Justice

(Cross-listed with RELIG 3250/ POLS 3250).

Credits: 3. Contact Hours: Lecture 3.

A study of the role of religion in law and justice with a focus on the United States. Examines the history of religious freedom, key contemporary legal cases, and how religious-oriented justice movements engage ethics and the law. (Typically Offered: Fall)

CJ 3320: Philosophy of Law

(Cross-listed with PHIL 3320).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 3 credits in PHIL or Permission of Instructor

Extent of our obligation to obey the law; what constitutes just punishment; how much of the immoral should be made illegal? Relation of these questions to major theories of law and the state. Discussion of such concepts as coercion, equality, and responsibility. (Typically Offered: Fall, Spring)

CJ 3330: Latinos/as/x in the Criminal Justice Complex

(Cross-listed with USLS 3330).

Credits: 3. Contact Hours: Lecture 3.

Intersections of ethnicity, culture, assimilation, immigration/migration, crime, and the criminal justice system in the United States. Topics include: criminality among Latinos/as and the challenges they face within the CJ complex (cops, courts, corrections, as well as immigration and border control) situated within mass incarceration; the use of criminalization as a form of social control; and Latino/as' human and civil rights and the role that race, ethnicity, gender, class, and immigration status play in the criminal justice system and border control enforcement. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall)

CJ 3350: Race, Ethnicity, and the US Criminal Justice System

(Cross-listed with AFAM 3350).

Credits: 3. Contact Hours: Lecture 2, Discussion 1.

Empirical and theoretical readings on the intersection of race, ethnicity, crime, and the criminal justice system in contemporary society. Topics include, but are not limited to racial and ethnic relations in society, media, violence, policing, and disparity and discrimination in crime and punishment. Criminological theories of racial and ethnic antagonism. Meets U.S. Cultures and Communities Requirement.

CJ 3390: Liberty and Law in America

(Cross-listed with POLS 3390/ PHIL 3390).

Credits: 3. Contact Hours: Lecture 3.

Competing conceptions of liberty in American political thought. Debates about how liberty should be protected by the law, in fields such as health care, drugs, property, speech, religion, and sex. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall, Spring)

CJ 3400: Deviant and Criminal Behavior

(Cross-listed with SOC 3400).

Credits: 3. Contact Hours: Lecture 3.

Theory and research on the etiology of types of social deviance; issues relating to crime, antisocial behavior and social policies designed to control deviant behavior. (Typically Offered: Spring, Summer)

CJ 3510: Police and Society

Credits: 3. Contact Hours: Lecture 3.

Introduction and overview of law enforcement in the United States. Theory and research on police history, function, and organization; constitutional issues of policing; and critical topics, such as community policing, officer discretion and decision-making, corruption, use of force, and racial profiling. The course illustrates the interconnections between communities, police organizations, citizens, and criminal offenders. (Typically Offered: Fall, Spring)

CJ 3520: Punishment, Corrections, and Society

Credits: 3. Contact Hours: Lecture 3.

Introduction and overview of corrections in the United States. Theory and research on probation, parole, intermediate sanctions, prison, inmate society, inmate behavior and misconduct, capital punishment, recidivism, correctional treatment, rehabilitation, and offender reintegration into society. (Typically Offered: Fall, Spring)

CJ 3540: Prevention of Crime and Delinquency

Credits: 3. Contact Hours: Lecture 3.

Introduction to various efforts to prevent crime and juvenile delinquency, as well as the reduction of specific risk factors for both. Theories that provide the baseline for various approaches to prevention, as well as the development, operation and effectiveness of prevention efforts centered in various social institutions such as the family, schools, neighborhoods/communities, religion and the media. Examine programs originating from within the traditional criminal justice institutions of the police, courts, and correctional systems. (Typically Offered: Spring)

CJ 3600: Latinas and Victimization

(Cross-listed with USLS 3600).

Credits: 3. Contact Hours: Lecture 3.

Intersections of race/ethnicity, class, gender, culture, acculturation, and immigration/migration in the victimization experiences of Latina women interacting with criminal justice systems and services. Topics include: domestic/intimate partner violence, sexual assault, human trafficking among Hispanic, Latina, and Chicana women, and the impact of language barriers, abuser threats of deportation, social and institutional discrimination and racism, cultural norms, and cultural insensitivity among first responders and service providers on help-seeking, well-being, and interactions with the criminal justice system. Meets U.S. Cultures and Communities Requirement.

CJ 4020: White-Collar Crime

Credits: 3. Contact Hours: Lecture 3.

Introduction and overview of white-collar crime as a form of deviance. Theory and research on occupational, corporate, and organizational offending; prevalence, costs, and consequences of white-collar crime; predictors and correlates of white-collar crime; and political, business, and public policy responses to white-collar crime. (Typically Offered: Spring)

CJ 4030: Criminal Offenders

Credits: 3. Contact Hours: Lecture 3.

Introduction and overview of criminal offenders. Theory and research on epidemiology, offender typologies, etiology of violence, recidivism, societal costs, correctional supervision, treatment, and prevention of serious antisocial behavior. (Typically Offered: Fall, Spring)

CJ 4040: Criminal Justice Policies

(Dual-listed with CJ 5040).

Credits: 3. Contact Hours: Lecture 3.

Development, implementation and evaluation of criminal justice policies affecting major areas of the criminal justice system. History, development and operation of the criminal justice system, including policing, courts/sentencing, corrections, crime prevention, and offender rehabilitation. (Typically Offered: Spring)

CJ 4050: Drugs and Crime

Credits: 3. Contact Hours: Lecture 3.

Prereq: CJ 2400

Analysis of the drug problem, including issues arising from the use and abuse of legal and illegal drugs and their relation to crime and the criminal justice system. Examination of issues related to effective prevention and treatment, crime, and the debates over the most effective policies for the control or prevention of drug abuse. Offered irregularly. (Typically Offered: Fall, Spring)

CJ 4060: Gender and Crime

Credits: 3. Contact Hours: Lecture 3.

Overview of the relationship between gender and crime. Examination of gender and gender roles definitions; how gender impacts criminal behavior in terms of offending, victimization, criminal justice processing, and working in the criminal justice system; and theories used to understand the gender gap in offending.

CJ 4100: Capital Punishment

Credits: 3. Contact Hours: Lecture 3.

Prereq: CJ 2400

History, philosophy, demographics, administration, and punishment rationales of capital punishment in the United States from its founding to the present. Methods of execution and trends in public opinion about the death penalty. Examination of correlates of capital offending and criminological characteristics of persons who are sentenced to death.

CJ 4510: Contemporary Issues in Policing

Credits: 3. Contact Hours: Lecture 3.

Introduction to contemporary issues in policing in the United States. Topics include: the media/law enforcement relationship, cultural competence for police, use of technology, and career foundations for hiring and advancement. Scenario-based learning in individual and group settings will help students to grasp the challenges next generation leaders will face in policing. (Typically Offered: Fall)

CJ 4600: Criminal and Juvenile Justice Internship

(Cross-listed with SOC 4600).

Credits: 3-9. Repeatable, maximum of 9 credits.

Prereq: Junior or Senior classification; major or minor in Criminal Justice or Sociology

Study of the criminal and juvenile justice systems and social control processes. Supervised placement in a police department, prosecutor's office, court, probation and parole department, penitentiary, juvenile correctional institution, community-based rehabilitation program, or related agency. Assessed service-learning component. Graduation Restriction: No more than a total of 9 credits of 4600 can be counted toward graduation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

CJ 4700: Ethical Issues in Criminal Justice

(Dual-listed with CJ 5700).

Credits: 3. Contact Hours: Lecture 3.

Ethical issues and considerations in policing, the practice of law, sentencing, corrections, criminal justice research, and crime control policy. Decision-making by criminal justice professionals in an environment of competing interest. Policy and legal issues confronting the American criminal justice system from an ethical perspective. Emphasis on moral and ethical issues in the criminal justice process. (Typically Offered: Spring)

CJ 4840: Topical Studies in Criminal and Juvenile Justice

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Thematic or topical issues and studies dealing with the sociology of police, judiciary, institutional and community-based corrections, gender/ethnicity and crime/delinquency, criminal and delinquent gangs, and crime and delinquency prevention.

Courses primarily for graduate students, open to qualified undergraduates:

CJ 5040X: Criminal Justice Policies

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Development, implementation and evaluation of criminal justice policies affecting major areas of the criminal justice system. History, development and operation of the criminal justice system, including policing, courts/sentencing, corrections, crime prevention, and offender rehabilitation. (Typically Offered: Fall, Spring)

CJ 5700: Ethical Issues in Criminal Justice

(Dual-listed with CJ 4700).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Ethical issues and considerations in policing, the practice of law, sentencing, corrections, criminal justice research, and crime control policy. Decision-making by criminal justice professionals in an environment of competing interest. Policy and legal issues confronting the American criminal justice system from an ethical perspective. Emphasis on moral and ethical issues in the criminal justice process. (Typically Offered: Spring, Summer)

CJ 5840: Current Issues in Crime and Justice

(Cross-listed with SOC 5840).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 3 credits.

Prereq: Graduate Standing or Permission of Instructor

Discussion of current research and theory in crime and delinquency; topics include the purpose and role of law in social life; emerging theoretical directions in criminology; recent work on specific forms of criminality; controversies in the criminal justice system. Offered odd-numbered years. (Typically Offered: Fall)

Cyber Security (CYBSC)

Courses primarily for undergraduates:

CYBSC 1310: Introduction to Computer Security Literacy

(Cross-listed with CPRE 1310).

Credits: 1. Contact Hours: Lecture 1.

Basic concepts of practical computer and Internet security: passwords, firewalls, antivirus software, malware, social networking, surfing the Internet, phishing, and wireless networks. This class is intended for students with little or no background in information technology or security. Basic knowledge of word processing required. Offered on a satisfactory-fail basis only.

CYBSC 3320: Cyber Defense Competition

(Cross-listed with CPRE 3320).

Credits: 1. Contact Hours: Laboratory 2.

Repeatable.

Participation in cyber defense competition driven by scenario-based network design. Includes computer system setup, risk assessment and implementation of security systems, as well as defense of computer and network systems against trained attackers. Team based. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

CYBSC 3700: Fundamentals of Network Security

Credits: 2. Contact Hours: Lecture 3.

Fundamentals of network security, including common network protocols, potential security risks, and countermeasures. Network routing and its impact on security.

CYBSC 3710: Adversarial Thinking

Credits: 2. Contact Hours: Lecture 2.

Mindset and tactics of cyber adversaries. Anticipating and countering cybersecurity threats. Analyzing and predicting the strategies of cyber adversaries, including understanding their motives, methods, and techniques to evade detection. Multi-week team project where students will assume the role of attackers and plan an attack against a fictitious target.

CYBSC 3720: Fundamentals of Data Security and Privacy

Credits: 2. Contact Hours: Lecture 2.

Introduction and application of basic mechanisms for protecting data. Security issues related to safeguarding sensitive personal and corporate information against inadvertent disclosure. Real-world effects of data breaches on individuals and businesses and the balancing of interests among individuals, government, and enterprises. Emerging technologies that may affect security and privacy concerns. Issues related to developing enterprise data security programs, policies, and procedures that consider the requirements of all relevant constituencies, e.g., technical, business, and legal.

CYBSC 4300: Network Protocols and Security

(Dual-listed with CPRE 5300/ CYBSC 5300). (Cross-listed with CPRE 4300).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (CPRE 3080 or COMS 2520 or COMS 3520) OR CPRE 2880

Detailed examination of networking standards, protocols, and their implementation. TCP/IP protocol suite, network application protocols. Network security issues, attack and mitigation techniques. Emphasis on laboratory experiments.

CYBSC 4600: Application of Security Literacy

Credits: 1. Contact Hours: Lecture 1.

Prereq: ENGL 3140 or ENGL 3140H

Training of teaching of basic cybersecurity concepts and running effective security awareness campaigns. Communication strategies, collaboration with departments such as HR, and promoting a security culture within organizations. Preparation to become advocates for security awareness in professional settings.

CYBSC 4610: Cyber Exercise Design

Credits: 1. Contact Hours: Lecture 1.

Prereq: ENGL 3140 or ENGL 3140H

Introduction to designing and facilitating cybersecurity exercises, including tabletop exercises and livesimulations. Creation of tabletop exercises and live simulations that enhance cybersecurity awareness, preparedness, and response capabilities. Scenario planning, facilitation skills, post-exercise evaluation, adaptation for various roles, and evaluation using federal guidelines.

CYBSC 4700: Threat Hunting and Intelligence

Credits: 2. Contact Hours: Lecture 2.

Prereq: CYBSC 3710 and CYBSC 3720 and CYBSC 4300

Tools and methods for threat hunting and intelligence gathering to strengthen organizational defense. Techniques for identifying and mitigating cyber threats, utilizing various security tools and intelligence sources.

CYBSC 4710: Digital Forensics and Incident Response

Credits: 2. Contact Hours: Lecture 2.

Prereq: CYBSC 3710 and CYBSC 3720 and CYBSC 4300

Fundamentals of digital forensics and incident response, including evidence collection, analysis, and response planning techniques. Preparation to handle security incidents effectively, covering forensic analysis techniques, evidence collection and handling, response planning, and incident response policy development.

CYBSC 4720: Applications of Cryptography

Credits: 2. Contact Hours: Lecture 2.

Prereq: CYBSC 3710 and CYBSC 3720 and CYBSC 4300

Cryptographic methods for information security, privacy assurance, and authenticity verification. Encryption techniques, cryptographic protocols, secure key management, and digital signatures, emphasizing practical applications in cybersecurity.

CYBSC 4730: Fundamentals of Operating Systems Security

Credits: 2. Contact Hours: Lecture 2.

Prereq: CYBSC 3710 and CYBSC 3720

Introduction of security principles for operating systems, focusing on securing Windows and Linux environments. Access control, privilege management, file system security, memory management, and system hardening techniques to protect against vulnerabilities. Exploring vulnerabilities in operating systems, analysis of security features, and defensive strategies for enhancing OS security.

CYBSC 4740: Fundamentals of Cloud Security

Credits: 2. Contact Hours: Lecture 2.

Prereq: CYBSC 3710 and CYBSC 3720

Introduction to cloud security concepts, architectural principles, secure cloud design, and best practices for cloud service providers and users. Cloud security principles, including secure design, data protection, identity management, and regulatory compliance. Protecting cloud environments from unique cybersecurity threats.

CYBSC 4750: Fundamentals of Software Security

Credits: 2. Contact Hours: Lecture 2.

Prereq: CYBSC 3710 and CYBSC 3720

Overview of secure software development, common vulnerabilities, secure coding practices, and testing methods. Basic secure coding practices, threat modeling, vulnerability assessment, and techniques for mitigating risks such as buffer overflows, injection attacks, and improper input validation.

CYBSC 4760: Fundamentals of Cybersecurity Scripting

Credits: 2. Contact Hours: Lecture 2.

Prereq: CYBSC 3710 and CYBSC 3720

Scripting for cybersecurity tasks, focusing on automation and custom tool development. Basics of scripting languages commonly used in cybersecurity, such as Python and PowerShell. Writing scripts for data parsing, log analysis, and network monitoring, as well as developing custom scripts for security tasks like vulnerability scanning and incident response.

CYBSC 4770: Fundamentals of Cyber Resilience

Credits: 2. Contact Hours: Lecture 2.

Prereq: CYBSC 3710 and CYBSC 3720

Strategies for designing systems that can withstand and recover from cyber-attacks, detection, response, and recovery from cyber-attacks while minimizing impact. Resilience planning, incident response, maintaining operational continuity, and strategies to ensure operational continuity under adverse conditions.

CYBSC 4780: Fundamentals of Cyber-Physical and Critical Infrastructure Security

Credits: 2. Contact Hours: Lecture 2.

Prereq: CYBSC 3710 and CYBSC 3720

Cybersecurity challenges unique to cyber-physical systems and critical infrastructure sectors. Securing cyber-physical systems, critical infrastructure, threat modeling, risk management, and incident response. Emphasizes security challenges in energy, manufacturing, agriculture, and transportation sectors.

CYBSC 4790: Fundamentals of Web Security

Credits: 2. Contact Hours: Lecture 2.

Prereq: CYBSC 3710 and CYBSC 3720

Securing web applications by addressing vulnerabilities such as SQL injection and cross-site scripting. Fundamental principles of web security and secure applications. SQL injection, cross-site scripting (XSS), authentication and session management, and the Open Web Application Security Project (OWASP) Top Ten.

CYBSC 4890: Cybersecurity Capstone

Credits: 3. Contact Hours: Lecture 3.

*Prereq: CYBSC 3710, CYBSC 3720, CYBSC 4300, and 8 additional credits
CYBSC courses*

Culminating capstone experience. Development of a cybersecurity solution, including threat assessment, architecture design, incident response plan, and final plan presentation.

Courses primarily for graduate students, open to qualified undergraduates:

CYBSC 5300: Network Protocols and Security

(Dual-listed with CPRE 4300/ CYBSC 4300). (Cross-listed with CPRE 5300).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Detailed examination of networking standards, protocols, and their implementation. TCP/IP protocol suite, network application protocols. Network security issues, attack and mitigation techniques. Emphasis on laboratory experiments.

CYBSC 5310: Information System Security

(Cross-listed with CPRE 5310).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Computer, software, and data security: basic cryptography, security policies, multilevel security models, attack and protection mechanisms, legal and ethical issues.

CYBSC 5320: Information Warfare

(Cross-listed with CPRE 5320).

Credits: 3. Contact Hours: Lecture 3.

Prereq: CPRE 4300 or 5300

Computer system and network security: implementation, configuration, testing of security software and hardware, network monitoring. Authentication, firewalls, vulnerabilities, exploits, countermeasures. Study and use of attack tools. Ethics in cyber security. Emphasis on laboratory experiments. (Typically Offered: Spring)

CYBSC 5330: Cryptography

(Cross-listed with CPRE 5330/ MATH 5330).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 3010 OR CPRE 310 OR COMS 230

Basic concepts of secure communication, DES and AES, public-key cryptosystems, elliptic curves, hash algorithms, digital signatures, applications. Relevant material on number theory and finite fields. (Typically Offered: Spring)

CYBSC 5340: Legal and Ethical Issues in Cyber Security

(Cross-listed with CPRE 5340/ POLS 5340).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Legal and ethical issues in computer security. State and local codes and regulations. Privacy issues. (Typically Offered: Spring)

CYBSC 5350: Steganography and Digital Image Forensics

(Cross-listed with CPRE 5350/ MATH 5350).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Basic principles of covert communication, steganalysis, and forensic analysis for digital images. Steganographic security and capacity, matrix embedding, blind attacks, image forensic detection and device identification techniques. Related material on coding theory, statistics, image processing, pattern recognition. (Typically Offered: Spring)

CYBSC 5360: Computer and Network Forensics

(Cross-listed with CPRE 5360).

Credits: 3. Contact Hours: Lecture 3.

Prereq: CPRE 4890 OR CPRE 4300 OR CPRE 5300

Fundamentals of computer and network forensics, forensic duplication and analysis, network surveillance, intrusion detection and response, incident response, anonymity and pseudonymity, privacy-protection techniques, cyber law, computer security policies and guidelines, court testimony and report writing, and case studies. Emphasis on hands-on experiments.

CYBSC 5380: Reverse Engineering and Security Testing

(Cross-listed with CPRE 5380).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Techniques and tools for understanding the behavior of software/ hardware systems based on reverse engineering. Flaw hypothesis, black, grey, and white box testing as well as other methods for testing the security of software systems. Discussion of counter-reverse engineering techniques. (Typically Offered: Spring)

CYBSC 5600: Data-Driven Security and Privacy

(Cross-listed with COMS 5600/ CPRE 5600).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Examination of applications of machine learning and big data techniques to various security and privacy problems, as well as secure and privacy-preserving machine learning algorithms. Offered irregularly. (Typically Offered: Spring)

CYBSC 5920: Seminar in Cyber Security

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Projects or seminar in Cyber Security. (Typically Offered: Fall, Spring, Summer)

Courses for graduate students:

CYBSC 6310: Cyber Security Operations Practicum

(Cross-listed with CPRE 6310).

Credits: 3. Contact Hours: Lecture 1.

Repeatable.

Practical experience in cyber operations. Cyber security threat analysis, malware analysis, and intrusion detection management. Cyber security data analysis methods. Pen testing tools and techniques. Weekly threat analysis briefings. Offered on a satisfactory-fail basis only.

CYBSC 6320: Cyber Security Capstone Design

(Cross-listed with CPRE 6320).

Credits: 3. Contact Hours: Lecture 3.

Capstone design course which integrates the security design process. Design of a security policy. Creation of a security plan. Implementation of the security plan. The students will attack each other's secure environments in an effort to defeat the security systems. Students evaluate the security plans and the performance of the plans. Social, political and ethics issues. Student self-evaluation, journaling, final written report.

CYBSC 6340: Current Research Problems in Cyber Security

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Discussion of complex cyber security problems. Students will learn how to apply research techniques, think clearly about these issues, formulate and analyze potential solutions, and communicate their results. Working in small groups under the mentorship of technical clients from government and industry, each student will formulate, carry out, and present original research on complex current cybersecurity problems of interest to the nation. This course will be run in a synchronized distance fashion, coordinating some activities with our partner schools and our technical clients. (Typically Offered: Fall, Spring)

CYBSC 6970: Cyber Security Summer Internship

Credits: Required.

One semester and one summer maximum per academic year professional work period. Offered on a satisfactory-fail basis only.

CYBE 2300: Cyber Security Fundamentals

(Cross-listed with CPRE 2300).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: COMS 2270 or EE 2850 or MIS 2070

Introduction to computer and network infrastructures used to support cyber security. Basic concepts of computer and network configuration used to secure environments. Computer virtualization, network routing and address translation, computer installation and configuration, network monitoring, in a virtual environment. Laboratory experiments and exercises including secure computer and network configuration and management. (Typically Offered: Fall)

CYBE 2310: Cyber Security Concepts and Tools

(Cross-listed with CPRE 2310).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: CPRE 2300 or CYBE 2300

Basic concepts of practical computer and Internet security and the tools used to protect and attack systems and networks. Computer and network security methods including: user authentication, access control, firewalls, intrusion detection, use of vulnerability assessment tools and methods, and penetration testing. Ethics and legal issues in cyber security will also be covered. Laboratory experiments and exercises including evaluating systems for vulnerabilities, understanding potential exploits of the systems, and defenses for the systems. (Typically Offered: Spring)

CYBE 2340: Legal, Professional, and Ethical Issues in Cyber Systems

(Cross-listed with CPRE 2340).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 2270 or EE 2850 or MIS 2070

Emphasizes legal, ethical, and professional issues in cyber systems. Other topics include privacy, government regulation, and compliance as applied to professional practice. Guest lecturer from government and industry, as well as discussions including current legal and ethical issues found in the main stream. (Typically Offered: Spring)

Cyber Security Engineering (CYBE)

Courses primarily for undergraduates:

CYBE 3310: Application of Cryptographic Concepts to Cyber Security

(Cross-listed with CPRE 3310).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: CPRE 2310 or CYBE 2310

Basic cryptographic underpinnings used in modern cyber security encryption suites. Encryption benefits to cyber security and its use in protocols. Topics include cryptographically secure hash functions and pseudorandom numbers, key distribution techniques, secure authentication including single sign on. Detection and prevention of security threats such as covert communication, malicious code, and other security threats in protocols are included. In addition to laboratory experiments and exercises, students complete a project focused on cyber security problem and solution. Graduation Restriction: Only one of CPRE/ CYBE 3310 and CPRE 4310 may count towards graduation. (Typically Offered: Fall, Spring)

CYBE 4360: Digital Forensics

(Cross-listed with CPRE 4360).

Credits: 3. Contact Hours: Lecture 3.

Prereq: CPRE/CYBE 3310

Introduction to forensics techniques used to investigate and analyze compromises in computers, networks, devices, and media. Focus on gathering, analyzing, and reporting on the collected evidence. Emphasis is on hands-on homework which include incident detection, response actions, compromise investigation, data collection, and after action reports.

CYBE 4370: Introduction to Wireless Security

(Cross-listed with CPRE 4370).

Credits: 3. Contact Hours: Lecture 3.

With communication and network services and applications increasingly leveraging wireless media, the importance of information and network security in the wireless domain continues to grow. The challenges of providing secure communication and network services are considerably more difficult in wireless environments than in traditional wired systems (e.g., the Internet), so the focus of the course will be purely wireless covering both networking issues and security aspects of modern wireless environments. Fundamentals of mobile LANs and WANs, ad hoc, sensor networks/internet of things and cloud, mobile IP/TCP, confidentiality, key establishment, authentication, broadcasting, RFIDs, and rogue attacks. Graduation Restriction: Only One Of CPRE 4370 And CPRE 5370 May Count Toward Graduation For Undergraduate Students.

CYBE 4400: Operating System Security

(Cross-listed with CPRE 4400).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 3520 or CPRE 3080

Focus on fundamentals and advanced topics in operating system (OS) security. Design issues, principles, mechanisms, and good practice for design and implementation of secure computer/OS systems. Threat models, vulnerabilities, attacks compromise security, and advanced OS-level techniques for achieving security. Topics include OS security concepts and principles, seminal security in Multics, vulnerabilities in ordinary systems, secure capability systems, information flow control, mandatory access control, security kernels, memory protection, file system, virtual machine systems, hardware/architecture support (e.g., Intel SGX) for OS security, secure microkernel OSes (e.g., seL4, QNX), modern mobile operating systems (e.g., Android and iOS), and security from end-user perspective. Assignments include labs exploring and implementing the technologies in the context of the Linux, Android, and seL4 systems (some involving kernel programming). (Typically Offered: Spring)

Dance (DANCE)

Courses primarily for undergraduates:**DANCE 1200: Modern Dance I**

Credits: 1. Contact Hours: Laboratory 3.

Introduction and practice of basic dance concepts, including preparatory techniques and guided creativity problems. No previous modern dance experience required. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

DANCE 1300: Ballet I

Credits: 1. Contact Hours: Laboratory 3.

Introduction to the basic skills, vocabulary, and tradition of ballet with concentration on control and proper alignment. No previous ballet experience required. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

DANCE 1400: Jazz I

Credits: 1. Contact Hours: Laboratory 3.

Introduction to the modern jazz style with concentration on isolation and syncopation. No previous jazz experience required. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

DANCE 1500: Tap Dance I

Credits: 1. Contact Hours: Laboratory 3.

Instruction and practice in basic tap technique and terminology. No previous tap experience required. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

DANCE 1600: Ballroom Dance I

Credits: 1. Contact Hours: Laboratory 2.

Instruction and practice in foxtrot, waltz, swing, cha cha, rhumba, tango, and selected contemporary dances. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

DANCE 1990: Dance Continuum

Credits: 0.5-2. Contact Hours: Laboratory 30.

Repeatable, maximum of 6 credits.

Advance registration required. Continued instruction and practice in either modern dance, recreational dance, ballet, jazz and/or compositional skills. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

DANCE 2110: Fundamentals and Methods of Social and World Dance

Credits: 1.

Prereq: Physical Education Teacher Education Specialization

Skill enhancement, teaching, progressions with emphasis on world and social dance. Designed for kinesiology and health majors, open to others. (Typically Offered: Spring)

DANCE 2200: Modern Dance Composition

Credits: 2.

Prereq: DANCE 1200 or Permission of Instructor

Theory and practice of the creative skills involved in solo and small group composition. (Typically Offered: Fall)

DANCE 2220: Modern Dance II

Credits: 1. Contact Hours: Laboratory 3.

Prereq: DANCE 1200 or Permission of Instructor

Dance techniques emphasizing strength, balance, endurance, rhythmic activity and extended combinations. (Typically Offered: Fall)

DANCE 2230: Modern Dance III

Credits: 1. Contact Hours: Laboratory 3.

Prereq: DANCE 2220

Continued experience in dance techniques and extended combinations. Emphasis on maturation of skill and artistry. Exposure to a variety of modern dance technical styles. (Typically Offered: Spring)

DANCE 2240: Concert and Theatre Dance

(Cross-listed with THRE 2240).

Credits: 0.5-2. Contact Hours: Laboratory 3.

Repeatable, maximum of 6 credits.

Choreography, rehearsal, and performance in campus dance concerts and/or musical theatre productions. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

DANCE 2320: Ballet II

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Instructor Permission for Course

Technical skills in the classical movement vocabulary. Emphasis on alignment, techniques, sequence development, and performing quality. (Typically Offered: Spring)

DANCE 2330: Ballet III

Credits: 1. Contact Hours: Laboratory 3.

Prereq: DANCE 2320

Concentration on technical proficiency at the intermediate level. Pointe work and partnering opportunities available. (Typically Offered: Fall)

DANCE 2420: Jazz II

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Instructor Permission for Course

Dance concepts within the jazz idiom. Instruction in extended movement sequences and artistic interpretation. (Typically Offered: Spring)

DANCE 2500: Yoga Movement

Credits: 1. Contact Hours: Laboratory 2.

Repeatable.

Mixed-level Hatha Yoga class that emphasizes Iyengar style yoga. Yoga Movement is designed for developing awareness and personal practice with yoga poses and relaxation techniques. Attention will be paid to postural alignment to safely develop strength, endurance, flexibility, balance, and reduce stress. The practice develops awareness and consciousness in the physical body to help unite body and mind. Class will include introduction to other somatic practices, asanas (poses), breathing practices, meditation, yoga philosophy and deep relaxation. (Typically Offered: Fall, Spring)

DANCE 2700: Dance Appreciation

Credits: 3. Contact Hours: Lecture 3.

Introduction to the many forms and functions of dance in world cultures. Develop abilities to distinguish and analyze various dance styles. No dance experience required. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

DANCE 3200: Sound and Movement

Credits: 3. Contact Hours: Laboratory 2, Lecture 2.

Intermediate composition based on the relationship of movement to improvised sounds, rhythmic scores, and the musical works of composers from various periods. (Typically Offered: Spring)

DANCE 3600: History and Philosophy of Dance

Credits: 3. Contact Hours: Lecture 3.

Study of the history of dance from early to modern times with emphasis on the theories and philosophies of contemporary modern dance, dancers, and dance educators. Offered even-numbered years. (Typically Offered: Spring)

DANCE 3700: Advanced Studies in Dance

Credits: 1-3. Repeatable, maximum of 8 credits.

Advance registration required. Designed to meet special interests and talents of students to include both group and independent study in various aspects of dance as a performing art including production, choreography, and performance. (Typically Offered: Fall, Spring)

DANCE 3840: Teaching Children's Dance

Credits: 2.

Content, experiences, and methods of a comprehensive dance program at the elementary school level. Theories and practice in guiding elementary school children in expressive movement experiences. (Typically Offered: Spring)

DANCE 3850: Methods of Teaching Dance

Credits: 2.

Methods and techniques of teaching social and world dance forms. Introduction to teaching educational modern dance. (Typically Offered: Fall)

DANCE 3860: Teaching Dance Technique and Composition

Credits: 2.

Prereq: DANCE 3200

Teaching yoga, body therapies, mindfulness and dance composition to enhance the physical and mental performance of the individual.

DANCE 4900A: Independent Study: Dance

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

Independent study of problems or areas of interest in dance. (Typically Offered: Fall, Spring)

DANCE 4900H: Independent Study in Dance - Honors

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: Permission of Instructor; Membership in the University Honors Program

Independent study of problems or areas of interest in dance for those admitted to the honors program. (Typically Offered: Fall, Spring)

Data Science (DS)

Courses primarily for undergraduates:

DS 1100: Orientation to Data Science

Credits: Required. Contact Hours: Lecture 1.

Introduction to the procedures and policies of Iowa State University and the Data Science program, test-outs, honorary societies, etc. Issues relevant to student adjustment to college life will also be discussed. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

DS 2010: Introduction to Data Science

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Satisfactory math placement test score (ALEKS, 51+)

Data Science concepts and their applications; domain case studies with applications in various fields; overview of data analysis; major components of data analysis pipelines; computing concepts for data science; descriptive data analysis; hands-on data analysis experience; communicating findings to stakeholders, and ethical issues in data science. Placement scores can be found at: <https://math.iastate.edu/academics/undergraduate/aleks/placement/>. (Typically Offered: Fall, Spring)

DS 2020: Data Acquisition and Exploratory Data Analysis

Credits: 3. Contact Hours: Lecture 3.

Prereq: DS 2010

Data acquisition: file structures, web-scraping, database access; ethical aspects of data acquisition; types of data displays; numerical and visual summaries of data; pipelines for data analysis: filtering, transformation, aggregation, visualization and (simple) modeling; good practices of displaying data; data exploration cycle; graphics as tools of data exploration; strategies and techniques for data visualizations; basics of reproducibility and repeatability; web-based interactive applets for visual presentation of data and results. Programming exercises. (Typically Offered: Fall, Spring)

DS 3010: Applied Data Modeling and Predictive Analysis

Credits: 3. Contact Hours: Lecture 3.

Prereq: DS 2020 and STAT 1010, STAT 1040, STAT 1050, STAT 2010, STAT 2260, STAT 2310, STAT 3050, STAT 3220 or STAT 3300

Elements of predictive analysis such as training and test sets; feature extraction; survey of algorithmic machine learning techniques, e.g. decision trees, Naive Bayes, and random forests; survey of data modeling techniques, e.g. linear model and regression analysis; assessment and diagnostics: overfitting, error rates, residual analysis, model assumptions checking; communicating findings to stakeholders in written, oral, verbal and electronic form, and ethical issues in data science. Participation in a multi-disciplinary team project. (Typically Offered: Fall, Spring)

DS 3030: Concepts and Applications of Machine Learning

Credits: 3. Contact Hours: Lecture 3.

Prereq: DS 2020, MATH 2070, MATH 2650, and STAT 3010

Machine learning concepts such as training and test sets; feature extraction; principles of machine learning techniques; regression; pattern recognition methods; unsupervised learning techniques; assessment and diagnostics: overfitting, error rates, residual analysis, model assumptions checking, feature selection; ethical issues in data science; communicating findings to stakeholders in written, oral, visual and electronic form. (Typically Offered: Fall)

DS 3900: Special Topics in Data Science

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

Lecture/seminar on special topics in Data Science. (Typically Offered: Fall, Spring, Summer)

DS 4010: Data Science Capstone

Credits: 3. Contact Hours: Lecture 3.

Prereq: DS 3010 or DS 3030

Students work as individuals and teams to complete the planning, design, and implementation of a significant multi-disciplinary project in data science. Oral and written reports. Offered irregularly. (Typically Offered: Spring)

DS 4220X: Mathematical Principles of Data Science

(Cross-listed with MATH 4220X).

Credits: 3. Contact Hours: Lecture 3.

Mathematical foundations of algorithms in data science. Topics include Riemann-Stieltjes integration, Riesz-Markov theorem, Stone-Weierstrass theorem, Universal Approximation theorem, reproducing kernel Hilbert spaces, Cauchy and Fourier kernels, convergence of clustering algorithms, and topological persistence. (Typically Offered: Spring)

Design (DES)

Courses primarily for undergraduates:

DES 1500: Introduction to Innovation and Design

Credits: 3. Contact Hours: Lecture 3.

Introduction to the concept of human-centered design and its crucial role for innovation, including fundamental concepts that explain the creative process. Builds an understanding of the innovation journey, through design tools and techniques for ideation, data collection, and insights forecasting.

DES 2300: Design Thinking

Credits: 3. Contact Hours: Lecture 3.

Introduction to design thinking processes, toolkits, and mindsets, and its interaction with art, design, and technology. Emphasis on interdisciplinary practices.

DES 2400: Design Innovation Studio

Credits: 3. Contact Hours: Studio 6.

First project-based studio focused on creative problem solving, idea generation, and design principles. Analogue and digital fabrication of mock-ups and sketch models. All majors are encouraged to enroll; no previous design studio training required.

DES 2500: Design Intersections

Credits: 3. Contact Hours: Lecture 3.

Cross disciplinary themes and issues relevant to interdisciplinary design, innovation, and entrepreneurship, such as design activism and agency, design for social change, civic innovation, and creative leadership.

DES 3300: Visual Literacy for Design Critique

Credits: 3. Contact Hours: Lecture 3.

Interpret, analyze, and evaluate visual materials, use images and text effectively to communicate ideas, and understand issues surrounding the creation and use of images and visual media for design critique. Precedent study and critique of sample student design work to understand principles of visual literacy and how to apply them to the presentation of design work. Emphasis on peer-to-peer discussion and in-class participation. Lecture and discussion format. (Typically Offered: Spring)

DES 3400: Design Entrepreneurship Studio

Credits: 3. Contact Hours: Studio 6.

Second project-based studio focused on addressing complex challenges and contemporary societal problems using key entrepreneurship concepts to evaluate design prototypes and minimum viable products. Application of user insights and customer data in design iteration. Expert guest speakers from business and industry to talk about design innovation. Students in all majors encouraged to enroll.

DES 4910: Portfolio and Professional Preparation

Credits: 3.

Discussion of interdisciplinary design practices and career planning. Guidance for interviewing, professional networking, business etiquette, and resume writing. Workshops and lectures.

DES 4950: Design Innovation Launchpad

Credits: 6. Contact Hours: Studio 12.

Prereq: DES 3400

Third project-based studio as applied design lab for a career, enterprise, business, social movement, or campaign. Launching and creating project start-ups in four areas: design research, design management, design leadership, and design entrepreneurship. Advanced practice of design skills, project planning, and new product development.

Design Studies (DSNS)

Courses primarily for undergraduates:

DSNS 1020: Design Studio I

Credits: 4. Contact Hours: Lecture 1, Studio 6.

A foundation design studio exploring two and three-dimensional design. Emphasis on fundamental skills and ideas shared across design disciplines. Creative processes, visual order, materials, and critical thinking are investigated through studio projects. Lectures and discussions cover the topics introduced in studios.

DSNS 1100: Design Exchange Seminar I

Credits: 1. Contact Hours: Studio 2.

Orientation to the College of Design. Introduction to the design disciplines and studio pedagogy. (Typically Offered: Fall)

DSNS 1110: Design Exchange Seminar II

Credits: 1. Contact Hours: Studio 2.

Development and clarification of career and academic plans. (Typically Offered: Spring)

DSNS 1150: Design Collaborative Seminar

Credits: 1. Contact Hours: Lecture 1.

Orientation to the College of Design. Introduction to the design disciplines and studio pedagogy.

DSNS 1310: Drawing I

Credits: 4. Contact Hours: Lecture 1, Studio 6.

An introduction to methods of visual thinking and drawing through studio experiences and lectures. All design fields utilize visual communication and drawing. Focus on the use of drawing as a method for creative problem solving, design development and visual communication. Explore, from observation and imagination, the use of fast sketching and in-depth drawing, using various scales, mediums and processes.

DSNS 1320: Digital Design Literacy

Credits: 1. Contact Hours: Lecture 1.

Prereq: Admission to a College of Design program

Introduction to cross-disciplinary concepts on digital literacy. Covers basic computer fundamentals, addresses file and image handling, illustrates the basic principles of documentation, demonstrates how to effectively present your work, and introduces the basic software necessary for design disciplines. (Typically Offered: Fall, Spring)

DSNS 1450: Diversity in Art

Credits: 1. Contact Hours: Lecture 1.

Repeatable, maximum of 3 credits.

Discussion on issues of diversity and inclusion utilizing the Art on Campus and University's Permanent Collection. Topics include ethnic heritage, family background, religious traditions, and interpersonal relationships, with a significant focus on instilling visual analysis skills. (Typically Offered: Spring)

DSNS 1830: Design in Context

Credits: 3. Contact Hours: Discussion 1, Lecture 2.

Explores designed media, objects, places, spaces, structures, and systems as products of varied and often intersecting contexts. Using historical and contemporary case studies, investigates how cultural, economic, environmental, spatial, social, and temporal contexts, among others, affect design. Explores in particular how design addresses complex and multifaceted problems.

DSNS 2320: Digital Design Communications

Credits: 3. Contact Hours: Lecture 3.

Introductory investigations of various digital design media to develop multi-dimensional problem solving, digital communication skills and perceptual sensitivity. Open to all university majors.

DSNS 3010: Study Abroad Preparation Seminar

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Cultural introduction to host country, introduction to faculty sponsor and program of study, the particulars of traveling and living abroad, and financial and logistical preparations. Guest lectures. Required of all students planning to participate in a College of Design study abroad program for 9 or more credits. Offered on a satisfactory-fail basis only.

DSNS 3020: Design Leadership Seminar

Credits: 2. Contact Hours: Lecture 1, Studio 2.

Repeatable, maximum of 4 credits.

For students serving as peer mentors for the Core Design Program, under faculty supervision. Development of teaching and leadership skills within the context of design education experiences. Offered on a satisfactory-fail basis only.

DSNS 3030: Design Ambassadors

Credits: 1-2. Contact Hours: Lecture 1, Studio 2.

Repeatable, maximum of 4 credits.

Prereq: Instructor Permission for Course

Opportunity to strengthen leadership, communication and presentation skills. Introduction to student development theory. Students participate in collaborative projects focused on prospective design students. Offered on a satisfactory-fail basis only.

DSNS 3040: Global Challenges: Intro to UN Sustainable Development Goals

Credits: 3. Contact Hours: Lecture 3.

The United Nations Sustainable Development Goals - also known as the SDGs or the Global Goals - cover a wide range of sustainability issues; highlighting local, national and international priority areas to end poverty and hunger, improve health and education, make cities more sustainable and combat climate change. Students are empowered & challenged to become self-directed as they explore each issue individually and collectively from a personal, academic, and professional perspective. Meets International Perspectives Requirement.

DSNS 3100: Practical Experience

Credits: Required.

Prereq: Instructor Permission for Course

Independent educational enrichment through practical experience. Students must register for this course prior to commencing each term. Available only to students taking course loads of eleven credits or less. Offered on a satisfactory-fail basis only.

DSNS 3320: Multi-Dimensional Digital Design Communication

Credits: 3. Contact Hours: Lecture 3.

Prereq: ARCH 2300 or ARTGR 2750 or DSNS 2320 or ART 2120

Investigations of interoperable digital-design tools, techniques and methods directed at human scale interactive hybrid design from ideation to visualization, synthesis to analysis, and realization to fabrication.

DSNS 3330: Time-Based Digital Media

Credits: 3. Contact Hours: Lecture 3.

Prereq: ARCH 2300 or ARTGR 2750 or DSNS 2320 or ART 2120

Introduction to various time-based digital media tools to develop basic skills including sequencing, storytelling, animation, sound editing, and video production. (Typically Offered: Spring)

DSNS 3400: Design Entrepreneurship

Credits: 3. Contact Hours: Lecture 3.

Focus on the interconnection between entrepreneurial thinking and applied design practices of innovation. Explores several business management tools, models and frameworks, relating it to the development of design projects. Critical areas for successful growth, open innovation, and entrepreneurial mindset. Designer entrepreneurs are more attuned to the social and meaningful values of their creations, than economic growth for an industrial venture. Social impact, inclusive responsibility, future foresight and change mindset are the key motors of their dive into innovation and creative problem-solving. By developing an attitude towards risk-taking, initiative, uncertainty and creative leaps, the course is substantiated by strategy planning and leadership skill sets that allow students to turn their innovative ideas and conceptual solutions into products (or services or experiences), and to distribute them in a viable market and/or a business venture.

DSNS 3450X: Design Justice

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Introduction to concepts of equity, inclusion, and social justice in relationship to the fields and practices of design. Students examine how art, design, and planning influence institutions capacity to support, educate, liberate, and or oppress those who engage with them. (Typically Offered: Spring)

DSNS 4450: Public Art/Public Space

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior classification

Exploration of the history, precedents, and practice of public art and public space with a focus on developments since 1970 in the United States and abroad. Course includes development of a proposal for a site specific work of art.

DSNS 4460: Interdisciplinary Design Studio

Credits: 4-6. Contact Hours: Studio 12.

Repeatable, maximum of 18 credits.

Prereq: Instructor Permission for Course

Advanced interdisciplinary design projects.

DSNS 4460H: Interdisciplinary Design Studio

Credits: 5-7. Contact Hours: Studio 12.

Repeatable, maximum of 18 credits.

Prereq: Permission of Instructor; Membership in the University Honors Program

Advanced interdisciplinary design projects.

DSNS 4900A: Independent Study: History

Credits: 1-4. Repeatable, maximum of 9 credits.

Prereq: Department Permission for Course

Independent investigation of a topic of special interest to the student.

DSNS 4900B: Independent Study: Technology

Credits: 1-4. Repeatable, maximum of 9 credits.

Prereq: Department Permission for Course

Independent investigation of a topic of special interest to the student.

DSNS 4900C: Independent Study: Communications

Credits: 1-4. Repeatable, maximum of 9 credits.

Prereq: Department Permission for Course

Independent investigation of a topic of special interest to the student.

(Typically Offered: Fall, Spring, Summer)

DSNS 4900D: Independent Study: Design

Credits: 1-4. Repeatable, maximum of 9 credits.

Prereq: Department Permission for Course

Independent investigation of a topic of special interest to the student.

(Typically Offered: Fall, Spring, Summer)

DSNS 4900E: Independent Study: Entrepreneurship

Credits: 1-4. Repeatable, maximum of 9 credits.

Prereq: Department Permission for Course

Independent investigation of a topic of special interest to the student.

(Typically Offered: Fall, Spring, Summer)

DSNS 4900F: Independent Study: Social/Behavioral

Credits: 1-4. Repeatable, maximum of 9 credits.

Prereq: Department Permission for Course

Independent investigation of a topic of special interest to the student.

DSNS 4900G: Independent Study: Outreach

Credits: 1-4. Repeatable, maximum of 9 credits.

Prereq: Department Permission for Course

Independent investigation of a topic of special interest to the student.

(Typically Offered: Fall, Spring, Summer)

DSNS 4900H: Independent Study: Honors

Credits: 1-4. Repeatable, maximum of 9 credits.

Prereq: Department Permission for Course; Membership in the University Honors Program

Independent investigation of a topic of special interest to the student.

DSNS 4900I: Independent Study: Sustainability

Credits: 1-4. Repeatable, maximum of 9 credits.

Prereq: Department Permission for Course

Independent investigation of a topic of special interest to the student.

Offered on a satisfactory-fail basis only.

DSNS 4920: Introduction to Italian Culture

Credits: 1. Contact Hours: Lecture 1.

Repeatable, maximum of 3 credits.

Prereq: Instructor Permission for Course

Introduction to Italian contemporary culture for design students, including food, religion, fashion, politics, media, and social mores.

Courses primarily for graduate students, open to qualified undergraduates:

DSNS 5010: Introduction to Research Design

Credits: 3. Contact Hours: Lecture 3.

Introduction to research design and methodology in social science research. Essential knowledge and skills required to frame and conduct research independently. Emphasizes various aspects of research design including: foundations of research; understanding research -related concepts; research ethics; developing research questions; reviewing literature and theory; critiquing and evaluating research studies; exploring data collection and analysis; writing research proposal and presenting findings to a diverse audience. (Typically Offered: Fall)

DSNS 5460: Interdisciplinary Design Studio

Credits: 4-6. Contact Hours: Studio 12.

Repeatable, maximum of 18 credits.

Prereq: Graduate or senior level status or Permission of Instructor

Advanced interdisciplinary design projects.

DSNS 5900: Special Topics

Credits: 1-4. Repeatable, maximum of 12 credits.

Prereq: Instructor Permission for Course

Independent investigation of a topic of special interest to the student.

(Typically Offered: Fall, Spring, Summer)

Dietetics (DIET)

Courses primarily for graduate students, open to qualified undergraduates:

DIET 5110: Research Methods

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

An overview of diverse research approaches focusing on methods for collecting and analyzing quantitative and qualitative data. (Typically Offered: Fall, Spring)

DIET 5120: Nutritional Epidemiology

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Important issues related to designing, conducting, and interpreting research on the role of diet or physical activity in the development of disease (& health) in human populations. Offered odd-numbered years. (Typically Offered: Spring)

DIET 5260: Obesity Across the Lifespan

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Exploration of the affects that obesity has on public health, the healthcare system, and society in general. Overview of strategies to prevent obesity across the lifespan. (Typically Offered: Fall)

DIET 5300: Nutrition and Wellness

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Addresses wellness promotion through nutrition. Nutritional risk and protective factors will be examined in relation to public health and individual nutrition. (Typically Offered: Spring)

DIET 5310: Nutrition Therapy for Eating Disorders

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

An online study of eating disorders management and nutrition care. Topics include eating disorders medical complications, clinical care guidelines, basic pharmacology, clinical nutrition education, nutrition care planning, psychology of eating disorders, team collaboration, and therapeutic modalities for nutrition counseling. (Typically Offered: Fall)

DIET 5320: Maternal and Child Nutrition

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Critical examination of behavioral, physiological, and public health issues impacting dietary and nutritional factors that support normal growth and development. Content focuses on early stages of the life cycle: gestation, lactation, infancy, preschool, school age, and adolescence. Offered even-numbered years. (Typically Offered: Summer)

DIET 5340: Nutrition Education in the Community

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Principles and practices of teaching individuals and groups to translate nutrition knowledge into action. Emphasis on research in and evaluation of nutrition education. (Typically Offered: Spring)

DIET 5380: Nutrition: A Focus on Life Stages

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Explores influence of normal physiological stresses on nutritional needs throughout the life span. Evaluates dietary intake and identification of appropriate community nutrition services in on-line discussions. Specific considerations, such as the influence of age and cultural heritage, are incorporated.

DIET 5400: Nutrition and Physical Activity in Aging

(Cross-listed with GERON 5400).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

WWW only. Basic physiologic changes during aging and their impacts in health and disease. The focus will be on successful aging with special emphasis on physical activity and nutrition. Practical application to community settings is addressed. (Typically Offered: Fall)

DIET 5410: Food Culture

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Survey of topics that affect how we perceive food in the modern world. Food is examined as a badge of cultural identity, focus of media scrutiny and promotion, symbol of religion, and driver of technology. Offered even-numbered years. (Typically Offered: Spring)

DIET 5440: Pediatric Clinical Nutrition

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Pediatric Clinical Nutrition. (Typically Offered: Fall)

DIET 5460: Phytochemicals

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Overview of phytochemicals (non-nutritive biologically active compounds) from fruits, vegetables, cereals and oilseeds. Covers recent findings of chemistry, physiological functions, and potential health implications of phytochemicals. Offered odd-numbered years. (Typically Offered: Fall)

DIET 5470: Functional Foods in Chronic Disease Prevention

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Examination of nutritional science, food science, regulatory principles, and nutrient metabolism to understand and explain functional foods, nutraceuticals, and dietary supplements. Additionally students will evaluate the biochemical basis, technologies, legal requirements, and clinical assessment in the marketplace. Offered odd-numbered years. (Typically Offered: Fall)

DIET 5480: Nutrition and Physical Activity Assessment

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to a variety of nutrition and physical activity assessment tools. Opportunity to discuss the strengths and weaknesses of different tools and gain experience collecting, analyzing, and interpreting nutrition and physical activity data. Offered odd-numbered years. (Typically Offered: Spring)

DIET 5510: Advanced Nutrition: Nutrigenomics, Nutrigenetics & Advanced Lipid Metabolism in Human Nutrition

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Exploration and integration of topics and ideas that are at the forefront of the field of nutritional science. Examination of topics that are new and/or controversial and have implications that range from the cellular/molecular/biochemical level up to clinical/educational level. Emphasis on the integrative and complex nature of human nutrition research from basic science to clinical studies to population studies and dietary recommendations. (Typically Offered: Spring)

DIET 5540: Statistics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Tools used to make statistical decisions. Major emphasis on explanation and understanding of important concepts involved; basic theme is understanding of data and methods used to analyze such data. Offered irregularly. (Typically Offered: Fall, Spring, Summer)

DIET 5550: Public Health Nutrition

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Examines U.S. public health and nutrition concerns in diverse U.S. populations, examines nutritional status in communities, looks at health communication, and considers nutrition policies and community-based nutrition interventions. Students explore roles of dietitians, nutritionists, and others in developing and delivering nutrition policies and interventions in U.S. communities. (Typically Offered: Fall, Spring)

DIET 5560: Micronutrients in Human Nutrition

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Interrelationships of micronutrients in terms of biochemistry, physiology, genetics, and nutrition. Emphasis on developing understanding of how the coordination of structure and function is related to metabolic needs of the cell and its response to the environment. This integrated approach forms the basis for evaluating the micronutrient needs of humans in both normal and altered metabolic states. (Typically Offered: Spring, Summer)

DIET 5580: Advanced Human Nutrition: Macronutrients

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Integration of the molecular, cellular and physiological aspects of macronutrients and energy metabolism in mammalian systems. Dietary energy, carbohydrates, fiber, lipids, proteins, their interactions, metabolic consequences, and major research methodologies. (Typically Offered: Summer)

DIET 5600: Advanced Medical Nutrition Therapy

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Pathophysiology of selected acute and chronic disease states and their associated medical problems. Specific attention directed to medical nutrition needs of patients in the treatment of each disease state. (Typically Offered: Summer)

DIET 5650: International Nutrition and World Hunger

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Identification and assessment of malnutrition in low-income countries. Social, cultural, political, economic, and geographic determinants of malnutrition. Protein-energy malnutrition, vitamin and mineral deficiencies. Intervention approaches; international efforts and local sustainability. (Typically Offered: Fall)

DIET 5660: Nutrition Counseling and Education Methods

Credits: 3.

Prereq: Graduate Standing or Permission of Instructor

Application of counseling and learning theories with individuals and groups in community and clinical settings. Includes discussion and experience in building rapport, assessment, diagnosis, intervention, monitoring, evaluation, and documentation. Literature review of specific counseling and learning theories. (Typically Offered: Fall, Spring)

DIET 5680: Entrepreneurship Theory and Practice

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Definition and discussion of entrepreneurship and its importance to economic and business environment. Offered odd-numbered years. (Typically Offered: Summer)

DIET 5690: Dietary and Herbal Supplements

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Develop skills to partner with patients in making dietary supplement decisions. Explore the safe, efficacious use of botanicals and supplements in nutritional support of aging, maternal health and wellness. Discussions on supplementation in the prevention and treatment of chronic disease include: arthritis, cancer, cardiovascular, diabetes, digestive, liver and renal disorders. (Typically Offered: Summer)

DIET 5700: Nutrition and Human Performance

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Develop an understanding of nutrition based on knowledge of the biochemical and physiological process and functions of specific nutrients in meeting nutritional requirements. Emphasis on the relationship of optimal nutrition and physical efficiency and performance. (Typically Offered: Spring)

DIET 5710: Foundation of Leadership in Dietetics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Using leadership theories to develop the fundamental concepts and skills to bridge the gap between theory and practice. Students will be able to successfully evaluate classic and contemporary leadership theories, investigate current leadership trends and identify positive applications in the dietetics community. (Typically Offered: Summer)

DIET 5720: Current Issues or Trends

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Overview of current topics, issues, and trends in dietetics practice. (Typically Offered: Fall, Spring)

DIET 5740: Nutrition and Immunology

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Principles and issues related to nutrition and immunology. Impact of nutrients and nutritional status on immune responses. Impact of disease states on nutritional status. Offered odd-numbered years. (Typically Offered: Spring)

DIET 5760: Diabetes Medical Nutrition Therapy

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

An in-depth study of diabetes management with emphasis in nutrition care. Topics will include diabetes pathophysiology, clinical care guidelines, basic pharmacology, clinical nutrition education and counseling strategies, and nutrition care planning.

DIET 5970: Nutritional Aspects of Oncology

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Understanding of basic cancer biology and methodology used to study nutrition and cancer relationships. Using current research as a basis, the role of nutrition in specific cancers will be explored. Students will learn about sources of information for cancer prevention programs, and how to apply this information to clinical patient management. Offered odd-numbered years. (Typically Offered: Spring)

DIET 5980: Clinical Aspects of Nutrition Support

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Specialized nutrition assessment and support. Review of energy expenditure and substrate utilization in specific disease states. Current Methods for the initiation and management of enteral and parenteral nutrition therapy including access, metabolic and mechanical complications. Evaluation of nutrition support methodology in selected disease states. (Typically Offered: Spring)

DIET 5990: Creative Component

Credits: 1-30. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

For non-thesis option only. (Typically Offered: Fall, Spring, Summer)

Early Childcare Education and Programming (ECP)

Courses primarily for undergraduates:

ECP 2010: Child Development - Ages Birth to 3

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 2300 or HDFS 1020

Development from birth to age three. Major theories and research on development will be covered including growth patterns, the influences of disabilities and risk factors, environmental factors and their effects on attachment styles, language acquisition, brain development, cognitive development, social-emotional development, and perceptual and sensory motor skills.

ECP 2020: Child Development - Ages 4 to 8

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 2300 or HDFS 1020

Development from ages four through eight. Major theories and research on development will be covered including growth patterns, the influences of disabilities and risk factors, environmental factors and their effects on attachment styles, language acquisition, brain development, cognitive development, social-emotional development, and perceptual and sensory motor skills.

ECP 3050: Professional Development

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 2300 or HDFS 1020

Exploring the role of a professional as a teacher, administrator or advocate in early childhood programming. Students will learn about professionalism and ethics, identifying child abuse, and applying universal precautions. Discussion of qualities of the early childhood educator role, program models, and working with children and professional colleagues.

ECP 3060: Health, Safety, and Nutrition

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 2300 or HDFS 1020

Important elements for planning, promoting and maintaining healthy and safe learning/care environments, understanding childhood illnesses and establishing healthy lifestyles, first aid, and care providers maintaining their own health. Maintaining safe relationships with others, including identifying and reporting abuse, neglect, and exploitation of children. Exploration of nutrients for life and feeding, food preparation and safety policies and guidelines, food allergies and intolerances, appropriate feeding practices.

ECP 3070: Child Guidance and Classroom Environments

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 2300 or HDFS 1020

Working knowledge of developmentally appropriate practice in child guidance. This goal will be accomplished through review of current guidance methods and programs in order to familiarize students with successful guidance techniques. By the end of this course, students will develop their own approach to guidance based upon practices best suited to their own unique skills and strengths.

ECP 3200: Practicum I - Child Observations in Classroom Environments

Credits: 3. Contact Hours: Laboratory 6.

Prereq: ECP 2010; ECP 2020; ECP 3050; ECP 3060; ECP 3070; HDFS 1030

Practicum in Early Childhood Education is an opportunity for ECP teacher candidates to have a guided learning experience in a professional agency that provides services to children and families. It is expected that learning experiences and projects at the practicum site will provide teacher candidates with the opportunity to utilize and implement theories and practices learned in other ECP classes.

ECP 3220: Diversity in the Lives of Young Children and Families

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 2300 or HDFS 1020

Exploration of cultural diversity in daily life and beliefs in families with young children. The focus is on U.S. families, with attention to the multiple cultures from which they come.

ECP 3230: Working with Families

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 2300 or HDFS 1020

Application of an ecological model to the understanding of variation in parental roles, perspectives, relationships, approaches, and challenges.

ECP 3240: Technology and Young Children

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 2300 or HDFS 1020

Impact of electronic technology on the development of young children in educational, home, and community environments, and how technology can be used to enhance teaching and learning. Students will be critical thinkers and informed consumers of technology related to young children.

ECP 4120: Development of Curriculum for Children Ages Birth to 3

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECP 2010; ECP 2020; ECP 3050; ECP 3060; ECP 3070; ECP 3200

Curriculum development related to children from birth to age 3: (1) learn and utilize assessment and documentation to inform curriculum, (2) plan and evaluate developmentally appropriate activities, and (3) learn about effective ways to share curriculum information with families. All areas of developmental domains and content areas; issues related to diversity in family composition, culture, and individual abilities will also be addressed.

ECP 4130: Development of Curriculum for Children Ages 4 to 8

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECP 2010; ECP 2020; ECP 3050; ECP 3060; ECP 3070; ECP 3200

Development of curriculum for children ages 4 to 8 years: (1) learn and utilize assessment and documentation to inform curriculum, (2) plan and evaluate developmentally appropriate activities, and (3) learn about effective ways to share curriculum information with families. This course addresses all areas of developmental domains and content areas, and issues related to diversity in family composition, culture, and individual abilities will also be addressed.

ECP 4240: Assessing Young Children and Their Environments to Enhance Development

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECP 2010; ECP 2020; ECP 3050; ECP 3060; ECP 3070; ECP 3200

Students will learn to select, evaluate, and use appropriate assessment tools for children birth to age 8. Students will use assessment data to inform decisions about teaching (environments and practice) and intervention. There will be an emphasis on the ethical use of assessments, validity of assessments, multicultural sensitivity, and assessments for children with special needs.

ECP 4250: Understanding and Adapting for Developmental Differences

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECP 2010; ECP 2020; ECP 3050; ECP 3060; ECP 3070; ECP 3200

Knowledge of disability conditions, assessment and identification, interventions in inclusive environments, and collaborations among family members and service providers.

ECP 4400: Practicum II - Curriculum Development and Implementation

Credits: 3.

Prereq: ECP 4120; ECP 4130; ECP 4240; ECP 4250

Practicum in Early Childhood Education is an opportunity for ECE teacher candidates to have a guided learning experience in a professional agency that provides services to children and families. It is expected that learning experiences and projects at the practicum site will provide teacher candidates with the opportunity to utilize and implement theories and practices learned in other required classes.

ECP 4420: Administration and Supervision in Early Childhood Settings

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 2300 or HDFS 1020

Exploration of issues surrounding the administration of early childhood programs including identification of community needs, analysis of business opportunities, the evaluation and appropriate use of space and quality programming, consideration of policy and legal responsibilities, and professionalism in the field. In addition, the course explores best practices in staff selection, training, coaching, and supervision.

ECP 4600: Practicum III - Capstone Experience

Credits: 3-6. Repeatable, maximum of 6 credits.

Prereq: ECP 3220; ECP 3230; ECP 3240; ECP 4400; ECP 4420

Professional practicum as a 15 week experience designed to allow the student to demonstrate practical application of developmentally appropriate early childhood teaching techniques and skills, actual teaching experience and developmental feedback. Practicum students will be involved in observation and evaluation of classroom experiences, environmental design, classroom management, and parent communication.

Ecology and Evolutionary Biology (EEB)

Courses primarily for graduate students, open to qualified undergraduates:

EEB 5110: Conceptual Foundations in Ecology and Evolutionary Biology

Credits: 4.

Prereq: Graduate Standing or Permission of Instructor

Introduction to key figures and ideas that have shaped the development of ecology and evolutionary biology. Covers major developments in ecology and evolutionary biology at five levels of biological organization: Genome, Organism, Population, Community, and Ecosystem. Impacts of these developments on current approaches to investigation and argument formulation. Effects of technological advances on the direction of scientific investigations. Introduction to analytical skills important for critical thinking in ecology and evolutionary biology and the impact of accepted lines of scientific reasoning on the objectives and conduct of research, such as explanation and prediction, design of studies as experimentation, and structured or unstructured observation. (Typically Offered: Fall)

EEB 5850B: Extended Field Trip: Travel

Credits: 1. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Extended field trip to study major terrestrial and aquatic ecosystems. Location and duration vary. Report required. (Typically Offered: Fall, Spring, Summer)

EEB 5900: Special Topics

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

For students wishing to conduct in-depth study of a particular topic in ecology and evolutionary biology. (Typically Offered: Fall, Spring, Summer)

Courses for graduate students:**EEB 6980: Seminar**

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Reports and discussion of recent research and literature. (Typically Offered: Fall, Spring)

EEB 6990: Research

Credits: 1-30. Repeatable.

Prereq: Department Permission for Course

Thesis and dissertation research. (Typically Offered: Fall, Spring, Summer)

Ecology, Evolution, and Organismal Biology (EEOB)

The department offers graduate work leading to both Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) degrees. Each EEOB faculty member is affiliated with one or more interdepartmental majors, and

EEOB students major in one of these programs. These interdepartmental programs include:

- Bioinformatics and Computational Biology (<http://www.bcb.iastate.edu/>)
- Ecology and Evolutionary Biology (<http://www.eeb.iastate.edu/>)
- Environmental Science (<https://ensci.iastate.edu/>)
- Genetics and Genomics (<http://www.genetics.iastate.edu>)
- Interdisciplinary Graduate Studies (<http://www.grad-college.iastate.edu/igs/admission.html>)
- Microbiology (<http://www.micrograd.iastate.edu/>)
- Plant Biology (<http://www.ipb.iastate.edu/>)
- Sustainable Agriculture (<https://susag.iastate.edu/>)

The department offers graduate work leading to both Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) degrees.

Courses primarily for graduate students, open to qualified undergraduates:

EEOB 5070: Advanced Animal Behavior

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Analysis of current research in animal behavior. Topics covered may include behavioral ecology, mechanisms of behavior, evolution of behavior, applications of animal behavior to conservation biology, and applications of animal behavior to wild animals in captivity. (Typically Offered: Spring)

EEOB 5140: Life History and Reproductive Strategies

(Dual-listed with BIOL 4140).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Evolution of ecological adaptations at the individual, population, and species level. Emphasis is on evolutionary mechanisms and adaptive strategies related to life histories and reproduction; age and size at maturity; lifespan and senescence; offspring size/number trade-offs; sex and mating systems; sex determination and sex ratios. BIOL 3150 or equivalent recommended. (Typically Offered: Fall)

EEOB 5210: Biological Principles of Aging

(Dual-listed with BIOL 4210). (Cross-listed with GERON 5210).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Basic biological principles of aging. Course modules include an introduction to the aging process, body systems and normal aging, and environment and the biology of aging. In addition, disorders and diseases of aging, prevention and treatment and exercise and aging topics will be covered. (Typically Offered: Summer)

EEOB 5310: Conservation Biology

(Cross-listed with AECL 5310).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 3120, BIOL 3130; or graduate standing

Examination of conservation issues from a population and a community perspective. Population-level analysis will focus on the role of genetics, demography, and environment in determining population viability. Community perspectives will focus on topics such as habitat fragmentation, reserve design, biodiversity assessment, and restoration ecology. Offered even-numbered years. (Typically Offered: Spring)

EEOB 5340: Endocrinology

(Dual-listed with BIOL 4340).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Chemical integration of vertebrate organisms. The structure, development, and evolution of the endocrine glands and the function and structure of their hormones. (Typically Offered: Spring)

EEOB 5350: Restoration Ecology

(Cross-listed with NREM 5350/ ENSCI 5350).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Theory and practice of restoring animal and plant diversity, structure and function of disturbed ecosystems. Restored freshwater wetlands, forests, prairies and reintroduced species populations will be used as case studies. Offered even-numbered years. (Typically Offered: Fall)

EEOB 5420A: Introduction to Molecular Biology Techniques: DNA Techniques

(Cross-listed with BMS 5420A/ BBMB 5420A/ FSHN 5420A/ GDCB 5420A/ HORT 5420A/ NREM 5420A/ NUTRS 5420A/ VDPAM 5420A/ VMPM 5420A).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes genetic engineering procedures, sequencing, PCR, and genotyping. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

EEOB 5420B: Introduction to Molecular Biology Techniques: Protein

(Cross-listed with BMS 5420B/ BBMB 5420B/ FSHN 5420B/ GDCB 5420B/ HORT 5420B/ NREM 5420B/ NUTRS 5420B/ VDPAM 5420B).

Credits: 1. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. Offered on a satisfactory-fail basis only. (Typically Offered: Spring, Summer)

EEOB 5420C: Introduction to Molecular Biology Techniques: Cell Techniques

(Cross-listed with BMS 5420C/ BBMB 5420C/ FSHN 5420C/ GDCB 5420C/ HORT 5420C/ NREM 5420C/ NUTRS 5420C/ VMPPM 5420C/ VDPAM 5420C).

Credits: 1. Contact Hours: Laboratory 2.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. ular biology techniques and related procedures. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

EEOB 5420D: Introduction to Molecular Biology Techniques: Plant Transformation

(Cross-listed with BMS 5420D/ BBMB 5420D/ FSHN 5420D/ GDCB 5420D/ HORT 5420D/ NREM 5420D/ NUTRS 5420D/ VMPPM 5420D/ VDPAM 5420D).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: Agrobacterium and particle gun-mediated transformation of tobacco, Arabidopsis, and maize, and analysis of tranformants. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

EEOB 5420E: Introduction to Molecular Biology Techniques: Proteomics

(Cross-listed with BMS 5420E/ BBMB 5420E/ FSHN 5420E/ GDCB 5420E/ HORT 5420E/ NREM 5420E/ NUTRS 5420E/ VMPPM 5420E/ VDPAM 5420E).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: two-dimensional electrophoresis, laser scanning, mass spectrometry, and database searching. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

EEOB 5420F: Introduction to Molecular Biology Techniques: Metabolomics

(Cross-listed with BMS 5420F/ BBMB 5420F/ FSHN 5420F/ GDCB 5420F/ HORT 5420F/ NREM 5420F/ NUTRS 5420F/ VMPPM 5420F/ VDPAM 5420F).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: metabolomics and the techniques involved in metabolite profiling. For non-chemistry majoring students who are seeking analytical aspects into their biological research projects. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

EEOB 5420G: Introduction to Molecular Biology Techniques: Genomic

(Cross-listed with BMS 5420G/ BBMB 5420G/ FSHN 5420G/ GDCB 5420G/ HORT 5420G/ NREM 5420G/ NUTRS 5420G/ VMPPM 5420G/ VDPAM 5420G).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

EEOB 5440: Intro Bioinformatcs

Credits: 4. Contact Hours: Lecture 4.

Prereq: Graduate Standing or Permission of Instructor

Intro Bioinformatcs. (Typically Offered: Fall)

EEOB 5460: Computational Skills for Biological Data

(Cross-listed with BCB 5460).

Credits: 3. Contact Hours: Lecture 1, Discussion 2.

Prereq: Graduate Standing or Permission of Instructor

Computational skills necessary for biologists working with big data sets. UNIX commands, scripting in R and Python, version control using Git and GitHub, and use of high performance computing clusters. Combination of lectures and computational exercises. (Typically Offered: Fall)

EEOB 5510: Plant Evolution and Phylogeny

(Dual-listed with BIOL 4510).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Survey of land plant evolution; phylogenetic comparison of anatomical, reproductive, and life history specializations. Relationships among bryophytes, lycophytes, pteridophytes, gymnosperms, and angiosperms emphasizing significant evolutionary changes documented by paleobotanical, morphological, and molecular studies. (Typically Offered: Fall)

EEOB 5530: Agrostology

Credits: 3.

Prereq: Graduate Standing or Permission of Instructor

Structure, identification, classification, phylogeny, and economic aspects of grasses and related families. Offered even-numbered years. (Typically Offered: Fall)

EEOB 5550: Bryophyte and Lichen Biodiversity

(Dual-listed with BIOL 4550).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to the biology and ecology of mosses, liverworts, and lichens. Emphasis on identification and diversity of local representatives of these three groups of organisms. Required field trips and service-learning. (Typically Offered: Spring)

EEOB 5610: Evolutionary and Ecological Genomics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Use of genomic and other 'omic' data in evolution and ecology. Review of data-generation platforms, computational methods, and examples of how phylogenomics, metagenomics, epigenomics, and population genomics are transforming the disciplines of evolution and ecology. Offered even-numbered years. (Typically Offered: Spring)

EEOB 5620: Evolutionary Genetics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Seminar/discussion course covering the genetic basis of evolutionary processes in multicellular organisms. Offered even-numbered years. (Typically Offered: Spring)

EEOB 5630: Molecular Phylogenetics

Credits: 3.

Prereq: Graduate Standing or Permission of Instructor

An overview of the theory underlying phylogenetic analysis and the application of phylogenetic methods to molecular datasets. The course emphasizes a hands-on approach to molecular phylogenetics and combines lecture presentations with computer exercises and discussion of original scientific literature. (Typically Offered: Spring)

EEOB 5640: Wetland Ecology

(Dual-listed with BIOL 4640/ ENSCI 4640). (Cross-listed with ENSCI 5640).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Ecology, classification, creation and restoration, and management of wetlands. Emphasis on North American temperate wetlands. (Typically Offered: Spring)

EEOB 5650: Macroevolution

(Dual-listed with BIOL 4650).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

The history and diversity of life on earth; evolutionary patterns and processes above the species level. Diversity from a phylogenetic perspective. Empirical exercises include: phylogeny estimation, ancestral states, estimating diversification rates, evaluating the tempo and mode of evolution, biogeographic patterns, and trait associations across the tree of life. Offered even-numbered years. (Typically Offered: Spring)

EEOB 5660: Molecular Evolution

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Seminar/discussion course covering the fundamentals of molecular evolution. Emphasis is placed on original scientific literature and current topics, including rates and patterns of genetic divergence; nucleotide and allelic diversity; molecular clocks; gene duplications; genome structure; organellar genomes; polyploidy; transposable elements; and modes and mechanisms of gene and genome evolution. Offered even-numbered years. (Typically Offered: Fall)

EEOB 5670: Empirical Population Genetics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

An overview of fundamental population genetic theory and the ecological and evolutionary factors underlying the distribution of genetic variation within and among natural populations. Emphasis on the analysis of inbreeding, breeding systems, parentage, relatedness, spatial autocorrelation, effective population size, hierarchical population models, and phylogeography. (Typically Offered: Fall)

EEOB 5680: Advanced Systematics

(Cross-listed with ENT 5680).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Principles and practice of systematic biology; taxonomy, nomenclature and classification of plants and animals; sources and interpretation of systematic data; speciation; fundamentals of phylogenetic systematics. (Typically Offered: Spring)

EEOB 5690: Biogeography

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Principles underlying the geographic distribution of organisms throughout the world; biological influences of geological history and tectonic movements; role of climate, migration, dispersal, habitat, and phylogeny on past and present organismal distribution patterns; biogeographic methods. (Typically Offered: Spring)

EEOB 5760: Functional Ecology

(Dual-listed with BIOL 4760).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

The nature of adaptations to physical and biotic environments. Biophysical, biomechanical, and physiological bases of the structure, form, growth, distribution, and abundance of organisms. (Typically Offered: Spring)

EEOB 5770: Concepts in Theoretical Ecology and Evolution

Credits: 1. Contact Hours: Lecture 1.

Prereq: Graduate Standing or Permission of Instructor

Readings and discussion of influential ideas in ecological and evolutionary theory, with an emphasis on how models are used as conceptual tools for building synthetic paradigms. Topics are chosen according to student interests; may include spatial ecology, behavioral theory, chaos, community assembly and biodiversity, and others. Offered even-numbered years. (Typically Offered: Fall)

EEOB 5810: Analysis of Environmental Systems

(Dual-listed with ENSCI 3810/ EEOB 3810). (Cross-listed with ENSCI 5810).

Credits: 3.

Prereq: Graduate Standing or Permission of Instructor

Systems approach to the analysis and modeling of material and energy flows in natural and managed environmental systems and the primary environmental factors controlling these systems. Applications in hydrology, biogeochemistry, and population dynamics. (Typically Offered: Spring)

EEOB 5840: Ecosystem Science

(Cross-listed with ENSCI 5840).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Advanced studies of ecosystems and the biological and physical factors that influence their properties and dynamics. Conceptual foundations and modern approaches to ecosystem studies. Interactions among organisms, biological diversity, and ecosystem attributes. Quantitative analyses of accumulations, transformations, and fluxes of nutrients, water, and energy within and among ecosystems. Global change issues. Offered even-numbered years. (Typically Offered: Spring)

EEOB 5850: Community Ecology

(Dual-listed with BIOL 4850).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

The effect of interspecific interactions on the structure and dynamics of natural and managed communities; including concepts of guild structure and trophic web dynamics and their importance to the productivity, diversity, stability, and sustainability of communities. The implications of interspecific interactions in the management of wild species will be emphasized with illustrative case histories of interactions between plants, invertebrates, and vertebrates. (Typically Offered: Spring)

EEOB 5860: Aquatic Ecology

(Dual-listed with AECL 4860/ BIOL 4860/ ENSCI 4860). (Cross-listed with AECL 5860/ ENSCI 5860).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 3120 or ENSCI 3810 or ENSCI 4020 or NREM 3010 or graduate classification

Structure and function of aquatic ecosystems with application to fishery and pollution problems. Emphasis on lacustrine, riverine, and wetland ecology. (Typically Offered: Fall)

EEOB 5860L: Aquatic Ecology Laboratory

(Dual-listed with AECL 4860L/ BIOL 4860L/ ENSCI 4860L). (Cross-listed with AECL 5860L/ ENSCI 5860L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Concurrent enrollment in BIOL 4860.

Field trips and laboratory exercises to accompany 4860. Hands-on experience with aquatic research and monitoring techniques and concepts. (Typically Offered: Fall)

EEOB 5870: Microbial Ecology

(Dual-listed with BIOL 4870/ ENSCI 4870/ GEOL 4870/ MICRO 4870).

(Cross-listed with ENSCI 5870/ GEOL 5870/ MICRO 5870).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to major functional groups of autotrophic and heterotrophic microorganisms and their roles in natural and environmental systems. Consequences of microbial activity on water chemistry, weathering, and precipitation/dissolution reactions will be emphasized. (Typically Offered: Fall)

EEOB 5890: Population Ecology

(Dual-listed with AECL 4890/ BIOL 4890). (Cross-listed with AECL 5890).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (BIOL 3120, STAT 1010 OR STAT 1040, MATH 1510 OR 1600 OR 1650) or graduate classification

Concepts and theories of population dynamics with emphasis on models of growth, predation, competition, and regulation. Offered even-numbered years. (Typically Offered: Fall)

EEOB 5900A: Special Topics: Current Topics in Ecology

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

EEOB 5900B: Special Topics: Current Topics in Evolutionary Biology

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

EEOB 5900C: Special Topics: Current Topics in Organismal Biology

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

EEOB 5990: Creative Component

Credits: 1-30. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Research toward nonthesis master's degree.

Courses for graduate students:

EEOB 6980: Seminar

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Prereq: Instructor Permission for Course

Meetings of graduate students and faculty to discuss recent literature and problems under investigation.

EEOB 6990: Research

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Research for thesis or dissertation. Offered on a satisfactory-fail basis only.

Early Childhood and Family Policy (ECFP)

Courses primarily for graduate students, open to qualified undergraduates:

ECFP 5500: History of Child Development and Equity

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Overview of research on children birth to age five, demographics of this population, critical domains of development, significance of early brain development, and issues of inequality and disproportionality that shape child outcomes. (Typically Offered: Fall)

ECFP 5600: Examining Practices, Policies, and Key Issues

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Advances general early childhood education and care (ECEC) policy knowledge and addresses contextual and historical variables that have affected its evolution in the United States. Overview of the practices, policies, and issues framing the design and delivery of contemporary early childhood education and care (ECEC), including the role of parents and families. Addresses understanding ECEC practice and policy and identifying and addressing critical policy challenges. (Typically Offered: Fall)

ECFP 5700: Theory, Analysis & Research

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Provides interdisciplinary perspective on early childhood education and care (ECEC) policy. Focus on research influence on policy, tools for policy analysis, and theoretical frames used to interpret and influence current ECEC policy discourse. Examine and analyze design, implementation, and outcomes of various policies. (Typically Offered: Spring)

ECFP 5800: Policy, Leadership & Advocacy

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Provides foundational knowledge of fundamentals of policy creation, design, and development. Emphasis on policies that impact early childhood education and care (ECEC) and focus on policy construction. (Typically Offered: Spring)

Economics (ECON)

Courses primarily for undergraduates:

ECON 1010: Principles of Microeconomics

Credits: 3. Contact Hours: Lecture 3.

Resource allocation, opportunity cost, comparative and absolute advantage. Supply and demand. Marginal analysis. Theories of production and consumption, pricing, and the market system. Perfect and imperfect competition and strategic behavior. Factor markets. Present discounted value. (Typically Offered: Fall, Spring, Summer)

ECON 1010H: Principles of Microeconomics: Honors

Credits: 3. Contact Hours: Lecture 3.

Prereq: Membership in the University Honors Program

Resource allocation, opportunity cost, comparative and absolute advantage. Supply and demand. Marginal analysis. Theories of production and consumption, pricing, and the market system. Perfect and imperfect competition and strategic behavior. Factor markets. Present discounted value.

ECON 1010L: Laboratory in Principles of Microeconomics

Credits: 1. Contact Hours: Laboratory 2.

Discussion of material typically covered in ECON 1010. Application of economic principles to real world problems. Economic principles and basic business management concepts applied to decision-making in agribusiness operations. (Typically Offered: Fall)

ECON 1020: Principles of Macroeconomics

Credits: 3. Contact Hours: Lecture 3.

Measurement of macro variables and general macro identities. Classical models of full employment. Production and growth. Savings and investment. Employment and unemployment. Money, inflation, and price levels. Operation of the U.S. banking system. Fiscal and monetary policy. Elements of international finance. ECON 1010 recommended. (Typically Offered: Fall, Spring, Summer)

ECON 1020H: Principles of Macroeconomics: Honors

Credits: 3. Contact Hours: Lecture 3.

Prereq: Membership in the University Honors Program

Measurement of macro variables and general macro identities. Classical models of full employment. Production and growth. Savings and investment. Employment and unemployment. Money, inflation, and price levels. Operation of the U.S. banking system. Fiscal and monetary policy. Elements of international finance. ECON 1010 recommended.

ECON 1030X: Introduction to Economics: Real World Applications

Credits: 3. Contact Hours: Lecture 3.

Introduction to key economics concepts in the context of current events and real-world questions. Topics will address some or all of the following concepts: market supply and demand, consumer and producer behavior, government policy and regulation, market structure, market failures, time value of money, inflation, gross domestic product, economic growth, labor markets, financial markets, and international trade. Cannot be used as a substitute for ECON 1010 or ECON 1020 prerequisite.

ECON 1100: Orientation in Agricultural Business

Credits: 1. Contact Hours: Discussion 0.5, Lecture 0.5.

Orientation course for freshman and new transfer students in agricultural business. (Typically Offered: Fall)

ECON 2070: Applied Economic Optimization

Credits: 3. Contact Hours: Lecture 2, Discussion 2.

Prereq: MATH 1510 or MATH 1600 or MATH 1650

Application of linear algebra, calculus and unconstrained and constrained optimization techniques to economic problems. Learning outcomes include the ability to (i) identify the objective, decision variables and constraints in economic decision problems, (ii) represent elements of an economic problem in simple mathematical models, (iii) identify and apply mathematical tools that can be used to solve the problems, (iv) identify the strengths and limitations of the solution method, and (v) interpret the economic meaning and implications of the solution. (Typically Offered: Fall, Spring)

ECON 2300: Farm Business Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: ACCT 2840; ECON 1010

Business and economic principles applied to decision making and problem solving in the management of a farm business. Cash flow, partial, enterprise, and whole farm budgeting. Information systems for farm accounting, analysis, and control. Obtaining and managing land, capital, and labor resources. Alternatives for farm business organization and risk management. (Typically Offered: Fall, Spring)

ECON 2340: Small Business Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 1010

An introduction to small business management, entrepreneurship, and economics utilizing a series of case studies. Exploration of issues related to starting or acquiring a new business and development of knowledge and skills for successful management of a small business, with an emphasis on agricultural business.

ECON 2350: Introduction to Agricultural Markets

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 1010

Basic concepts and economics principles related to markets for agricultural inputs and products. Overview of current marketing problems faced by farms and agribusinesses, farm and retail price behavior, structure of markets, food marketing channels, food quality and food safety, and the role of agriculture in the general economy. The implications of consumer preferences at the farm level. Introduction to hedging, futures, and other risk management tools. (Typically Offered: Fall, Spring)

ECON 2360: Agricultural Selling

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 1010

Principles of selling with application to agricultural and food related businesses. Attitudes, value systems, and behavioral patterns that relate to agricultural sales. Marketing, selling strategies, preparing for sales calls, making sales presentations, handling objections, and closing sales. Analysis of the buying or purchasing process. Evaluation of agri-selling profession. (Typically Offered: Fall, Spring, Summer)

ECON 2710: Introduction to Data Analysis in Agri-Food Industry

Credits: 3. Contact Hours: Lecture 3.

Introduction to quantitative methods for economic decision making. Examples from agricultural and natural resource economics presented using spreadsheet software tools such as Microsoft Excel. (Typically Offered: Spring)

ECON 2920A: Career Seminar: Agricultural Business

Credits: 1. Contact Hours: Lecture 1.

Prereq: Major in economics or agricultural business

Career opportunities in the various industries and government institutions. Required training and skills needed to perform successfully in different types of careers. Factors important in finding and obtaining employment either before or after graduation including personal resumes, interviewing, and letter writing. Graduation Restriction: Only one of ECON 2920, 2920A, and 2920B can be used toward graduation.

ECON 2920B: Career Seminar: Economics and Business Economics

Credits: 1. Contact Hours: Lecture 1.

Prereq: Major in economics or business economics

Career opportunities in the various industries and government institutions. Required training and skills needed to perform successfully in different types of careers. Factors important in finding and obtaining employment either before or after graduation including personal resumes, interviewing, and letter writing. Graduation Restriction: Only one of ECON 2920, 2920A, and 2920B can be used toward graduation.

ECON 2970: Internship

Credits: 2. Repeatable, maximum of 4 credits.

Prereq: Permission of Instructor; and major in Agricultural Business or Economics

Students complete a research report, based on their internship or approved work experience, that examines chosen topics in management, marketing or finance.

ECON 2980: Cooperative Education

Credits: Required. Repeatable.

Prereq: Permission of the department cooperative education coordinator; sophomore classification

Required of all cooperative education students. Students must register for this course prior to commencing each work period.

ECON 3010: Intermediate Microeconomics

Credits: 3-4. Contact Hours: Discussion 1, Lecture 3.

Prereq: ECON 1010 and ECON 2070 or MATH 1660

Theory of consumer and business behavior; optimal consumption choices and demand; theory of firm behavior; costs, production, and supply; competitive and imperfectly competitive markets; theory of demand for and supply of factors of production; general equilibrium analysis. Fall and spring require recitation and are 4 credits; summer is 3.0 credits. (Typically Offered: Fall, Spring, Summer)

ECON 3010H: Intermediate Microeconomics: Honors

Credits: 3-4. Contact Hours: Lecture 3.

Prereq: ECON 1010 and ECON 2070 or MATH 1660; Membership in the University Honors Program

Theory of consumer and business behavior; optimal consumption choices and demand; theory of firm behavior; costs, production, and supply; competitive and imperfectly competitive markets; theory of demand for and supply of factors of production; general equilibrium analysis. Recitation required for 4 credits.

ECON 3020: Intermediate Macroeconomics

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 1010; ECON 1020; (MATH 1600 or MATH 1650)

Theory of income, employment, interest rates, and the price level; fiscal and monetary policy; budget and trade deficits; money and capital inflows, interest rates, and inflation. (Typically Offered: Fall, Spring)

ECON 3020H: Intermediate Macroeconomics: Honors

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 1010; ECON 1020; (MATH 1600 or MATH 1650); Membership in the University Honors Program

Theory of income, employment, interest rates, and the price level; fiscal and monetary policy; budget and trade deficits; money and capital inflows, interest rates, and inflation.

ECON 3130: Economics of Sports

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 1010

Application of economics to issues in sports, including franchising; rival leagues and barriers to entry; cooperative, competitive, and collusive behavior; player productivity and compensation; contracts, unions, and discrimination; antitrust, taxation, and subsidies. Economic concepts include supply and demand, costs, competition, time value of money, labor economics, pricing, public finance, production, game theory, risk analysis, and industrial organization.

ECON 3200: Labor Economics

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 1010 or ECON 1020

Economic analysis of contemporary domestic and international labor market issues including labor supply and demand, unemployment, and employment in the U.S. and elsewhere; investments in and returns to education, training, health, immigration and migration; income inequality; labor productivity; out-sourcing and global competitiveness; work incentives; compensation including benefits; and labor policies such as minimum wages, over-time pay, discrimination, unions, and immigration. Examples drawn from the U.S. and other developed countries with reference to developing countries where relevant. Meets International Perspectives Requirement.

ECON 3210: Economics of Discrimination

(Cross-listed with WGS 3210).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 1010

Economic theories of discrimination. Analysis of the economic problems of women and minorities in such areas as earnings, occupations, and unemployment. Public policy concerning discrimination. Poverty measurement and antipoverty programs in the U.S. Meets U.S. Cultures and Communities Requirement.

ECON 3220X: Health Economics

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 1010

Study of the economic behaviors of individuals, medical care providers, insurers, and governments in decision-making related to healthcare resource allocation. Analysis of market inefficiencies created from asymmetric information problems between patients, insurers, and healthcare providers, policies promoting fair access to essential healthcare and for addressing externalities in the health industry. (Typically Offered: Spring)

ECON 3300: Advanced Farm Business Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 2300

Effective use of strategic planning, decision methods, and computer assistance for solving farm problems. Applications of economic and management theory to analyze farm business decisions using efficiency measures to assess current resource use and direct the farm business analysis, planning, and tax process.

ECON 3320: Cooperatives

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 1010

Survey of cooperative business structure, including historical developments in the United States, principles of cooperation, state and federal authorization for cooperative activity, economic motivations and foundations, governance, marketing and pricing strategies, and financing, capitalization and taxation considerations. Students will learn how the cooperative model is applied in a variety of markets.

ECON 3340: Entrepreneurship in Agriculture

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 1010

Introduction to the process of entrepreneurship within the agricultural and food sectors. Emphasis on opportunity recognition and creation of concept for new startup ventures. Students will develop a business plan for a startup business or non-profit organization. (Typically Offered: Fall, Spring)

ECON 3350: The Economics of Global Agricultural Food and Bio-energy

(Cross-listed with GLOBE 3350).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 1010

Applied economic analysis of the determinants of world agricultural production, marketing, and use in feed, food, fiber, biofuel, and other applications, and global food processing and consumption. Analysis of market case studies and various data on global agricultural production and transformation, land and resource use, demography, economic activity, nutrition and health trends. Meets International Perspectives Requirement.

ECON 3370: Agricultural Marketing

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 1010

Understanding of agricultural commodity markets for grain, livestock and dairy with emphasis on marketing decisions and risk management for farmers and processors. Hands-on applications of marketing and management tools via market simulations. ECON 2350 recommended.

ECON 3440: Public Finance

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 1010

The economic role of governments in market economies. Public goods, externalities, income distribution, and income maintenance programs. The effect of taxes on economic behavior, descriptions of the structure of the principal U.S. taxes, and current reform proposals.

ECON 3530: Money, Banking, and Financial Institutions

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 1020

Theoretical and applied analysis of money, banking, and financial markets; interest rates and portfolio choice; the banking industry in transition; the money supply process; the Federal Reserve System and the conduct of monetary policy; macro implications of monetary policy; international finance. (Typically Offered: Fall, Spring, Summer)

ECON 3550: International Trade and Finance

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 1010; ECON 1020

Explanations of causes of international trade and the impact of trade on welfare and employment patterns. Analysis of government policies towards trade, such as tariffs, quotas, and free trade areas. Theory of balance of payments and exchange rate determination, and the role of government policies. Examination of alternative international monetary arrangements. Meets International Perspectives Requirement.

ECON 3620: Applied Ethics in Agricultural Business

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 1010; Junior or Senior classification; College of Agriculture and Life Sciences major

Explore ethics of management and decision-making in agriculture and agricultural business. Discuss and debate proper ethical behavior in these issues and situations and the relationship between business and personal ethical behavior.

ECON 3640: Rural Property Appraisal

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 1010

Use of income capitalization, sales comparison and cost appraisal concepts in appraising agricultural resources. Application of underlying economic/business/management principles, especially present value, as they relate to farmland appraisal. Determination and estimation of economic impacts of special consideration and property use factors. Evaluate feasibility and profitability of investment in rural property.

ECON 3710: Introductory Econometrics

Credits: 4. Contact Hours: Lecture 4.

Prereq: ECON 3010 AND (STAT 3260 or STAT 3410)

Introduction to the models and methods used to estimate relationships and test hypotheses pertaining to economic variables. Among the topics covered in the course are: Single and multiple regression analysis; functional forms; omitted variable analysis; multicollinearity; heteroskedasticity; autocorrelation; simultaneous equations; and dynamic models. (Typically Offered: Fall, Spring)

ECON 3760: Rural, Urban and Regional Economics

(Cross-listed with CRP 3760).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 1010

Firm location with respect to regional resources, transport, scale economies, externalities, and policies. Measures of local comparative advantage and specialization. Spatial markets. Population location considering jobs, wages, commuting, and local amenities. Business, residential, and farm land use and value. Migration. Other topics may include market failure, regulation, the product cycle, theories of rural and urban development, developmental policy, firm recruiting, local public goods and public finance, schools, poverty, segregation, and crime.

ECON 3800: Energy, Environmental and Resource Economics

(Cross-listed with ENVS 3800).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 1010

Natural resource availability, use, conservation, and government policy, with emphasis on energy issues. Environmental quality and pollution control policies.

ECON 3820X: Climate Economics

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 1010

Application of economic concepts to understand implications of climate change. Topics covered will include economic costs and benefits of climate mitigation and adaptation; efficiency and distributional dimensions of climate policy; and current topics in climate and energy policy. (Typically Offered: Fall)

ECON 3830X: Economics of Innovation

Credits: 3.

Prereq: ECON 1010

Key concepts in the economics of innovation. Definition and measure of innovation; useful mental frameworks in understanding innovation; factors that drive innovation; and policies and actions that impact direction and rate of innovation. (Typically Offered: Fall)

ECON 3850: Economic Development

(Cross-listed with GLOBE 3850).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 1020

Current problems of developing countries, historical experiences and interrelationships between developed and developing countries, theories of economic growth and economic development, measurements and predictions of economic performance of developing countries, and alternative policies and reforms for economic development. Topics to include poverty, income inequality, population growth, and environmental and economic development. Meets International Perspectives Requirement.

ECON 3870: Economies of China and India

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 1010

The economic development of China and India within the larger historical, political, and socioeconomic contexts. The characteristics of the development paths of major industries. The drivers of and impediments for future economic development. The two economies' connections with the world economy. Meets International Perspectives Requirement.

ECON 3980: Cooperative Education

Credits: Required. Repeatable.

Prereq: Permission of Department Cooperative Education Coordinator; Junior classification

Required of all cooperative education students. Students must register for this course prior to commencing each work period.

ECON 4010: Topics in Microeconomics

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 3010 and STAT 2260

Advanced treatment of selected topics from one or more of the following areas: household production models, factor markets, game theory and imperfect competition, general equilibrium, intertemporal choice, asset markets, income distribution, externalities and public goods, etc.

ECON 4020: Topics in Macroeconomics

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 3020 or ECON 3530

Advanced treatment of selected topics from one or more of the following areas: business cycle theory, growth theory, fiscal and monetary policy, coordination issues, open economy macroeconomics, and financial economics.

ECON 4100X: Experimental Economics

Credits: 3. Contact Hours: Lecture 3.

Introduction to experimental economics and major subject areas addressed by laboratory and field experiments. Topics include an introduction to the technique of using laboratory experimental methods to test economic theories, understanding economic behavior, and conducting field experiments. Additional topics will introduce students to human subjects review, experimental design, writing a literature review, and the study of a series of experiments: markets, individual decision-making, asset markets, behavioral game theory, and neuroeconomics.

ECON 4160: Industrial Organization

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 3010

Study of the structure of firms and markets and of their interaction, with emphasis on imperfectly competitive markets. Behavior of firms in strategic settings and insights of basic game-theoretic models. Welfare implications of alternative market organizations, consequences of market power, and scope for government regulation and antitrust/competition policies. Topics include monopoly and price discrimination, oligopoly models, product quality, product differentiation, vertical integration, information and advertising, patents, R&D and innovation, and regulation.

ECON 4180: Introduction to Game Theory

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 3010

Systematic introduction to game theory and its uses in economics. Develops the basic framework, models and tools necessary to analyze games of strategy, including: Strategic and extensive-form representations of games; best response functions and Nash equilibrium, mixed strategies backward induction and subgame-perfect equilibrium, imperfect and incomplete information, Bayesian and sequential equilibria. Examples and applications taken from economics, business, political science, law and biology.

ECON 4310: Managerial Economics

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 3010

Theory of the firm; organizational incentives and efficiency; moral hazard; role of information and decision making under uncertainty; ownership and control; business investment.

ECON 4350: Analysis of Food Markets

(Cross-listed with FSHN 4350).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 3010 and STAT 2260

Food market analysis from an economics perspective; food markets and consumption; methods of economic analysis; food industry structure and organization; food and agriculture regulations; labeling; consumer concerns; agricultural commodity promotion. Final project required. (Typically Offered: Spring)

ECON 4370: Commodity Marketing and Risk Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 2350 AND ECON 3010 AND (ECON 2710 or STAT 3260)

The purpose and performance of commodity markets. How commodity marketing institutions function. Merchandising arrangements. Distinguishing features of agricultural commodities. Hedging, arbitrage, and speculation in commodity spot, forward, futures, and options markets. Valuation theory.

ECON 4500X: Economic Growth

Credits: 3. Contact Hours: Lecture 3.

A theoretical and empirical examination of economic growth and income differences between countries. Focuses on both the historical experience of countries that are currently rich and the process of catch-up, or stagnation, among poor countries. Topics include population growth, accumulation of physical and human capital, technological change, natural resources, income distribution, geography, government, and culture. Meets International Perspectives Requirement. (Typically Offered: Fall)

ECON 4550: International Trade

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 3010

Rigorous treatment of theories of international trade and international factor movements. Examination of the impact of trade and labor migration on domestic and world welfare and on the distribution of income. Theoretical analysis of government policies towards trade and factor movements, including quotas, tariffs, free trade areas and immigration restrictions. Discussion of contemporary issues and controversies concerning globalization, including multinational firms and labor migration. Meets International Perspectives Requirement.

ECON 4570: International Finance

(Dual-listed with ECON 5570).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 3020

National income accounting and balance of payments; foreign exchange rates and exchange rate markets; money, interest rates, and exchange rate determination; prices, exchange rates, and output in the short run; international monetary arrangements; fixed versus flexible exchange rates; optimal currency areas; international capital flows; currency and financial crises in emerging markets. Graduation Restriction: Retrieving data. Wait a few seconds and try to cut or copy again. Meets International Perspectives Requirement.

ECON 4600: Agricultural, Food, and Trade Policy

(Dual-listed with ECON 5600).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 3010 or ECON 5010

Description and analysis of economic problems of U.S. agriculture. Explanation and economic analysis of government policies and programs to develop agriculture, conserve agricultural resources, address consumer food concerns, stabilize farm prices, and raise farm incomes. The influence of macropolicy, world economy, international trade, and bioenergy on U.S. agriculture.

ECON 4660: Agricultural Finance

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 3010; FIN 3010; STAT 2260

Financial analysis of agricultural businesses; liquidity, capital structure, and growth and risk of agricultural firms; capital budgeting methods; analysis of land investments, leasing, and costs of credit; financial intermediation and major financial institutions for agriculture; borrower-lender relationships, and asset-liability management techniques by financial intermediaries; public policies affecting agricultural credit markets. ECON 3530 recommended.

ECON 4800: Intermediate Environmental and Resource Economics

(Dual-listed with ECON 5800).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 3010

Theories of natural resource utilization and allocation. Externalities, public goods, and environmental quality. Renewable energy, biofuels, land use change and life cycle analysis of carbon, and sustainability and resource conservation. Methodologies for analyzing natural resource and environmental problems and evaluating resource policies.

ECON 4900: Independent Study

Credits: 1-3. Repeatable, maximum of 4 credits.

Prereq: Junior or Senior classification; 14 credits in ECON; Permission of Instructor

Graduation Restriction: No more than 9 credits of ECON 4900 may be used toward graduation.

ECON 4900E: Independent Study: Entrepreneurship

Credits: 1-5. Repeatable, maximum of 6 credits.

Prereq: Junior or Senior classification; 14 credits in ECON; Permission of Instructor

Graduation Restriction: No more than 9 credits of ECON 4900 may be used toward graduation.

ECON 4900H: Independent Study: Honors

Credits: 1-5. Repeatable, maximum of 6 credits.

Prereq: Junior or Senior classification; 14 credits in ECON; Permission of Instructor: Membership in the University Honors Program

Graduation Restriction: No more than 9 credits of ECON 4900 may be used toward graduation.

ECON 4920: Graduating Senior Survey

Credits: Required. Contact Hours: Lecture 1.

Final preparations for graduation. The final stages of job searching, interviewing, letter writing, and resume preparation. Outcomes assessment information from graduating seniors including opinion surveys, instructor/advisor/course evaluations, exit interviews, student accomplishment surveys, job placement surveys, and comprehensive skills examinations. Departmental recognition of graduating seniors. Life as an alumnus - expectations and obligations. Convocation and commencement information. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

ECON 4950: Economics Domestic Travel Course

Credits: 1-3. Contact Hours: Lecture 4.

Prereq: Permission of Instructor; Sophomore classification

Tour and study of domestic businesses, markets, and economic institutions located outside Iowa to expose students to the diversity of activities within the U.S. economy. Pre-trip sessions arranged. Locations and duration of tours will vary.

ECON 4960: Economics International Travel Course

Credits: 1-3. Repeatable.

Prereq: Sophomore classification

Tour and study of international agricultural and/or nonagricultural economies, markets, and institutions. Locations and duration of tours will vary. Limited enrollment. Meets International Perspectives Requirement.

ECON 4970X: Agricultural Business Capstone

Credits: 3.

Students admitted into this experiential course will act as consultants to an agricultural business, consortium, or trade organization to execute an innovation project. Students are mentored through a process for developing and executing the consulting project, where they assimilate knowledge from other courses as they analyze new business/market opportunities. Students will develop insights through idea/concept articulation, opportunity assessment, customer needs analysis, value proposition, and financial modeling which will coalesce into a final summary report and presentation to present to the sponsor organization at the end of the semester.

ECON 4980: Cooperative Education

Credits: Required. Repeatable.

Prereq: Permission of Department Cooperative Education Coordinator; Senior classification

Required of all cooperative education students. Students must register for this course prior to commencing each work period.

Courses primarily for graduate students, open to qualified undergraduates:

ECON 5000: Quantitative Methods in Economic Analysis I

Credits: 4. Contact Hours: Lecture 4.

Prereq: Graduate Standing or Permission of Instructor

Economic applications of selected mathematical and statistical concepts: linear models and matrix algebra; differential calculus and optimization; integral calculus and economic dynamics; probability distributions, estimation, and hypothesis testing in the analysis of economic data. The best math preparation is a full year of calculus. (Typically Offered: Fall)

ECON 5010: Microeconomics

Credits: 4. Contact Hours: Lecture 4.

The theory of the consumer, theory of the firm, perfect and imperfect competition, welfare economics, and selected topics in general equilibrium and uncertainty. (Typically Offered: Fall)

ECON 5020: Macroeconomics

Credits: 4. Contact Hours: Lecture 4.

Prereq: Graduate Standing or Permission of Instructor

Models of aggregate supply and demand, theories of consumption and investment, money supply and demand, inflation, rational expectations, stabilization policy, financial markets, and international finance. (Typically Offered: Fall)

ECON 5090: Applied Numerical Methods in Economics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Use of numerical techniques to solve economic problems. Numerical differentiation and integration numeric solutions of systems of equations, static and dynamic optimization problems including unconstrained optimization, maximum likelihood methods, general nonlinear programming methods, dynamic programming and optimal control, numerical methods for solving functional equations.

ECON 5100: Experimental Economics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to experimental economics and major subject areas addressed by laboratory and field experiments. Exploration of experimental methods by concentrating on series of experiments. Applications include individual decision-making, behavioral game theory, markets, behavioral labor, public and development economics, social network, and neuroeconomics. Research project.

ECON 5110X: Research Seminar in Experimental Economics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Design, conduct, interpret, and report on economic experiments. Preparation of a potentially publishable experimental research paper. Topics vary according to student interest. (Typically Offered: Fall)

ECON 5200: Labor Supply and Human Capital Formation

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Labor supply decisions and empirical analysis for agricultural operators and other self-employed and wage-earning households; multiple job holding; resource allocation in productive households; human capital formation by households, firms, and public institutions, which includes schooling, on-the-job training, migration, health, research, raising of children, and implications for household income and welfare; applications to problems in rural areas of developing and developed countries.

ECON 5310: Trends Impacting Agri-Food Businesses

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Explore trends impacting agricultural and food businesses. Video interviews with a range of entrepreneurs, investors and industry experts will expose students to a variety of ideas and opinions on the most important trends and issues impacting the future structure of agri-food markets and explore the implications for agri-food businesses. In addition, students will be challenged to develop their own ideas about how these trends will impact their business and career. (Typically Offered: Fall)

ECON 5320: Managerial Economics for the Global Organization

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Applications of microeconomic theory and decision analysis for firms operating in U.S. and internationally. Topics include demand & supply, consumer choice theory, production and cost theory, short run and long run business decisions, input cost and human capital differences across countries, empirical estimation of demand and supply, pricing, exchange rates, government and business, market structures and strategy.

ECON 5370: Commodity Markets: Analysis and Strategy

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Analysis of exchange-traded and over-the-counter commodity markets, their functions and performance. Evaluation of hedging, speculation, and arbitrage strategies. Commodity transformation over space and time. Valuation of derivatives and comparison with derivatives on financial assets. Efficiency and the role of information in commodity markets. Market regulation.

ECON 5450: Public Economics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Economic justifications for government activities; illustrative theoretical and empirical analyses of expenditure programs; foundations of excess burden, incidence analysis, and optimal taxation; effects of taxation on labor supply; public goods and externalities; social insurance; introduction to economics of the health sector with an emphasis on the role of market failures.

ECON 5570X: International Finance

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

National income accounting and balance of payments; foreign exchange rates and exchange rate markets; money, interest rates, and exchange rate determination; prices, exchange rates, and output in the short run; international monetary arrangements; fixed versus flexible exchange rates; optimal currency areas; international capital flows; currency and financial crises in emerging markets. Graduation Restriction: Retrieving data. Wait a few seconds and try to cut or copy again. Meets International Perspectives Requirement.

ECON 5600: Agricultural, Food, and Trade Policy

(Dual-listed with ECON 4600).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Description and analysis of economic problems of U.S. agriculture. Explanation and economic analysis of government policies and programs to develop agriculture, conserve agricultural resources, address consumer food concerns, stabilize farm prices, and raise farm incomes. The influence of macroeconomic policy, world economy, international trade, and bioenergy on U.S. agriculture. (Typically Offered: Fall, Spring, Summer)

ECON 5710: Intermediate Econometrics

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Single and multiple equation regression models; dummy explanatory variables; serial correlation; heteroskedasticity; distributed lags; qualitative dependent variables; simultaneity. Use of econometric models for tests of economic theories and forecasting. (Typically Offered: Spring)

ECON 5760: Spatial Economics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Analysis of location choice by firms, employees, and households emphasizing the role of spatial variations in agglomeration economies, economies of scale, distance, transport, endowments, amenities, and local government. Models of land use, urban form, spatial competition, central place theory, and migration. Techniques of discrete choice analysis, statistical analysis of categorical data, urban system modeling, and interregional computable general equilibrium.

ECON 5800: Intermediate Environmental and Resource Economics

(Dual-listed with ECON 4800).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Theories of natural resource utilization and allocation. Externalities, public goods, and environmental quality. Renewable energy, biofuels, land use change and life cycle analysis of carbon, and sustainability and resource conservation. Methodologies for analyzing natural and environmental problems and evaluating resource policies. (Typically Offered: Fall, Spring, Summer)

ECON 5810: Advanced Environmental Economics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Interrelationships of natural resource use and the environment. Applied welfare and benefit-cost analyses. Externalities and pollution abatement. Nonmarket valuation of resources. Property rights. Legal and social constraints. Policy approaches.

ECON 5900: Special Topics

Credits: 1-5. Repeatable.

Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

ECON 5940: Research Methods in Economics I

Credits: 1. Contact Hours: Lecture 1.

Prereq: Graduate Standing or Permission of Instructor

Introduction to methods used in empirical economic research.

Formulation of well-posed economic questions, locating and evaluating relevant literature, and meaning of testable hypotheses. (Typically Offered: Fall)

ECON 5950: Research Methods in Economics II

Credits: 1. Contact Hours: Lecture 1.

Prereq: Graduate Standing or Permission of Instructor

Develop skills required to successfully acquire, manipulate and analyze data that can be used for conducting empirical economic research.

Topics include research design, developing workflows that support reproducible analysis, data visualization and related issues. Hands on work with one or more example data sets to gain experience and confidence in using statistical software and interpreting the results of this analysis. (Typically Offered: Spring)

ECON 5960: Research Methods in Economics III

Credits: 1. Contact Hours: Lecture 1.

Prereq: Graduate Standing or Permission of Instructor

Formulation of the research question, problem identification, literature review, data identification, formulation and testing of hypotheses, and presentation of research results. Lectures will build on assigned readings, and cover components of applied economic research, and writing skills. Student research presentations and lectures by invited speakers. Students develop their creative component in a "hands on" environment where the instructor and others can offer guidance. (Typically Offered: Spring)

ECON 5990: Creative Component

Credits: 1-5. Repeatable.

Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

Courses for graduate students:**ECON 6010: Microeconomic Analysis I**

Credits: 4. Contact Hours: Lecture 4, Discussion 1.

Economic theory and methodology; theory of consumer behavior; theory of the competitive firm, supply and factor demand; duality relations in consumer and producer theory, welfare change measures; partial equilibrium analysis, perfect competition, monopoly; choice under uncertainty, the expected utility model, risk aversion; insurance, portfolio and production decisions under risk. (Typically Offered: Fall)

ECON 6020: Macroeconomic Analysis

Credits: 4. Contact Hours: Lecture 4, Discussion 1.

Neoclassical aggregate growth models; the overlapping generations model; endogenous growth models; equilibrium business cycle theories; equilibrium job search and matching; models of money; fiscal and monetary policy; income and wealth distribution. (Typically Offered: Spring)

ECON 6030: Microeconomic Analysis II

Credits: 4. Contact Hours: Lecture 3, Discussion 1.

General equilibrium analysis, efficiency, and welfare; market failures, externalities, and the theory of the second best; introduction to game theory; adverse selection, signaling, screening and moral hazard. (Typically Offered: Spring)

ECON 6040: Advanced Macroeconomic Analysis

Credits: 4. Contact Hours: Lecture 4, Discussion 1.

Topics will be selected from: new Keynesian approaches to business cycle theory; endogenously generated business cycles; models of credit and financial intermediation; mechanism design and time inconsistency issues; political economy models; heterogeneous-agent models with strategic interaction; path dependence, network effects, and lock-in; economies as evolving self-organizing systems. (Typically Offered: Fall)

ECON 6060: Advanced Topics in Macroeconomics

Credits: 3. Contact Hours: Lecture 3.

Selected topics in macroeconomic theory of current significance to the profession.

ECON 6150: Industrial Organization I

Credits: 3. Contact Hours: Lecture 3.

Introduction to industrial organization theory and game-theoretic methods. Monopoly and price discrimination. Oligopoly theory and product differentiation. Quality and asymmetric information. Research & development and innovation. Introduction to empirical methods in industrial organization. Discrete choice models of product differentiation. Cost and production functions. Entry, exit, and dynamic equilibrium models.

ECON 6180: Game Theory

Credits: 3. Contact Hours: Lecture 3.

Theoretical analysis and applications of strategic games, extensive form games, and cooperative games. Nash equilibrium, correlated equilibrium, Bayesian games, subgame perfect equilibrium, the core, evolutionary equilibrium, repeated games with finite automata, and common knowledge.

ECON 6210: Advanced Labor Demand and Labor Markets

Credits: 3. Contact Hours: Lecture 3.

Analysis of labor demand, job search and matching, unemployment, market determination of wages, compensating differentials, employment contracts and incentives, wage inequality and discrimination, effects of minimum wage legislation, occupation choice, labor unions. (Typically Offered: Spring)

ECON 6410: Agricultural Economics I

Credits: 3. Contact Hours: Lecture 3.

Advanced treatment of selected topics and models in agricultural economics, with policy analysis applications. Topics include: farm-level input and output choices; decision making under uncertainty; supply analysis, storage and commodity markets; risk management and hedging; crop insurance; credit markets; farmland prices; market integration.

ECON 6420: Agricultural Economics II

Credits: 3. Contact Hours: Lecture 3.

Advanced treatment of selected topics and models in agricultural economics, with policy analysis applications. Topics include: demand systems for food and agricultural goods; imperfect competition and market power in agriculture; contracts; economics of R&D and innovation; quality and product differentiation; equilibrium models for agricultural policy analysis.

ECON 6530: Financial Economics

Credits: 3. Contact Hours: Lecture 3.

Review of decision-making under uncertainty. Portfolio Theory. Theoretical foundations of asset valuation models: capital asset pricing model (CAPM), arbitrage pricing theory (APT), representative agent models, pricing of derivative securities. Complete and incomplete asset markets, credit markets, financial intermediaries, the role of government in the financial sector. Market frictions, crashes, bubbles. Applications of asset valuation models, with emphasis on their testable implications.

ECON 6550: International Trade

Credits: 3. Contact Hours: Lecture 3.

Theories of international trade; welfare and distributional aspects of trade and commercial policies. Optimal trade policies in the presence of domestic distortions; strategic trade policy; international trade and economic growth.

ECON 6570: International Finance

Credits: 3. Contact Hours: Lecture 3.

The intertemporal approach to current account determination; non-traded goods and the real exchange rate; fiscal policy in the open economy; monetary approach to balance of payments and exchange rate determination; sticky price models of the open economy; exchange-rate based stabilizations; capital inflows; financial and balance of payments crises; international business cycles.

ECON 6710: Econometrics I

Credits: 4. Contact Hours: Lecture 4, Discussion 1.

Probability and distribution theory for univariate and multivariate normal random variables, introduction to the theory of estimators for linear models, hypothesis testing and inference, introduction to large sample properties of estimators; derivation of common estimators and their properties for the classical and general multiple regression models, hypothesis testing, forecasting, implications of specification errors - missing data, left-out regressors, measurement error, stochastic regressors. (Typically Offered: Fall)

ECON 6720: Econometrics II

Credits: 4. Contact Hours: Lecture 4, Discussion 1.

Identification, estimation, and evaluation of systems of simultaneous equations; qualitative choice and limited dependent variable models; introduction to time series methods and applications, including alternative variance specifications. (Typically Offered: Spring)

ECON 6730: Microeconometrics

Credits: 3. Contact Hours: Lecture 3.

Econometric treatment of models arising in microeconomic applications. Methods are primarily concerned with the analysis of cross-section data. Topics may include: systems of demand equations in panel data settings, random utility models of discrete choices, production possibilities frontier estimation, and discrete/continuous models of participation and consumption.

ECON 6740: Macroeconometrics

Credits: 3. Contact Hours: Lecture 3.

Time-series econometric techniques and their application to macroeconomics and financial markets. Techniques may include GARCH and ARCH-M models, unit-root tests, nonlinear adjustment models, structural VARs, and cointegration tests.

ECON 6800: Advanced Resource Economics

Credits: 3. Contact Hours: Lecture 3.

Dynamic allocation of scarce, exhaustible, and renewable natural resources, including minerals and energy, soil, water, forests, and fish. Social versus private decisions. Market and nonmarket considerations. Technological change. Regulation. Dynamics and uncertainty.

ECON 6900: Advanced Topics

Credits: 1-5. Contact Hours: Lecture 5.

Repeatable.

Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

ECON 6940A: Research Workshop

Credits: 3. Contact Hours: Lecture 3.

Prereq: Instructor Permission for Course

Instruction in basic and applied research methods commonly used in economics. Survey methodologies, critique written work, summarize and evaluate data, prepare and present work orally, and develop an original research paper. Satisfactory-fail only. (Typically Offered: Fall)

ECON 6940B: Research Workshop

Credits: 3. Contact Hours: Lecture 2, Discussion 1.

Prereq: ECON 6940A

Writing and communicating economic research. Continuation of ECON 6940A, resulting in completion of an original research paper. Satisfactory-fail only. (Typically Offered: Spring)

ECON 6990: Research for Thesis or Dissertation

Credits: 1-30. Repeatable.

Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

Education (EDUC)

Courses primarily for undergraduates:

EDUC 2010: Educational Technologies in the PK-6 Classroom

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Overview of ways to use educational technologies to support instruction in PK-6 settings. Focus on pedagogical approaches that integrate technologies to support learning in the content areas. Laboratory experiences include development of activities to use web 2.0 tools, apps, multimedia, web page development, digital video and other technologies to facilitate learning and teaching. (Typically Offered: Fall, Spring)

EDUC 2020: Educational Technologies in the 7-12 Classroom

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Overview of ways to use educational technologies to support instruction in 7-12 settings. Focus on pedagogical approaches that integrate technologies to support learning in the content areas. Laboratory experiences include development of activities to use tool software, multimedia, web page development, digital video and other technologies to facilitate learning and teaching. (Typically Offered: Fall, Spring)

EDUC 2040: Social Foundations of Education in the United States: Secondary

Credits: 3. Contact Hours: Lecture 3.

Introduction to the historical and contemporary landscape of schooling in the United States. Emphasis is placed on topics and tensions in the relationship between school and society (e.g. equity of access to education and competing purposes of education) and the implications of these topics and tensions for teaching and learning at the secondary level in public schools. For prospective teachers in an ISU Secondary Educator Preparation program; open to students who are considering teaching and/or work in education as a career path. (Typically Offered: Fall, Spring, Summer)

EDUC 2050: Social Foundations of Education in the United States: Early Childhood and Elementary Education

Credits: 3. Contact Hours: Lecture 3.

Introduction to the historical and contemporary landscape of schooling in the United States. Emphasis on topics and tensions in the relationship between school and society (e.g., equity of access to education and competing purposes of education) and the implications of these topics and tensions for teaching and learning in public schools. Student in K-12 education, or a non-education major should take EDUC 2040. (Typically Offered: Fall, Spring)

EDUC 2160: Learning Community Orientation to Teacher Education

Credits: 1. Contact Hours: Lecture 1.

Learning Community for Elementary Education majors to help with their transition to university life. Offers an overview of K-8 teacher certification in Iowa as well as degree and career planning. With the help of guest speakers and peer mentors students learn about elementary teaching as a profession and are introduced to a social justice orientation to teaching. All first semester freshman Elementary Education majors are required to register. Open to those interested in pursuing education. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

EDUC 2190: Orientation to Teacher Education: English, FCS, History, Math, Science and World Language Majors

Credits: 1. Contact Hours: Lecture 1.

Overview of English, mathematics, science, family and consumer sciences and history, and world language and cultures secondary education (grades 5-12), teacher licensure requirements in Iowa and other states. Program and career planning. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

EDUC 2450: Landscape of Teaching

Credits: 3. Contact Hours: Lecture 3.

Prereq: EDUC 2050; sophomore classification.

Introduction to the landscape of teaching including the exploration of outside influences that impact schools, classroom structures (including classroom management systems) that help classrooms function efficiently and effectively, and instructional planning (basic lesson design and assessment) that addresses state standards and students' needs. Open to students majoring in Elementary Education or Early Childhood Education. (Typically Offered: Fall, Spring)

EDUC 2750: International Travel Study - Pre-departure Orientation

Credits: 1. Contact Hours: Lecture 1.

Repeatable, maximum of 1 credits.

Orientation to the international travel study, offered during the semester preceding the trip. (Typically Offered: Spring)

EDUC 2800A: Pre-Student Teaching Experience

Credits: 1-2. Contact Hours: Lecture 0.4.

Repeatable.

Prereq: Admitted to the Educator Preparation Program

Pre-Student teaching experience in school settings. Two, half days per week needed for school experience. Clinical Experience Level 2 or 3. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

EDUC 2800B: Pre-Student Teaching Experience I: Educational Technologies

Credits: 1.

Prereq: EDUC 2010 or EDUC 2020 or EDUC 2030

Pre-Student teaching experience with technologies in various educational settings with K-12 technology leaders. 2 1/2-hour blocks of time needed. Clinical Experience Level 1. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

EDUC 2800I: Pre-Student Teaching Experience I: Mild/Moderate Disabilities

Credits: 1. Repeatable.

Pre-Student teaching experience in mild/moderate disabilities in school settings. One, half-day per week needed for school experience. Clinical Experience Level 1. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

EDUC 2800J: Pre-Student Teaching Experience I: Mathematics Clinic

Credits: 1. Repeatable.

Early field experience where students explore and develop an understanding of research-based instructional practices that could be implemented with middle level students to teach mathematical concepts. Clinical Experience Level 1. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

EDUC 2800K: Pre-Student Teaching Experience I: Music

(Cross-listed with MUSIC 2800K).

Credits: 0.5. Repeatable.

Pre-student teaching experience in music in school settings. Permission of Music coordinator required prior to enrollment. Clinical Experience Level 1. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

EDUC 2800L: Pre-Student Teaching Experience I: Secondary Education

Credits: 0.5. Repeatable.

Pre-student teaching experience for secondary education students in school settings. One, half-day per week needed for school experience. Clinical Experience Level 1. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

EDUC 2800N: Pre-Student Teaching Experience I: Elementary Education

Credits: 0.5-1. Contact Hours: Laboratory 1.5, Lecture 0.5.

Repeatable.

Pre-student teaching experience for students in school settings. One, half-day per week needed for school experience. Clinical Experience Level 1. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

EDUC 2800O: Pre-Student Teaching Experience 1: Art Education

Credits: 1. Repeatable.

Pre-student teaching experience in art education in school settings. 2 1/2-hour blocks of time needed. Clinical Experience Level 1. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

EDUC 2800S: Pre-Student Teaching Experience I: English as a Second Language (ESL)

Credits: 1. Repeatable, maximum of 1 credits.

Prereq: Admitted to the Educator Preparation Program

Pre-student teaching experience in English as a Second Language. One, half-day per week needed for school experience. Graduation Restrictions: EDUC 2800 may be taken more than once for credit toward graduation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

EDUC 2800T: Pre-Student Teaching Experience I: Tutoring

Credits: 1. Repeatable.

Pre-student teaching experience tutoring in a school setting focused on mathematics, literacy, and/or other content areas. Clinical Experience Level 1. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

EDUC 2900: Independent Study

Credits: 1-3. Repeatable.

Prereq: 6 credits in Education, permission of instructor

Independent study, under faculty supervision, of a topic in the field of education. (Typically Offered: Fall, Spring, Summer)

EDUC 3020: Principles and Practices of Learning with Technology

Credits: 3. Contact Hours: Lecture 3.

Prereq: EDUC 2010 or EDUC 2020 or EDUC 2030

Advanced integration of learning technologies into PK-12 educational contexts. Examine current trends in using learning technologies with PK-12 students; explore current applications used in formal and informal educational settings; and discuss issues focused on technology use in education. Required for Learning Technologies Minor. (Typically Offered: Spring)

EDUC 3150: Transfer Orientation

Credits: 1. Contact Hours: Lecture 1.

Offers an overview of Elementary Education requirements, university procedures, K-8 certification in Iowa as well as degree and career planning. With the help of guest speakers students learn about elementary teaching as a profession and are introduced to a social justice orientation to teaching. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

EDUC 3320: Educational Psychology of Early Childhood and Elementary Education

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 2300 or HDFS 1020, major in Early Childhood Education or Elementary Education

Psychological theories relevant to student development, learning, and motivation. Review of assessment principles and practices. Implications of theory for teaching children and for assessing learning in educational settings with primary and intermediate grade children. (Typically Offered: Fall, Spring)

EDUC 3330: Educational Psychology

(Cross-listed with PSYCH 3330).

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 2300 or HDFS 1020

Psychological theories relevant to student development, learning, and motivation. Review of assessment principles and practices. Implications of theory for teaching children and for assessing learning in K-12 educational settings, with an emphasis on grades 5 - 12. (Typically Offered: Fall, Spring)

EDUC 3470: Nature of Science

(Dual-listed with EDUC 5470).

Credits: 3. Contact Hours: Lecture 3.

The history, philosophy, and sociology of science, how scientific knowledge differs from other forms of knowledge, and the relationship of the Nature of Science to science teaching and learning.

EDUC 3550X: Teaching Multilingual Learners

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 2 times.

Focus on in teaching in schools and/or community agencies serving multilingual populations. Topics include: theories of first and second language acquisition, translanguaging, language policies and laws, strategies for teaching academic content in the mainstream classroom, creating classroom/school cultures that invite all students into learning, and the role of advocacy and professional collaboration in educational equity & excellence. (Typically Offered: Spring)

EDUC 3690X: Dilemmas in Education

Credits: 3. Contact Hours: Lecture 3.

Exploration of dilemmas in education that revolve around issues of the societal value placed on P-20 education, as the value placed on the students and professionals who work in the field, and the educational challenges facing society and individuals. Analysis, critique, and discussions will integrate current topics, historical context, and social, political, and cultural impacts within P-20 education systems. (Typically Offered: Fall, Spring)

EDUC 3700: Toying with Technology

Credits: 3.

Prereq: EDUC 2010 or EDUC 2030

Integration of learning technologies into PK-12 STEM contexts with a focus on engineering design and computational thinking. Examine current trends and explore how technology can be used to design creative and innovative hands-on experiences that promote computational thinking and problem-solving skills across STEM-related educational contexts. (Typically Offered: Fall, Spring)

EDUC 3770: Foundations of Literacy

Credits: 4. Contact Hours: Lecture 4.

Prereq: Elementary Education major, sophomore classification

Foundations of literacy development and research related to science-based literacy instruction and strategies pertinent to teaching reading, writing, listening, and speaking in the elementary classroom. (Typically Offered: Fall, Spring, Summer)

EDUC 3780: Methods for Teaching Literacy in the Elementary Classroom

Credits: 4. Contact Hours: Lecture 4.

Prereq: EDUC 3770; Admitted into the Educator Preparation Program

Methods and processes of literacy instruction. Application through reading and writing across the curriculum aligned to scientific-based literacy instruction, integration of language arts, literature-based instruction, and metacognitive strategies. (Typically Offered: Fall, Spring, Summer)

EDUC 3800A: Pre-Student Teaching Experience II: Core Experience

Credits: 1-2. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Admitted to the Educator Preparation Program

Pre-student teaching experience in school setting. Two, half-days per week needed for school experience. Clinical Experience Level 2. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

EDUC 3800B: Pre-Student Teaching Experience II: Physical Science, Chemistry or Physics

Credits: 1-2. Repeatable, maximum of 2 credits.

Prereq: Admitted to the Educator Preparation Program

Pre-student teaching experience in physical science, chemistry, or physics. Two, half-days per week needed for school experience. Clinical Experience Level 2. Graduation Restriction: EDUC 3800 may be taken more than once for credit toward graduation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

EDUC 3800D: Pre-Student Teaching Experience II: Biological Sciences

Credits: 1-2. Repeatable, maximum of 2 credits.

Prereq: Admitted to the Educator Preparation Program

Pre-student teaching experience in biological sciences. Two, half-days per week needed for school experience. Clinical Experience Level 2. Graduation Restriction: EDUC 3800 may be taken more than once for credit toward graduation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

EDUC 3800J: Pre-Student Teaching Experience II: Earth Sciences

Credits: 1-2. Repeatable, maximum of 2 credits.

Prereq: Admitted to the Educator Preparation Program

Pre-student teaching experience in earth science. Two, half-days per week needed for school experience. Clinical Experience Level 2. Graduation Restriction: EDUC 3800 may be taken more than once for credit toward graduation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

EDUC 3800K: Pre-Student Teaching Experience II: Music

(Cross-listed with MUSIC 3800K).

Credits: 1-2. Contact Hours: Lecture 1, Studio 8.

Prereq: Admitted to the Educator Preparation Program

Participation in a K-12 school setting. Permission of Music coordinator required prior to enrollment. Clinical Experience Level 2. Offered on a satisfactory-fail basis only.

EDUC 3800S: Pre-Student Teaching Experience II: English as a Second Language (ESL)

Credits: 1. Repeatable, maximum of 1 credits.

Prereq: Admitted to the Educator Preparation Program

Pre-student teaching experience in English as a Second Language. One, half-day per week needed for school experience. Clinical Experience Level 2. Graduation Restriction: EDUC 3800 may be taken more than once for credit toward graduation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

EDUC 3800V: Pre-Student Teaching Experience in FCS Education

(Cross-listed with FCEDS 3800V).

Credits: 1-2. Contact Hours: Laboratory 2.

Repeatable.

Prereq: Admission to Educator Preparation program AND Credit or concurrent enrollment in FCEDS 3060.

Clinical Experience Level II in culinary, fashion design, housing, and/or human development courses related to Family & Consumer Sciences at the secondary level. Includes 24 hours practicum: unsupervised. 1/2 day of time needed in schedule. Offered on a satisfactory-fail basis only. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

EDUC 3950: Teaching Disciplinary Literacy

(Dual-listed with EDUC 5950).

Credits: 3. Contact Hours: Lecture 3.

Prereq: EDUC 2040; junior classification

Analysis and application of strategies to enhance students' disciplinary literacy development in middle and secondary school setting. Research paper related to a course topic for EDUC 5950. (Typically Offered: Fall, Spring, Summer)

EDUC 4050: Teaching and Learning in a Pluralistic Society: Early Childhood and Elementary

Credits: 3. Contact Hours: Lecture 3.

Prereq: Admitted to the Educator Preparation Program

Exploration of education at the levels of self, teaching, and systems; multicultural concepts and theories; awareness of context of cultural groups - their history, perspective, needs, and contributions; problems and issues regarding prejudice, and discrimination based on race, ethnicity, socioeconomic class, gender, sexual identity and language in the school environment. Special attention is given to enacting culturally relevant teaching in grades PK through 6, along with curriculum transformation and social action in those grades. Restricted to those enrolled in Early Childhood and Elementary Education Programs. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall, Spring)

EDUC 4060: Teaching and Learning in a Pluralistic Society: Secondary

Credits: 3. Contact Hours: Lecture 3.

Exploration of education at the levels of self, teaching, and systems; multicultural concepts and theories; awareness of context of cultural groups - their history, perspective, needs, and contributions; problems and issues regarding prejudice, and discrimination based on race, ethnicity, socioeconomic class, gender, sexual identity and language in the school environment. Special attention to culturally relevant teaching in grades 5 through 12, along with curriculum transformation and social action in those grades. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall, Spring, Summer)

EDUC 4070: Online Education in Pre-K-12 Classrooms: Hybrid, Virtual, and Blended Approaches

Credits: 3. Contact Hours: Lecture 3.

Prereq: EDUC 2010 or EDUC 2030

Preparing educators to develop and sustain learning environments where their students are physically separated from them. Developing flexible and distance learning experiences where Pre- K-12 students expand their knowledge and improve their skills in curricular areas outside of the traditional classroom. Required for the Learning Technologies Minor. (Typically Offered: Fall, Summer)

EDUC 4160A: Supervised Student Teaching - Elementary: Primary grades (K-3)

Credits: 1-30. Repeatable.

Prereq: Admitted to the Educator Preparation Program

Supervised teaching experience in the elementary grades. (Typically Offered: Fall, Spring)

EDUC 4160B: Supervised Student Teaching - Elementary: Intermediate grades (3-6)

Credits: 1-30. Repeatable.

Prereq: Admitted to the Educator Preparation Program

Supervised teaching experience in the elementary grades. (Typically Offered: Fall, Spring)

EDUC 4160D: Supervised Student Teaching - Elementary: International Student Teaching - Primary Grades

Credits: 1-30. Repeatable.

Prereq: Admitted to the Educator Preparation Program

Supervised teaching experience in the elementary grades. (Typically Offered: Fall, Spring)

EDUC 4160E: Supervised Student Teaching - Elementary: International Student Teaching - Intermediate Grades

Credits: 1-30. Repeatable.

Prereq: Admitted to the Educator Preparation Program

Supervised teaching experience in the elementary grades. (Typically Offered: Fall, Spring)

EDUC 4160Z: Supervised Student Teaching - Elementary: English as a Second Language

Credits: 1-30. Repeatable.

Prereq: Admitted to the Educator Preparation Program

Supervised teaching experience in the elementary grades. (Typically Offered: Fall, Spring)

EDUC 4170A: Student Teaching: Social Studies-Middle School

(Dual-listed with EDUC 5170A).

Credits: 1-30. Repeatable.

Prereq: Admitted to the Educator Preparation Program

Evaluation of instruction, lesson planning, and teaching in the liberal arts and sciences. (Typically Offered: Fall, Spring)

EDUC 4170B: Student Teaching: Physical Sciences

(Dual-listed with EDUC 5170B).

Credits: 1-30. Repeatable.

Evaluation of instruction, lesson planning, and teaching in physical sciences grades 5-12. (Typically Offered: Fall, Spring)

EDUC 4170C: Student Teaching: Mathematics

(Dual-listed with EDUC 5170C).

Credits: 1-30. Repeatable.

Prereq: Admitted to the Educator Preparation Program

Evaluation of instruction, lesson planning, and teaching in mathematics grades 5-12. (Typically Offered: Fall, Spring)

EDUC 4170D: Student Teaching: Biological Sciences

(Dual-listed with EDUC 5170D).

Credits: 1-30. Repeatable.

Prereq: Admitted to the Educator Preparation Program

Evaluation of instruction, lesson planning, and teaching in biological sciences grades 5-12. (Typically Offered: Fall, Spring)

EDUC 4170E: Student Teaching: English and Literature

(Dual-listed with EDUC 5170E). (Cross-listed with ENGL 4170E).

Credits: 1-30. Repeatable.

Prereq: Admitted to the Educator Preparation Program

Full-time teaching in secondary English: long term and unit planning, lesson planning, classroom teaching practice in English language arts. (Typically Offered: Fall, Spring)

EDUC 4170F: Student Teaching: Speech

Credits: 1-30. Repeatable.

Prereq: Admitted to the Educator Preparation Program

Evaluation of instruction, lesson planning, and teaching in speech.

EDUC 4170G: Student Teaching: World Language

(Dual-listed with EDUC 5170G/ WLC 5170G). (Cross-listed with WLC 4170G).

Credits: 1-30. Repeatable.

Prereq: Admitted to the Educator Preparation Program

Evaluation of instruction, lesson planning, and teaching in world languages, secondary grades. (Typically Offered: Fall, Spring)

EDUC 4170J: Student Teaching: Earth Sciences

(Dual-listed with EDUC 5170J).

Credits: 1-30. Repeatable.

Prereq: Admitted to the Educator Preparation Program

Evaluation of instruction, lesson planning, and teaching in earth sciences grades 5-12. (Typically Offered: Fall, Spring)

EDUC 4170M: Student Teaching: Science - Basic

(Dual-listed with EDUC 5170M).

Credits: 1-30. Repeatable.

Prereq: Admitted to the Educator Preparation Program

Evaluation of instruction, lesson planning, and teaching in basic sciences grades 5-12. (Typically Offered: Fall, Spring)

EDUC 4170N: Student Teaching: International

(Dual-listed with EDUC 5170N).

Credits: 1-30. Repeatable.

Prereq: Admitted to the Educator Preparation Program

Evaluation of instruction, lesson planning, and teaching in the liberal arts and sciences. (Typically Offered: Fall, Spring)

EDUC 4170P: Student Teaching: Social Studies-High School

(Dual-listed with EDUC 5170P).

Credits: 1-30. Repeatable.

Prereq: Admitted to the Educator Preparation Program

Evaluation of instruction, lesson planning, and teaching in the liberal arts and sciences. (Typically Offered: Fall, Spring)

EDUC 4170R: Student Teaching: Music-Elementary

(Dual-listed with EDUC 5170R/ MUSIC 5170R). (Cross-listed with MUSIC 4170R).

Credits: 1-30. Repeatable.

Prereq: Admitted to the Educator Preparation Program

Evaluation of instruction, lesson planning, and teaching in the liberal arts and sciences. (Typically Offered: Fall, Spring)

EDUC 4170S: Student Teaching: Music-Secondary

(Dual-listed with EDUC 5170S/ MUSIC 5170S). (Cross-listed with MUSIC 4170S).

Credits: 1-30. Repeatable.

Prereq: Admitted to the Educator Preparation Program

Evaluation of instruction, lesson planning, and teaching in the liberal arts and sciences. (Typically Offered: Fall, Spring)

EDUC 4170Z: Supervised Student Teaching- Secondary: English as Second Language

Credits: 1-30. Repeatable.

Prereq: Admitted to the Educator Preparation Program

Evaluation of instruction, lesson planning, and teaching in English as a Second Language grades 7-12. (Typically Offered: Fall, Spring)

EDUC 4180: Secondary Science Methods I

(Dual-listed with EDUC 5180).

Credits: 3. Contact Hours: Lecture 3.

Develop an understanding of research-based practices for effective and equitable science teaching that align with state and national standards. Emphasis is on the character and role of science inquiry, teaching behaviors and strategies, and actively engaging students in self-evaluation and evidence-based inquiry learning experiences. (Typically Offered: Fall)

EDUC 4190: Secondary Science Methods II

(Dual-listed with EDUC 5190).

Credits: 3. Contact Hours: Lecture 3.

Prereq: EDUC 4180; (concurrent enrollment in EDUC 4800B OR EDUC 4800D, OR EDUC 4800J)

Advancing a research-based framework for effective and equitable science teaching rooted in the idea that students need opportunities to make sense of phenomena, and grapple with scientific ideas using authentic science and engineering practices while observing science safety. (Typically Offered: Spring)

EDUC 4200: Bilingualism & The Education of Latinx Youth

(Dual-listed with EDUC 5200). (Cross-listed with USLS 4200).

Credits: 3. Contact Hours: Lecture 3.

Introduction to research on bilingualism and examination of the social, historical, and political contexts of Spanish/English education in the U.S. Attention to policy environment, school program structure, mode of classroom instruction, family and community context, and attainment of bilingualism and biculturalism for Latinx youth. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall)

EDUC 4220: Teaching and Learning Iowa History

(Dual-listed with EDUC 5220).

Credits: 3. Contact Hours: Lecture 3.

Multicultural and social justice focus on Iowa history; different theme each summer. Effective pedagogical and assessment strategies for integrating these themes into K-12 curriculum. (Typically Offered: Summer)

EDUC 4240X: Teaching Middle School Mathematics

Credits: 0. Contact Hours: Lecture 3.

EDUC 4240X. Teaching Middle School Mathematics (dual-listed with EDUC 5240X) Credits: 3. Contact Hours: Lecture 3. This course is designed to equip future educators with the essential knowledge, skills, and strategies to effectively teach mathematics to middle school students (grades 6–8). It integrates critical content areas, including ratios and proportional relationships, expressions and equations, geometry, and statistics, with pedagogical methods tailored to the middle school setting. The course emphasizes understanding adolescent developmental characteristics, implementing effective strategies for diverse learners, and utilizing technology to enhance mathematics instruction. Prerequisites: 6 credits MATH AND (credit or concurrent enrollment in EDUC 4480 or EDUC 4970 or EDUC 5970). (Typically Offered: Fall)

EDUC 4250X: Current Issues in Math Education

Credits: 3. Contact Hours: Lecture 3.

Course Catalog Descriptions EDUC 4250 Current Issues in Math Education (dual-listed with EDUC 5250) This course explores contemporary challenges and trends in mathematics education, including problem-solving and modeling, social justice, artificial intelligence, multilingual learners, and culturally sustaining pedagogy, to equip students with cutting-edge knowledge in the field. Through discussions and research, participants will critically engage with current debates to deepen their understanding of the evolving landscape of math education. Prerequisites: Prereq: 6 credits MATH AND (credit or concurrent enrollment in EDUC 4480 or EDUC 4970 or EDUC 5970). (Typically Offered: Spring)

EDUC 4260: Principles of Secondary Education

(Dual-listed with EDUC 5260).

Credits: 3. Contact Hours: Lecture 3.

Introduction to secondary education teaching strategies, lesson planning that provides equitable learning opportunities for all students, classroom management, legal aspects of schools, professional and ethical issues, current educational issues, professional learning communities, and social-justice oriented teaching. (Typically Offered: Fall, Spring, Summer)

EDUC 4330: Teaching Social Studies in the Primary Grades

Credits: 2. Contact Hours: Lecture 2.

Emphasis is placed on providing equity and justice-oriented social studies learning experiences (e.g. curriculum content, instructional strategies, and assessment) for primary grade children. (Typically Offered: Fall, Spring)

EDUC 4380: Teaching Mathematics in the Primary Grades

Credits: 2. Contact Hours: Lecture 2.

Prereq: Concurrent enrollment in (EDUC 3770, EDUC 4680F, EDUC 4680G), MATH 1950 (minimum grade of C-), MATH 1960 (minimum grade of C-); Admitted to the Educator Preparation Program.

Develop an understanding of effective mathematics teaching practices situated in equitable pedagogies that support primary students' mathematical understanding. (Typically Offered: Fall, Spring)

EDUC 4390: Teaching Science in the Primary Grades

Credits: 2. Contact Hours: Lecture 2.

Development and application of effective methods of science teaching that align with standards and best practices. Emphasis is on research-based, equitable teaching practices that provide appropriate science learning experiences in the early elementary grades. (Typically Offered: Fall, Spring)

EDUC 4430: The Teaching of Social Studies

Credits: 3. Contact Hours: Lecture 3.

Prereq: Admitted to the Educator Preparation Program

Emphasis is placed on providing equity and justice-oriented social studies learning experiences (e.g. curriculum content, instructional strategies, and assessment) for primary and intermediate grade children. (Typically Offered: Fall, Spring, Summer)

EDUC 4480: Teaching Children Mathematics

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 1950 (minimum grade of C-), MATH 1960 (minimum grade of C-); Admitted to the Educator Preparation Program

Develop an understanding of effective mathematics teaching practices situated in equitable pedagogies that support elementary students' mathematical understanding. (Typically Offered: Fall, Spring, Summer)

EDUC 4490: The Teaching of Science

Credits: 3. Contact Hours: Lecture 3.

Development and application of effective methods of science teaching that align with standards and best practices. Emphasis is on research-based, equitable teaching practices that provide appropriate science learning experiences in the elementary grades. (Typically Offered: Fall, Spring, Summer)

EDUC 4500: Ethnicity and Learning

(Dual-listed with EDUC 5500).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (EDUC 3320 or EDUC 3330), EDUC 4060

Examination of cultural relevance in education. Development and application of strategies and techniques for implementing multicultural goals and multiethnic perspectives in PreK-12 school classroom settings. Offered even-numbered years. (Typically Offered: Spring)

EDUC 4520: Assessment for Literacy and Learning

(Dual-listed with EDUC 5520).

Credits: 3. Contact Hours: Lecture 3.

Prereq: EDUC 3780. Concurrent enrollment in EDUC 4880.

Identification, analysis and correction of reading problems in five areas: print knowledge, integration of print knowledge, oral reading fluency, vocabulary, and comprehension. (Typically Offered: Fall, Spring, Summer)

EDUC 4540: Emerging Topics in Educational Technologies

Credits: 1. Contact Hours: Lecture 1.

Repeatable, maximum of 6 credits.

Prereq: EDUC 2010 or EDUC 2030

Development and application of emerging technology topics related to digital learning. Series of 1 credit on-line learning modules on current technology being used in education and topics being addressed. These modules extend learning opportunities from other courses and experiences. Required for Learning Technologies Minor. (Typically Offered: Fall, Spring, Summer)

EDUC 4560: Integrating Technology into Literacy

(Dual-listed with EDUC 5560).

Credits: 3. Contact Hours: Lecture 3.

Prereq: EDUC 2010 or EDUC 2030; EDUC 3770

Methods and strategies used to integrate technology into K-8 literacy. Examination of the use and evaluation of technology appropriate for elementary literacy classrooms. (Typically Offered: Fall, Spring)

EDUC 4590: Critical Approaches to Teaching Children's and Adolescent Literature

(Dual-listed with EDUC 5590).

Credits: 3. Contact Hours: Lecture 3.

Research and discussion of issues surrounding the classroom use of literature for children and young adults including censorship, diversity, selection, critical literacy and the influences of technology. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall, Spring, Summer)

EDUC 4680A: Pre-Student Teaching Experience III: Primary Grades, Reading and Language Arts

Credits: 1.

Prereq: Admitted to the Educator Preparation Program

Application of current methods and instructional experiences with children in a supervised K-3 elementary classroom while engaged in other elementary methods courses. Clinical Experience Level 3. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

EDUC 4680B: Pre-Student Teaching Experience III: Intermediate Grades, Reading and Language Arts

Credits: 1.

Prereq: Admitted to the Educator Preparation Program

Application of current methods and instructional experiences with children in a supervised 3-6 elementary classroom while engaged in other elementary methods courses. Clinical Experience Level 3. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

EDUC 4680C: Pre-Student Teaching Experience III: Primary Grades, Mathematics

Credits: 1.

Prereq: Admitted to the Educator Preparation Program

Application of current methods, and instructional experiences with children in a supervised K-3 elementary classroom while engaged in other elementary methods courses. Clinical Experience Level 3. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

EDUC 4680D: Pre-Student Teaching Experience III: Intermediate Grades, Science

Credits: 1.

Prereq: Admitted to the Educator Preparation Program

Application of current methods and instructional experiences with children in a supervised 3-6 elementary classroom while engaged in other elementary methods courses. Clinical Experience Level 3. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

EDUC 4680F: Pre-Student Teaching Experience III: Primary Grades Inclusive, Literacy

Credits: 1.

Prereq: Admitted to the Educator Preparation Program

Application of current methods and instructional experiences with children in a supervised K-3 inclusive elementary classroom while engaged in other elementary methods courses. Clinical Experience Level 3. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

EDUC 4680G: Pre-Student Teaching Experience III: Primary Grades Inclusive, Mathematics

Credits: 1.

Prereq: Admitted to the Educator Preparation Program

Application of current methods and instructional experiences with children in a supervised K-3 inclusive elementary classroom while engaged in other elementary methods courses. Clinical Experience Level 3. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

EDUC 4680I: Pre-Student Teaching Experience III: Primary Grades Inclusive, Science

Credits: 1.

Prereq: Admitted to the Educator Preparation Program

Application of current methods and instructional experiences with children in a supervised K-3 inclusive elementary classroom while engaged in other elementary methods courses. Clinical Experience Level 3. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

EDUC 4680R: Pre-Student Teaching Experience II: Intermediate Grades, Reading Endorsement

Credits: 1.

Prereq: Admitted to the Educator Preparation Program

Application of current methods and instructional experiences with children in a supervised 3-6 elementary classroom while engaged in other elementary methods courses. Clinical Experience Level 3. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

EDUC 4680T: Pre-Student Teaching Experience III: Elementary

Credits: 2. Repeatable.

Prereq: Admitted to the Educator Preparation Program

Application of current methods and instructional experiences with children in a supervised elementary classroom outside of Iowa while engaged in other elementary methods courses. Clinical Experience Level 3. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

EDUC 4750: International Travel Study in Education

(Dual-listed with EDUC 5750).

Credits: 1-6. Repeatable, maximum of 6 credits.

Prereq: Credit or enrollment in EDUC 2750

Seminar-based course for undergraduate and graduate students to develop a better understanding around global issues related to teaching, learning, curriculum, and educational policy through international travel study. 1 to 6 week duration involving study in a country other than the US. (Typically Offered: Summer)

EDUC 4800A: Pre-Student Teaching Experience III: History/Social Sciences

(Cross-listed with HIST 4800A).

Credits: 2. Repeatable, maximum of 2 credits.

Prereq: Admitted to the Educator Preparation Program

Supervised participation in a 5-12 school setting. Permission of History/Social Sciences coordinator required prior to enrollment. Two, half-days per week needed for school experience. Clinical Supervision Level 3. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

EDUC 4800B: Pre-Student Teaching Experience III: Physical Science, Chemistry, or Physics

Credits: 2. Repeatable, maximum of 2 credits.

Prereq: Admitted to the Educator Preparation Program

Supervised participation in a 5-12 school setting. Permission of program coordinator required prior to enrollment. Two, half-days per week needed for school experience. Clinical Supervision Level 3. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

EDUC 4800C: Pre-Student Teaching Experience III: Mathematics

Credits: 0.5-2. Repeatable, maximum of 2 credits.

Prereq: Admitted to the Educator Preparation Program

Supervised participation mathematics in a 5-12 school setting. Permission of mathematics coordinator required prior to enrollment. Two, half-days per week needed for school experience. Clinical Experience Level 3. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

EDUC 4800D: Pre-Student Teaching Experience III: Biological Sciences

Credits: 2. Repeatable, maximum of 2 credits.

Prereq: Admitted to the Educator Preparation Program

Supervised participation in a 5-12 school setting. Permission of program coordinator required prior to enrollment. Two, half-days per week needed for school experience. Clinical Supervision Level 3. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

EDUC 4800E: Pre-Student Teaching Experience III: English

Credits: 1-2. Repeatable, maximum of 2 credits.

Prereq: Admitted to the Educator Preparation Program

Supervised participation in a 5-12 school setting. Permission of English coordinator required prior to enrollment. Two, half-days per week needed for school experience. Clinical Experience Level 3. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

EDUC 4800G: Pre-Student Teaching Experience III: World Languages and Cultures

Credits: 1-2. Repeatable, maximum of 2 credits.

Prereq: Admitted to the Educator Preparation Program

Supervised participation in a 5-12 school setting. Permission of World Languages and Cultures coordinator required prior to enrollment. Two, half-days per week needed for school experience. Clinical Experience Level 3. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

EDUC 4800J: Pre-Student Teaching Experience III: Earth Science

Credits: 2. Repeatable, maximum of 2 credits.

Prereq: Admitted to the Educator Preparation Program

Supervised participation in a 5-12 school setting. Permission of program coordinator required prior to enrollment. Two, half-days per week needed for school experience. Clinical Supervision Level 3. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

EDUC 4800K: Pre-Student Teaching Experience III: Music

(Cross-listed with MUSIC 4800K).

Credits: 1-2. Repeatable.

Prereq: Admitted to the Educator Preparation Program

Participation in a K-12 school setting. Permission of Music coordinator required prior to enrollment. Clinical Experience Level 3. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

EDUC 4800S: Pre-Student Teaching Experience III: English as a Second Language (ESL)

Credits: 2. Repeatable, maximum of 2 credits.

Prereq: EDUC 3800S; ENGL 2190 or LING 2190; ENGL 2200 or LING 2200; Admitted to Educator Preparation Program

Supervised participation in a school setting. Permission of ESL area coordinator required prior to enrollment. Two, half-days per week needed for school experience. Clinical experience level 3. Offered on a satisfactory-fail basis only.

EDUC 4800T: Pre-Student Teaching Experience III: Secondary Education

Credits: 2. Repeatable, maximum of 4 credits.

Prereq: Admitted to the Educator Preparation Program

Supervised participation in a 5-12 school setting outside of Iowa. Permission of content program coordinator required prior to enrollment. Clinical Experience Level 3. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

EDUC 4800V: Pre-Student Teaching Experience in FCS Education

(Cross-listed with FCEDS 4800V).

Credits: 2. Contact Hours: Laboratory 4.

Repeatable.

Prereq: FCEDS 3060; FCEDS 3800V; admission to Educator Preparation program

Clinical Experience Level III in culinary, fashion design, housing, and/or human development courses related to Family & Consumer Sciences at the secondary level. Includes 48 hours practicum and supervised individual teaching. 1/2 day of time needed in schedule. Offered on a satisfactory-fail basis only. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

EDUC 4810: Philosophy of Education

(Dual-listed with EDUC 5810).

Credits: 3. Contact Hours: Lecture 3.

Introduction to philosophy of education. Emphasis is placed on historical and contemporary debates about the nature and purpose(s) of education in a just society. Possible topics include questions such as: When is one justified in claiming to know or to have learned? Who is morally responsible for a learner's education or schooling? What is a just distribution of educational opportunities? How might one teach philosophically? Offered odd-numbered years. (Typically Offered: Fall)

EDUC 4860: Methods in Elementary School World Language Instruction

(Cross-listed with WLC 4860/ LING 4860).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 25 credits in a World Language

Planning, implementation, and assessment of standards-based, student-centered, and thematic instruction in the elementary (K-8) classroom. Special emphasis on K-8 students' communicative skills, cultural knowledge, and content learning. (Typically Offered: Fall)

EDUC 4870: Methods in Secondary School World Language Instruction

(Cross-listed with WLC 4870/ LING 4870).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 25 credits in a world language; Department Permission

Theories and principles of contemporary world language learning and teaching. Special emphasis on designing instruction and assessments for active learning. Admission to teacher education required. (Typically Offered: Fall)

EDUC 4880: Supervised Tutoring in Reading

(Dual-listed with EDUC 5880).

Credits: 3. Contact Hours: Lecture 2.

Prereq: EDUC 3780; concurrent enrollment in EDUC 4520

Using formal and informal diagnostic procedures to plan and implement individualized reading instruction. Field experience in tutoring and a related research project. (Typically Offered: Fall, Spring, Summer)

EDUC 4900A: Independent Study: Education

(Cross-listed with MUSIC 4900A).

Credits: 1-30. Repeatable.

Prereq: 12 credits in MUSIC; Department Permission

Music. (Typically Offered: Fall, Spring, Summer)

EDUC 4900C: Independent Study: Curriculum Construction

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

EDUC 4900D: Independent Study: Principles of Education

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

EDUC 4900E: Independent Study: Methods of Teaching

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

EDUC 4900F: Independent Study: Educational Psychology

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

EDUC 4900G: Independent Study: Digital Learning

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

EDUC 4900H: Independent Study: Honors

Credits: 1-3. Repeatable.

Prereq: Membership in the University Honors Program

(Typically Offered: Fall, Spring, Summer)

EDUC 4900J: Independent Study: Social and Cultural Studies

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

EDUC 4900K: Independent Study: History/Social Sciences

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

EDUC 4900L: Independent Study: Literacy Education

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

EDUC 4900M: Independent Study: Mathematics Education

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

EDUC 4900N: Independent Study: World Language

Credits: 1-3. Repeatable.

(Typically Offered: Fall, Spring, Summer)

EDUC 4900O: Independent Study: Foundations of Education

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

EDUC 4900P: Independent Study: Science Education

Credits: 1-3.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring)

EDUC 4950B: Independent Study: Teaching Speech

(Cross-listed with SPCM 4950B).

Credits: 3. Contact Hours: Lecture 3.

Problems, methods, and materials related to teaching speech, theatre, and media in secondary schools. (Typically Offered: Fall)

EDUC 4970: Teaching Secondary School Mathematics

(Cross-listed with MATH 4970).

Credits: 3. Contact Hours: Lecture 3.

Develop an understanding of instructional planning, lesson implementation, and assessment in grades 5-12 mathematics, with a focus on reform-based mathematics, equity, and conceptual understanding. (Typically Offered: Fall)

EDUC 4980: Methods of Teaching History/Social Sciences

(Dual-listed with HIST 5980). (Cross-listed with HIST 4980).

Credits: 3. Contact Hours: Lecture 3.

Theories and processes of teaching and learning secondary history/social sciences. Emphasis on development and enactment of current methods, assessments, and curriculum materials for providing appropriate learning experiences. (Typically Offered: Fall, Spring)

Courses primarily for graduate students, open to qualified undergraduates:

EDUC 5010: Foundations of Educational Technology

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Educational philosophies and theories of teaching, learning, and technologies. Understanding of how people learn with, and through, educational technology, in many settings. Overview of significant topics in educational technology. Major learning theories, including recent debates in how educators conceive of learning; teaching and learning with technology and new literacies practices.

EDUC 5020: Teaching Mathematics to English Language Learners

Credits: 3. Contact Hours: Lecture 3.

Prereq: EDUC 4480 or EDUC 4970 or EDUC 5970 or permission of instructor

Understanding the needs of various English language learners, learn to use ELLs' language and culture as a resource in mathematics classrooms, and implement research-based instructional strategies that are effective to teach mathematics for ELLs. For pre-service/in-service teachers and others who will work or currently works with English language learners (ELLs). (Typically Offered: Spring, Summer)

EDUC 5030: Designing Effective Learning Environments

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Application of theories and models of instructional design. Design decision-making based on the analysis of performance problems and instructional inputs. Practical experience with the design and development of instruction and evaluation principles.

EDUC 5040: Evaluating Technology-based Learning Environments

(Cross-listed with HCI 5040).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Principles and procedures to plan, design, and conduct effective evaluation studies (formative, summative, usability) in different settings are studied. Opportunities to engage in real or simulated evaluation projects of substantial scope are provided. Course activities include: create evaluation instruments, develop methods with which to evaluate a product or program, conduct try-outs or usability sessions, analyze the data, report the findings, and recommendations.

EDUC 5050: Using Technology in Learning and Teaching

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Teaching and learning using educational technology. Selection and evaluation of digital tools for teaching and learning. Research on educational technology. Tool software. Trends in computer-based instruction.

EDUC 5060: Social Justice Education and Teaching: Advanced

Credits: 3. Contact Hours: Lecture 3.

Prereq: 6 graduate credits in EDUC

Engage with justice-oriented multicultural frameworks for transformative education and education research, understand equity in education in historical and contemporary contexts, develop principled approaches to critical self-reflection, interpret educational situations in justice-oriented ways, and counter inequities in education through curriculum, pedagogy, and research. (Typically Offered: Fall, Summer)

EDUC 5080: Algebra in the K-12 Classrooms

Credits: 3. Contact Hours: Lecture 3.

Prereq: 6 credits MATH AND (credit or concurrent enrollment in EDUC 4480 or EDUC 4970 or EDUC 5970)

Focus on Algebraic reasoning, concepts, and associated procedures in K-12 classrooms, especially middle level. Using algebra and algebraic reasoning to solve a real-life problem. Attention is given to algebraic habits of mind, generalization, representation, and transition from arithmetic algorithms to algebra. (Typically Offered: Fall)

EDUC 5090: Geometry in the K-12 Classrooms

Credits: 3. Contact Hours: Lecture 3.

Prereq: 6 credits MATH AND (credit or concurrent enrollment in EDUC 4480 or EDUC 4970 or EDUC 5970)

Explore geometry and measurement through research-based pedagogies in K-12 classrooms. An investigative approach involving problem solving, reasoning and proof, connections, and communication are emphasized. (Typically Offered: Fall)

EDUC 5100: Foundations of Game-based Learning

(Cross-listed with HCI 5100).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 12 graduate credits

Theories, principles and best practices of utilizing games in educational environments. Topics include the theoretical foundations of learning games and game play, identity development in online environments, and assessment of learning in and out of games.

EDUC 5110: Technology, Leadership, and Change

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Principles and practices of technology, leadership and change. Coursework focuses on technology broadly and implications on educational contexts. Leadership frameworks and strategies for professional development and organizational change are examined, as well as new literacy practices and current debates in the field.

EDUC 5120: Research Trends in Educational Technology

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Critical review and synthesis of current research trends in educational technology. Designed for students to synthesize knowledge of issues in research, and methods of conducting research in practice.

EDUC 5130: Mathematical Problem Solving in K-12 Classrooms

Credits: 3. Contact Hours: Lecture 3.

Prereq: 6 credits MATH AND (credit or concurrent enrollment in EDUC 4480 or EDUC 4970 or EDUC 5970)

Develop problem solving strategies across all strands of mathematics. Issues surrounding the appropriate role of problem solving in K-12 mathematics classrooms are discussed, including distinctions among teaching 'about,' 'for,' and 'through' problem solving. Emphasis on task modification and mathematical modeling. (Typically Offered: Spring)

EDUC 5140: Introduction to Science Teaching and Learning

Credits: 1-4. Contact Hours: Lecture 1, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Introduction to critical issues facing science education, science education goals reflecting contemporary purposes of schooling, and how people learn science. (Typically Offered: Summer)

EDUC 5150: Action Research in Education

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Methods of conducting and communicating action research focused on improving educational practices. Develop first cycle of action plan with purpose of investigating an educational setting. Learn to identify problems to investigate, select appropriate research methods, collect and analyze data, and draw conclusions from research.

EDUC 5160X: Personalized Learning in Technology-Rich Environments

Credits: 3. Repeatable, maximum of 3 credits.

EDUC 5160. Personalized Learning. Cr. 3. No Prereq. This course introduces personalized learning in technology-rich environments. This course provides students with a broader initial understanding of what personalized learning is and how to make a plan for integrating personalized learning.

EDUC 5170A: Student Teaching: Social Studies-Middle School

(Dual-listed with EDUC 4170A).

Credits: 1-30. Repeatable.

Prereq: Admitted to the Educator Preparation Program

Evaluation of instruction, lesson planning, and teaching in the liberal arts and sciences. (Typically Offered: Fall, Spring)

EDUC 5170B: Student Teaching: Physical Sciences

(Dual-listed with EDUC 4170B).

Credits: 1-30. Repeatable.

Prereq: Admitted to the Educator Preparation Program

Evaluation of instruction, lesson planning, and teaching in physical sciences grades 5-12. (Typically Offered: Fall, Spring)

EDUC 5170C: Student Teaching: Mathematics

(Dual-listed with EDUC 4170C).

Credits: 1-30. Repeatable.

Prereq: Admitted to the Educator Preparation Program

Evaluation of instruction, lesson planning, and teaching in mathematics grades 5-12. (Typically Offered: Fall, Spring)

EDUC 5170D: Student Teaching: Biological Sciences

(Dual-listed with EDUC 4170D).

Credits: 1-30. Repeatable.

Prereq: Admitted to the Educator Preparation Program

Evaluation of instruction, lesson planning, and teaching in biological sciences grades 5-12. (Typically Offered: Fall, Spring)

EDUC 5170E: Student Teaching: English

(Dual-listed with EDUC 4170E/ ENGL 4170E).

Credits: 1-30. Repeatable.

Prereq: Admitted to the Educator Preparation Program

Seminar-based course for undergraduate and graduate students to develop a better understanding around global issues related to teaching, learning, curriculum, and educational policy through international travel study. 1 to 6 week duration involving study in a country other than the US.

EDUC 5170G: Student Teaching: World Language

(Dual-listed with EDUC 4170G/ WLC 4170G). (Cross-listed with WLC 5170G).

Credits: 1-30. Repeatable.

Prereq: Admitted to the Educator Preparation Program

Evaluation of instruction, lesson planning, and teaching in world languages, secondary grades. (Typically Offered: Fall, Spring)

EDUC 5170J: Student Teaching: Earth Sciences

(Dual-listed with EDUC 4170J).

Credits: 1-30. Repeatable.

Prereq: Admitted to the Educator Preparation Program

Evaluation of instruction, lesson planning, and teaching in earth sciences grades 5-12. (Typically Offered: Fall, Spring)

EDUC 5170M: Student Teaching: Science - Basic

(Dual-listed with EDUC 4170M).

Credits: 1-30. Repeatable.

Prereq: Admitted to the Educator Preparation Program

Evaluation of instruction, lesson planning, and teaching in basic sciences grades 5-12. (Typically Offered: Fall, Spring)

EDUC 5170N: Student Teaching: International

(Dual-listed with EDUC 4170N).

Credits: 1-30. Repeatable.

Prereq: Admitted to the Educator Preparation Program

Evaluation of instruction, lesson planning, and teaching in the liberal arts and sciences. (Typically Offered: Fall, Spring)

EDUC 5170P: Student Teaching: Social Studies-High School

(Dual-listed with EDUC 4170P).

Credits: 1-30. Repeatable.

Prereq: Admitted to the Educator Preparation Program

Evaluation of instruction, lesson planning, and teaching in the liberal arts and sciences. (Typically Offered: Fall, Spring)

EDUC 5170R: Student Teaching: Music-Elementary

(Dual-listed with EDUC 4170R/ MUSIC 4170R). (Cross-listed with MUSIC 5170R).

Credits: 1-30. Repeatable.

Prereq: Admitted to the Educator Preparation Program

Evaluation of instruction, lesson planning, and teaching in the liberal arts and sciences. (Typically Offered: Fall, Spring)

EDUC 5170S: Student Teaching: Music-Secondary

(Dual-listed with EDUC 4170S/ MUSIC 4170S). (Cross-listed with MUSIC 5170S).

Credits: 1-30. Repeatable.

Prereq: Admitted to the Educator Preparation Program

Evaluation of instruction, lesson planning, and teaching in the liberal arts and sciences. (Typically Offered: Fall, Spring)

EDUC 5180: Secondary Science Methods I

(Dual-listed with EDUC 4180).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Develop an understanding of research-based practices for effective and equitable science teaching that align with state and national standards. Emphasis is on the character and role of science inquiry, teaching behaviors and strategies, and actively engaging students in self-evaluation and evidence-based inquiry learning experiences. (Typically Offered: Fall)

EDUC 5190: Secondary Science Methods II

(Dual-listed with EDUC 4190).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Advancing a research-based framework for effective and equitable science teaching rooted in the idea that students need opportunities to make sense of phenomena, and grapple with scientific ideas using authentic science and engineering practices while observing science safety. (Typically Offered: Spring)

EDUC 5200: Bilingualism & The Education of Latinx Youth

(Dual-listed with EDUC 4200/ USLS 4200).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to research on bilingualism and examination of the social, historical, and political contexts of Spanish/English education in the U.S. Attention to policy environment, school program structure, mode of classroom instruction, family and community context, and attainment of bilingualism and biculturalism for Latinx youth. (Typically Offered: Fall)

EDUC 5210: Introduction to the Teaching and Learning of Mathematics and Science

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Provides future secondary teachers with opportunities to explore learning theories and approaches for teaching mathematics and science, especially those related to constructivism and social constructivism. Opportunities to understand how students learn mathematics and science and how to assess secondary students' understanding in these content areas. Includes 12-hours (2 full days) of classroom observation in a nearby middle or high school and may include other practical experiences in teaching math and science. (Typically Offered: Summer)

EDUC 5220: Teaching and Learning Iowa History

(Dual-listed with EDUC 4220).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Multicultural and social justice focus on Iowa history; different theme each summer. Effective pedagogical and assessment strategies for integrating these themes into K-12 curriculum. (Typically Offered: Summer)

EDUC 5230: Teaching Students who Struggle in Mathematics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Explore and implement research-based instructional practices with K-8 students who are struggling with learning essential mathematical concepts. (Typically Offered: Spring)

EDUC 5240X: Teaching Middle School Mathematics

Credits: 3. Contact Hours: Lecture 3.

EDUC 5240X. Teaching Middle School Mathematics (dual-listed with EDUC 4240X) Credits: 3. Contact Hours: Lecture 3. This course is designed to equip future educators with the essential knowledge, skills, and strategies to effectively teach mathematics to middle school students (grades 6–8). It integrates critical content areas, including ratios and proportional relationships, expressions and equations, geometry, and statistics, with pedagogical methods tailored to the middle school setting. The course emphasizes understanding adolescent developmental characteristics, implementing effective strategies for diverse learners, and utilizing technology to enhance mathematics instruction. Prerequisites: 6 credits MATH AND (credit or concurrent enrollment in EDUC 4480 or EDUC 4970 or EDUC 5970). (Typically Offered: Fall)

EDUC 5250X: Current Issues in Math Education

Credits: 3. Contact Hours: Lecture 3.

EDUC 5250X Current Issues in Math Education (dual-listed with EDUC 4250) This course explores contemporary challenges and trends in mathematics education, including problem-solving and modeling, social justice, artificial intelligence, multilingual learners, and culturally sustaining pedagogy, to equip students with cutting-edge knowledge in the field. Through discussions and research, participants will critically engage with current debates to deepen their understanding of the evolving landscape of math education. Prerequisites: Prereq: 6 credits MATH AND (credit or concurrent enrollment in EDUC 4480 or EDUC 4970 or EDUC 5970). (Typically Offered: Spring)

EDUC 5260: Principles of Secondary Education

(Dual-listed with EDUC 4260).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to secondary education teaching strategies, lesson planning that provides equitable learning opportunities for all students, classroom management, legal aspects of schools, professional and ethical issues, current educational issues, professional learning communities, and social-justice oriented teaching. (Typically Offered: Fall, Spring, Summer)

EDUC 5290: Educational Psychology and the Secondary Classroom

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Analysis of psychological research theory related to learning, cognition, motivation, individual differences, and teaching techniques. Student and classroom assessment to facilitate positive learning outcomes. Adaption and differentiation of instruction to meet individual learners' needs. This course can only be used for teacher licensure programs. It is not acceptable for use in meeting the non-licensure M.Ed., M.S. or Ph.D. requirements. (Typically Offered: Summer)

EDUC 5330: Theories of Learning

(Cross-listed with PSYCH 5330).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Major theories of learning and cognition in educational settings. Emphasis on behavioral, cognitive, constructivist, and sociocultural theories and their implications for educational policy and practice. (Typically Offered: Fall)

EDUC 5360: Sociocultural Theories of Learning

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Study of sociocultural learning theories, including how knowledge is constructed through interactions and how learning is embedded in these interactions. Examination of how particular sociocultural approaches to learning can inform responsive teaching and responsive research, and impact opportunities for educational equity. (Typically Offered: Summer)

EDUC 5410: How People Learn: Implications for Teaching Science and Mathematics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Examination of theories of learning and motivation in science and mathematics and their application to teaching and current research in science and mathematics education.

EDUC 5460: Advanced Pedagogy in Science Education

Credits: 3. Contact Hours: Lecture 3.

Advanced examination of effective and equitable science teaching, emphasizing teacher behaviors and strategies, methods of self-evaluation, and current issues and trends in science education. Offered odd-numbered years. (Typically Offered: Spring)

EDUC 5470: Nature Of Science

(Dual-listed with EDUC 3470).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

The history, philosophy, and sociology of science, how scientific knowledge differs from other forms of knowledge, and the relationship of the nature of science-to-science teaching and learning.

EDUC 5480: Restructuring Science Activities

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Modification of laboratory activities and other everyday science activities so they are more congruent with how students learn, the nature of science, and national standards. (Typically Offered: Summer)

EDUC 5500: Ethnicity and Learning

(Dual-listed with EDUC 4500).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Examination of cultural relevance in education. Development and application of strategies and techniques for implementing multicultural goals and multiethnic perspectives in PreK-12 school classroom settings. Offered even-numbered years. (Typically Offered: Spring)

EDUC 5510: Assessment for Literacy and Learning

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Analyzing, discussing, and researching the theory and practice of current literacy issues. (Typically Offered: Fall)

EDUC 5520: Corrective Reading

(Dual-listed with EDUC 4520).

Credits: 3. Contact Hours: Lecture 3.

Prereq: EDUC 3780. Concurrent enrollment in EDUC 4880.

Identification, analysis and correction of reading problems in five areas: print knowledge, integration of print knowledge, oral reading fluency, vocabulary, and comprehension. (Typically Offered: Fall, Spring, Summer)

EDUC 5530: Teaching Adolescent Readers with Reading Difficulties

(Cross-listed with SPED 5530).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Instructional strategies for enhancing the fluency, vocabulary and comprehension of adolescents with reading difficulties. Attention to content-area reading materials and strategies. (Typically Offered: Fall, Spring)

EDUC 5550: Literacy, Leadership, and Advocacy

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Examination of the roles of literacy specialists in diverse pre-K-12 schools and communities. Particular focus placed on current theories, research, standards, and policies relative to literacy processes and instruction, including culturally responsive literacy; successful methods of supporting teachers and other school personnel in planning, implementing, and evaluating literacy instruction for all students. (Typically Offered: Spring)

EDUC 5560: Integrating Technology into Literacy

(Dual-listed with EDUC 4560).

Credits: 3. Contact Hours: Lecture 3.

Prereq: EDUC 2010 or EDUC 2030; EDUC 3770

Methods and strategies used to integrate technology into K-8 literacy. Examination of the use and evaluation of technology appropriate for elementary literacy classrooms. (Typically Offered: Fall, Summer)

EDUC 5580: Perspectives on Reading Comprehension

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Critical examination of the topics central to the study of reading comprehension, including processes, development, contexts, motivation, teaching and learning, and assessment. Reading and discussion of research literature in reading comprehension and comprehension instruction. (Typically Offered: Fall)

EDUC 5590: Critical Approaches to Teaching Children's and Adolescent Literature

(Dual-listed with EDUC 4590).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Research and discussion of issues surrounding the classroom use of literature for children and young adults including censorship, diversity, selection, critical literacy and the influences of technology. (Typically Offered: Fall, Spring, Summer)

EDUC 5650: Literacy: Connecting Research, Policy and Practice

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Critical examination of current policy initiatives and reform efforts that affect how literacy is viewed, assessed, and practiced, as well as how literacy professionals are prepared for their roles in public schools and colleges. (Typically Offered: Fall, Spring)

EDUC 5670: Teaching Secondary Learners with Mathematics Difficulties

(Cross-listed with SPED 5670).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Instructional methods and assessment techniques for secondary students struggling to learn mathematics. Particular emphasis on current research, practices, and trends in mathematics interventions for at-risk students and students with disabilities.

EDUC 5680: New Media Literacies: Understanding Research and Practice

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Designed to increase awareness and understanding of critical issues surrounding the evolving concept of literacy and examine the effect that technology has on the literacy we use every day, teach in our schools, and need in order to function as 21st century citizens. (Typically Offered: Fall)

EDUC 5690: Critical Disciplinary Literacy across the Content Areas

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Guided by frameworks of critical literacies and sociocultural theories of disciplinary literacy, students investigate the specialized and unique histories, discourses, practices, norms, and skills of select disciplines/programs/fields. Course is intended/differentiated for graduate students from various disciplines/programs/fields. Students will design their own inquiry-based critical disciplinary literacy research project. (Typically Offered: Spring)

EDUC 5750: International Travel Study in Education

(Dual-listed with EDUC 4750).

Credits: 1-6. Repeatable, maximum of 3 times.

Prereq: 6 graduate credits and permission of instructor

Seminar-based course for undergraduate and graduate students to develop a better understanding around global issues related to teaching, learning, curriculum, and educational policy through international travel study. 1 to 6 week duration involving study in a country other than the US. (Typically Offered: Summer)

EDUC 5770: Historical Perspectives on Technology Equity: Implications for Policy and Practice

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Examination of the definition and origin of the 'digital divide' and its relationship to the histories of racism, sexism, classism, and imperialism/globalization. Exploration of the historical, political, sociological, and economic factors that engender global inequities. Exploration and analysis of research-based alternative approaches to alleviating technology inequities in educational settings.

EDUC 5780: Pedagogy, Equality of Opportunity, and the Education of Blacks in the United States

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Examination of the historical, social, economic, political, and legal contexts of the education of Blacks in the U.S. Educational theories and philosophies, Critical Race Theory and Black Feminist Thought form the framework for investigating broad-based, multiple issues of education for Blacks in the U.S. as they are situated in the prevailing dominant views.

EDUC 5800: Studies in the Foundations of Education in the United States

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to the historical and contemporary landscape of schooling in the United States. Emphasis is placed on topics and tensions in the relationship between school and society (e.g. equity of access to education and competing purposes of education) and the implications of these topics and tensions for teaching and learning in public schools. Designed for students in a graduate licensure program. (Typically Offered: Summer)

EDUC 5810: Philosophy of Education

(Dual-listed with EDUC 4810).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to philosophy of education. Emphasis is placed on historical and contemporary debates about the nature and purpose(s) of education in a just society. Possible topics include questions such as: When is one justified in claiming to know or to have learned? Who is morally responsible for a learner's education or schooling? What is a just distribution of educational opportunities? How might one teach philosophically? Offered odd-numbered years. (Typically Offered: Fall)

EDUC 5820: History of Public Schooling in the United States

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Examination of the history of public schools in the United States. Historicizes the development of an educational system marked by both profound expectations and extreme inequalities. Readings include primary and secondary materials.

EDUC 5830: Inequality & Schooling in the U.S.

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

General introduction to the disciplinary tools of social and cultural studies to examine historical and contemporary inequalities and attempts to disrupt them in U.S. schools. Required for all TLLP doctoral students. (Typically Offered: Spring)

EDUC 5880: Supervised Tutoring in Reading

(Dual-listed with EDUC 4880).

Credits: 3. Contact Hours: Lecture 2.

Prereq: Graduate classification; concurrent enrollment in EDUC 5520

Using formal and informal diagnostic procedures to plan and implement individualized reading instruction. Field experience in tutoring and a related research project. (Typically Offered: Fall, Spring, Summer)

EDUC 5900A: Special Topics: Curriculum

Credits: 1-3.

Prereq: 9 graduate credits in EDUC; Instructor Permission for Course
(Typically Offered: Fall, Spring)

EDUC 5900B: Special Topics: Educational Technology

Credits: 1-3.

Prereq: 9 graduate credits in EDUC; Instructor Permission for Course
(Typically Offered: Fall, Spring)

EDUC 5900C: Special Topics: Science Education

Credits: 1-3.

Prereq: 9 graduate credits in EDUC; Instructor Permission for Course
(Typically Offered: Fall, Spring)

EDUC 5900D: Special Topics: Secondary Education

Credits: 1-3.

Prereq: 9 graduate credits in EDUC; Instructor Permission for Course
(Typically Offered: Fall, Spring)

EDUC 5900F: Special Topics: Social and Cultural Studies

Credits: 1-3. Repeatable.

Prereq: 9 graduate credits in EDUC; Instructor Permission for Course
(Typically Offered: Fall, Spring)

EDUC 5900G: Special Topics: Mathematics Education

Credits: 1-3.

Prereq: 9 graduate credits in EDUC; Instructor Permission for Course
(Typically Offered: Fall, Spring)

EDUC 5900I: Special Topics: Elementary Education

Credits: 1-3.

Prereq: 9 graduate credits in EDUC; Instructor Permission for Course
(Typically Offered: Fall, Spring)

EDUC 5900J: Special Topics: World Language Education

Credits: 1-3.

Prereq: 9 graduate credits in EDUC; Instructor Permission for Course
(Typically Offered: Fall, Spring)

EDUC 5900K: Special Topics: Educational Psychology

Credits: 1-3.

Prereq: 9 graduate credits in EDUC; Instructor Permission for Course
(Typically Offered: Fall, Spring)

EDUC 5900L: Special Topics: Social Studies Education

Credits: 1-3.

Prereq: 9 graduate credits in EDUC; Instructor Permission for Course
(Typically Offered: Fall, Spring)

EDUC 5900M: Special Topics: Literacy Education

Credits: 1-3.

Prereq: 9 graduate credits in EDUC; Instructor Permission for Course
(Typically Offered: Fall, Spring)

EDUC 5910A: Graduate Level Pre-Student Teaching Experience: Secondary Social Studies

Credits: 0.5-6. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Supervised pre-student teaching experience in Social Studies education at middle school. Supervision level 3. Offered on a satisfactory-fail basis only.

EDUC 5910C: Supervised Field Experience: Elementary Education

Credits: 0.5-6.

Prereq: Graduate Standing or Permission of Instructor

Supervised on-the-job field experience in special area. (Typically Offered: Fall, Spring, Summer)

EDUC 5910D: Graduate Level Pre-Student Teaching Experience: Secondary Science

Credits: 0.5-6. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Supervised pre-student teaching experience in secondary science education. Supervision level 3. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

EDUC 5910EX: Graduate Level Pre-Student Teaching Experience: Secondary English Education

Credits: 0.5-6. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Pre-Stdnt Tchng-Eng. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

EDUC 5910G: Graduate Level Pre-Student Teaching Experience: Secondary Mathematics Education

Credits: 0.5-6. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Supervised pre-student teaching experience in mathematics education. Supervision level 3. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

EDUC 5910M: Supervised Field Experience: Literacy

Credits: 0.5-6.

Prereq: Graduate Standing or Permission of Instructor

Supervised on-the-job field experience in special area. (Typically Offered: Fall, Spring, Summer)

EDUC 5910N: Supervised Field Experience: College Teaching

Credits: 0.5-6. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

Supervised on-the-job field experience in special area. (Typically Offered: Fall, Spring)

EDUC 5930A: Workshops: Curriculum

Credits: 1-3. Contact Hours: Lecture 3.

Prereq: 9 graduate credits in EDUC

(Typically Offered: Fall, Spring)

EDUC 5930B: Workshops: Educational Technology

Credits: 1-3. Contact Hours: Lecture 3.

EDUC 5930C: Workshops: Science Education

Credits: 1-3. Contact Hours: Lecture 3.

Prereq: 9 graduate credits in EDUC

(Typically Offered: Fall, Spring)

EDUC 5930D: Workshops: Secondary Education

Credits: 1-3. Contact Hours: Lecture 3.

Prereq: 9 graduate credits in EDUC

(Typically Offered: Fall, Spring)

EDUC 5930F: Workshops: Social and Cultural Studies

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: 9 graduate credits in EDUC

(Typically Offered: Fall, Spring)

EDUC 5930G: Workshops: Mathematics Education

Credits: 1-3.

Prereq: 9 graduate credits in EDUC

(Typically Offered: Fall, Spring)

EDUC 5930I: Workshops: Elementary Education

Credits: 1-3. Contact Hours: Lecture 3.

Prereq: 9 graduate credits in EDUC

(Typically Offered: Fall, Spring)

EDUC 5930J: Workshops: World Language Education

Credits: 1-3. Contact Hours: Lecture 3.

Prereq: 9 graduate credits in EDUC

(Typically Offered: Fall, Spring)

EDUC 5930K: Workshops: Educational Psychology

Credits: 1-3. Contact Hours: Lecture 3.

Prereq: 9 graduate credits in EDUC

(Typically Offered: Fall, Spring)

EDUC 5930L: Workshops: Social Studies Education

Credits: 1-3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

(Typically Offered: Fall, Spring)

EDUC 5930M: Workshops: Literacy Education

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: 9 graduate credits in EDUC

(Typically Offered: Fall, Spring)

EDUC 5940: Contemporary Curriculum Theory and Principles

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Theoretical and historical perspectives of contemporary curriculum; social, cultural, and epistemological aspects of curriculum theory; diverse philosophical positions and approaches to understanding curriculum as it relates to educational settings. (Typically Offered: Fall)

EDUC 5950: Teaching Disciplinary Literacy

(Dual-listed with EDUC 3950).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Analysis and application of strategies to enhance students' disciplinary literacy development in middle and secondary school setting. Research paper related to a course topic for EDUC 5950. (Typically Offered: Fall, Spring, Summer)

EDUC 5970: Teaching Secondary School Mathematics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Develop an understanding of instructional planning, lesson implementation, and assessment in grades 5-12 mathematics, with a focus on reform-based mathematics, equity, and conceptual understanding. (Typically Offered: Fall)

EDUC 5990A: Creative Component: Curriculum

Credits: 1-3. Repeatable.

Prereq: 9 graduate credits in EDUC; Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

EDUC 5990B: Creative Component: Educational Technology

Credits: 1-3. Repeatable.

Prereq: 9 graduate credits in EDUC; Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

EDUC 5990C: Creative Component: Science Education

Credits: 1-3. Repeatable.

Prereq: 9 graduate credits in EDUC; Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

EDUC 5990D: Creative Component: Secondary Education

Credits: 1-3. Repeatable.

Prereq: 9 graduate credits in EDUC; Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

EDUC 5990F: Creative Component: Social and Cultural Studies

Credits: 1-3. Repeatable.

Prereq: 9 graduate credits in EDUC; Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

EDUC 5990G: Creative Component: Mathematics Education

Credits: 1-3. Repeatable.

Prereq: 9 graduate credits in EDUC; Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

EDUC 5990I: Creative Component: Elementary Education

Credits: 1-3. Repeatable.

Prereq: 9 graduate credits in EDUC; Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

EDUC 5990J: Creative Component: World Language Education

Credits: 1-3. Repeatable.

Prereq: 9 graduate credits in EDUC

(Typically Offered: Fall, Spring, Summer)

EDUC 5990K: Creative Component: Educational Psychology

Credits: 1-3. Repeatable.

Prereq: 9 graduate credits in EDUC

(Typically Offered: Fall, Spring, Summer)

EDUC 5990L: Creative Component: Social Studies Education

Credits: 1-3. Repeatable.

Prereq: 9 graduate credits in EDUC

(Typically Offered: Fall, Spring, Summer)

EDUC 5990M: Creative Component: Literacy Education

Credits: 1-3. Repeatable.

Prereq: 9 graduate credits in EDUC; Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

Courses for graduate students:

EDUC 6020: Educational Inquiry in Action

Credits: 3. Contact Hours: Lecture 3.

Opportunities to learn about a variety of faculty research in the School of Education, engage faculty in conversation about their research, and continue reflecting on the theory and practice of educational inquiry.

Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

EDUC 6030: Advanced Learning Environments Design

(Cross-listed with HCI 6030).

Credits: 3. Contact Hours: Lecture 3.

Exploration of advanced aspects of the learning environments design process. Application of analysis, design, development and production, evaluation, implementation, and project management principles. Theory and research in educational technology provides the foundation for design decisions. Focus on current trends in learning environment design and the production and use of educational technology.

EDUC 6080: Social Media and Education

(Cross-listed with HCI 6080).

Credits: 3. Contact Hours: Lecture 3.

Increase understanding of how social media is changing traditional concepts of identity, literacy, citizenship and more. Develop an online social presence through active social media participation.

EDUC 6100: Digital Learning in Teacher Education

Credits: 3. Contact Hours: Lecture 3.

Research on using technology in teacher education programs.

Application examples studied. Field component involving relating material from class to a teacher education situation.

EDUC 6110: Philosophical Foundations of Educational Technology

Credits: 3. Contact Hours: Lecture 3.

Exploration of philosophies of science that serve as foundations for research and practice in educational technology, including positivism, post-positivism, interpretivism/constructivism, and critical theory. The roles of language, nature of truth and reality, and acceptable ways of knowing are explored in terms of their implications for educational technology design, delivery, research, and scholarship.

EDUC 6120: Socio-psychological Foundations of Educational Technology

Credits: 3. Contact Hours: Lecture 3.

Examining socio-psychological theories of educational technology, their historical development, and their implications for the research and design of learning and instructional environments. Emphasis on cognitive and social constructivist paradigms and the creation and use of learning environments supported by technology.

EDUC 6150A: Seminar: Curriculum

Credits: 1. Contact Hours: Lecture 1.

Selected topics in curriculum and instruction; an analysis of research potential; evaluation of impact upon the profession; implications for additional research. (Typically Offered: Fall, Spring)

EDUC 6150B: Seminar: Educational Technology

Credits: 1. Contact Hours: Lecture 1.

Selected topics in educational technology; an analysis of research potential; evaluation of impact upon the profession; implications for additional research.

EDUC 6150C: Seminar: Science Education

Credits: 1. Contact Hours: Lecture 1.

Selected topics in curriculum and instruction; an analysis of research potential; evaluation of impact upon the profession; implications for additional research. (Typically Offered: Fall, Spring)

EDUC 6150D: Seminar: Secondary Education

Credits: 1. Contact Hours: Lecture 1.

Selected topics in curriculum and instruction; an analysis of research potential; evaluation of impact upon the profession; implications for additional research. (Typically Offered: Fall, Spring)

EDUC 6150F: Seminar: Social and Cultural Studies

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Selected topics in curriculum and instruction; an analysis of research potential; evaluation of impact upon the profession; implications for additional research. (Typically Offered: Fall, Spring)

EDUC 6150G: Seminar: Mathematics Education

Credits: 1. Contact Hours: Lecture 1.

Selected topics in curriculum and instruction; an analysis of research potential; evaluation of impact upon the profession; implications for additional research. (Typically Offered: Fall, Spring)

EDUC 6150I: Seminar: Elementary Education

Credits: 1. Contact Hours: Lecture 1.

Selected topics in curriculum and instruction; an analysis of research potential; evaluation of impact upon the profession; implications for additional research. (Typically Offered: Fall, Spring)

EDUC 6150J: Seminar: World Language Education

Credits: 1. Contact Hours: Lecture 1.

Selected topics in curriculum and instruction; an analysis of research potential; evaluation of impact upon the profession; implications for additional research. (Typically Offered: Fall, Spring)

EDUC 6150K: Seminar: Educational Psychology

Credits: 1. Contact Hours: Lecture 1.

Selected topics in curriculum and instruction; an analysis of research potential; evaluation of impact upon the profession; implications for additional research. (Typically Offered: Fall, Spring)

EDUC 6150L: Seminar: Social Studies Education

Credits: 1. Contact Hours: Lecture 1.

Selected topics in curriculum and instruction; an analysis of research potential; evaluation of impact upon the profession; implications for additional research. (Typically Offered: Fall, Spring)

EDUC 6150M: Seminar: Literacy Education

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Selected topics in curriculum and instruction; an analysis of research potential; evaluation of impact upon the profession; implications for additional research. (Typically Offered: Fall, Spring)

EDUC 6800: Motivation in Educational Contexts

Credits: 3. Contact Hours: Lecture 3.

Current conceptualizations and research regarding motivation in educational contexts from Pre-K through college. Understanding historical development of a body of research, including critical examination of inclusivity. Implications for education and practice.

EDUC 6900B: Advanced Special Topics: Educational Technology

Credits: 1-30. Repeatable.

Prereq: 9 graduate credits in EDUC; Instructor Permission for Course

EDUC 6900C: Advanced Special Topics: Science Education

Credits: 1-30. Repeatable.

Prereq: 9 graduate credits in EDUC; Instructor Permission for Course

EDUC 6900D: Advanced Special Topics: Secondary Education

Credits: 1-30. Repeatable.

Prereq: 9 graduate credits in EDUC; Instructor Permission for Course

EDUC 6900F: Advanced Special Topics: Social and Cultural Studies

Credits: 1-30. Repeatable.

Prereq: 9 graduate credits in EDUC; Instructor Permission for Course

EDUC 6900G: Advanced Special Topics: Mathematics Education

Credits: 1-30. Repeatable.

Prereq: 9 graduate credits in EDUC; Instructor Permission for Course

EDUC 6900I: Advanced Special Topics: Elementary Education

Credits: 1-30. Repeatable.

Prereq: 9 graduate credits in EDUC; Instructor Permission for Course

EDUC 6900J: Advanced Special Topics: World Language Education

Credits: 1-30. Repeatable.

Prereq: 9 graduate credits in EDUC; Instructor Permission for Course

EDUC 6900K: Advanced Special Topics: Educational Psychology

Credits: 1-30. Repeatable.

Prereq: 9 graduate credits in EDUC; Instructor Permission for Course

EDUC 6900L: Advanced Special Topics: Social Studies Education

Credits: 1-30. Repeatable.

Prereq: 9 graduate credits in EDUC; Instructor Permission for Course

EDUC 6900M: Advanced Special Topics: Literacy Education

Credits: 1-30. Repeatable.

Prereq: 9 graduate credits in EDUC; Instructor Permission for Course

EDUC 6990A: Research: Curriculum

Credits: 1-30. Repeatable.

Prereq: 9 graduate credits in EDUC; Instructor Permission for Course

EDUC 6990B: Research: Educational Technology

Credits: 1-30. Repeatable.

Prereq: 9 graduate credits in EDUC; Instructor Permission for Course

EDUC 6990C: Research: Science Education

Credits: 1-30. Repeatable.

Prereq: 9 graduate credits in EDUC; Instructor Permission for Course

EDUC 6990D: Research: Secondary Education

Credits: 1-30. Repeatable.

Prereq: 9 graduate credits in EDUC; Instructor Permission for Course

EDUC 6990F: Research: Social and Cultural Studies

Credits: 1-30. Repeatable.

Prereq: 9 graduate credits in EDUC; Instructor Permission for Course

EDUC 6990G: Research: Mathematics Education

Credits: 1-30. Repeatable.

Prereq: 9 graduate credits in EDUC; Instructor Permission for Course

EDUC 6990I: Research: Elementary Education

Credits: 1-30. Repeatable.

Prereq: 9 graduate credits in EDUC; Instructor Permission for Course

EDUC 6990J: Research: World Language Education

Credits: 1-30. Repeatable.

Prereq: 9 graduate credits in EDUC; Instructor Permission for Course

EDUC 6990K: Research: Educational Psychology

Credits: 1-30. Repeatable.

Prereq: 9 graduate credits in EDUC; Instructor Permission for Course

EDUC 6990L: Research: Social Studies Education

Credits: 1-30. Repeatable.

Prereq: 9 graduate credits in EDUC; Instructor Permission for Course

EDUC 6990M: Research: Literacy Education

Credits: 1-30. Repeatable.

Prereq: 9 graduate credits in EDUC; Instructor Permission for Course

Educational Administration (EDADM)

Courses primarily for graduate students, open to qualified undergraduates:

EDADM 5410: Principles of Inclusive Educational Leadership

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Basic principles of educational organizations, including an understanding of organizational behavior and theoretical approaches to administration. Exploration of substantive elements related to school reform, such as the change process, current issues in education, and developing a shared vision and mission around inclusive leadership. Clinical field experience hours required in PK-12 school settings.

EDADM 5430: Leadership and Evaluation for Equitable Outcomes

Credits: 3. Contact Hours: Lecture 3.

Prereq: EDADM 5410

Exploration and application of school and community-level action research and evaluation strategies to facilitate equitable school outcomes and inclusive learning environments. Develop future school administrators' understanding of action research and evaluation tools to analyze state and locally produced learning data, initiate educational program planning, and assess program effectiveness. Clinical field experience hours required in PK-12 school settings.

EDADM 5510: Supervision for Learning Environments

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Study of effective classroom instructional practices that reflect current principles of learning. Understanding and practice of supervisory techniques that support teachers in improving the teaching and learning process, including skills in observational data collection, data analysis, collaboration, and conferencing skills. Clinical field experience hours required in PK-12 school settings.

EDADM 5520: Contemporary Issues in Principal Leadership

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Develops an equity-centered principal and building-level leadership understanding of school/work and community context. Emphasis placed on understanding essential tasks of building-level leadership and management; connecting management and operational decisions to mission and vision; building expertise in instructional leadership to improve teacher practice and student learning; leveraging school culture/atmosphere to provide opportunities and success for all students and their learning needs; advocacy for resources; and, examining the role of principals in a changing world. Clinical field experience hours required in PK-12 school settings.

EDADM 5540: Leading School Reform

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Study of principles of transformational leadership and collaborative decision-making skills. Leadership activities that facilitate the development of a school culture that embraces change and school reforms that result in high quality schools dedicated to improved student achievement. Clinical field experience hours required in PK-12 school settings.

EDADM 5560: Leading for Equitable Learning in School Systems

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

This course explores how a leader can establish a vision for equitable and excellent learning. It provides historical, practical and theoretical perspectives on the culture and systems of schools. Clinical field experience hours required in PK-12 school settings.

EDADM 5570: Human Resource Development for Learning

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Leadership theory and practice that focuses on the professional development of school staff to promote improved student learning. Principles of school personnel evaluation; legal issues related to hiring, retention, and dismissal; evaluation models for professional and classified staff; and effective professional development models to support lifelong learning and reflective practice. Clinical field experience hours required in PK-12 school settings.

EDADM 5580: Diverse Learning Needs

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

This course is designed to address practical and ethical dimensions of school leadership, especially related to disability status, race, gender, language status, and other minoritized statuses. Specific focus will be on the various ecological contexts of the school, the community, and the family as means of making effective use of multiple resources to enrich education. Clinical field experience hours required in PK-12 school settings.

EDADM 5590: Curriculum Leadership

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Analysis of PK-12 school curricula (hidden, explicit, and null), including current and historical curriculum and instructional issues; design, development, and evaluation of instructional materials. Promoting a vision of learning and instructional program conducive to student learning and staff professional growth. Examining the role curricula play in maintaining and advancing bodies of thought, norms, and historic attitudes. Draws on critical curriculum leadership theories to promote socially just curriculum leadership. Clinical field experience hours required in PK-12 school settings.

EDADM 5750: Education Law and Ethics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Examination of constitutional, statutory, and judicial provisions as a basis for the legal operation of educational institutions. Rights and ethical responsibilities of school leaders are examined in relation to their roles and responsibilities with boards, other school personnel, and students. Clinical field experience hours required in PK-12 school settings.

EDADM 5900: Special Topics

Credits: 1-4. Repeatable.

Prereq: Instructor Permission for Course

EDADM 5910A: Supervised Field Experience: Elementary Principal

Credits: 1-6. Repeatable.

Prereq: Instructor Permission for Course

Supervised on-the-job field experience in special areas.

EDADM 5910B: Supervised Field Experience: Secondary Principal

Credits: 1-6. Repeatable.

Prereq: Instructor Permission for Course

Supervised on-the-job field experience in special areas.

EDADM 5930: Workshops

Credits: 1-4. Contact Hours: Lecture 4.

Prereq: Graduate Standing or Permission of Instructor

EDADM 5990: Creative Component Development

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Courses for graduate students:

EDADM 6150A: Seminar: Client Focus

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

In-depth study of administrative topics of contemporary interest and importance.

EDADM 6150B: Seminar: Research

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

In-depth study of administrative topics of contemporary interest and importance.

EDADM 6150C: Seminar: Quality Improvement

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

In-depth study of administrative topics of contemporary interest and importance.

EDADM 6150D: Seminar: Special Services

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

In-depth study of administrative topics of contemporary interest and importance.

EDADM 6150E: Seminar: Assessment

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

In-depth study of administrative topics of contemporary interest and importance.

EDADM 6150F: Seminar: Leadership

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

In-depth study of administrative topics of contemporary interest and importance.

EDADM 6200: Program Induction Leadership Seminar

Credits: 3. Contact Hours: Lecture 3.

Assessment of candidate skill areas, including communication, leadership, technology, and team facilitation for the development of an individualized learning plan for the program. Orientation to program expectations and leadership challenges in the context of schooling for a global society. (Typically Offered: Summer)

EDADM 6210: Aligning the System for Student Achievement

Credits: 5. Contact Hours: Lecture 5.

Alignment of system goals and leadership theory with student achievement, governance, systems thinking, and communication and collaboration with various publics. (Typically Offered: Fall)

EDADM 6220: Maximizing Human and Financial Resources for Student Achievement

Credits: 3. Contact Hours: Lecture 3.

Allocation of system resources to enhance student achievement; human resource development and negotiations; and coaching and evaluating the administrative team. (Typically Offered: Spring)

EDADM 6230: Mid-Program Leadership Seminar

Credits: 1. Contact Hours: Lecture 1.

Mid-program assessment of candidate progress and exploration of leadership strategies for working with diverse populations.

EDADM 6240: School Finance

Credits: 2. Contact Hours: Lecture 2.

General issues of school finance and managing a school district's financial responsibilities. Role of the federal, state and local governments in educational finance, tax issues, and structures; budgeting procedures; and financial analysis and accountability.

EDADM 6250: Social Justice Leadership in Organizations

Credits: 3. Contact Hours: Lecture 4.

Study of the principles of transformative leadership and leadership for social justice. Exploration of scholarly and practitioner-based perspectives on equitable school organizations, with particular emphasis on how to develop culturally responsive and community oriented systems-level leadership. (Typically Offered: Fall)

EDADM 6260: Equitable School Finance

Credits: 3. Contact Hours: Lecture 3.

Examine the equitable management of a school district's financial responsibilities. Coursework addresses the role of the federal, state, and local governments in educational finance, tax issues, and structures; bonding; budgeting procedures; and financial analysis and accountability. Clinical field experience hours required in PK-12 school settings.

EDADM 6270: Transformative Instructional Leadership

Credits: 3.

Accountability strategies for applying leadership theory to student achievement, evaluation, governance, systems thinking, change agency, and communication and collaboration with various publics. Conduct an analysis of PK-12 school curricula (hidden, explicit, and null), including current and historical curriculum and instructional issues; design, development, and evaluation of instructional materials. Develop a vision of learning and instructional program that promotes student learning and staff professional growth. Examine the role curricula play in maintaining and advancing bodies of thought, norms, and historic attitudes. Utilize critical curriculum leadership theories to promote socially just curriculum and instructional leadership. Clinical field experience hours required in PK-12 school settings.

EDADM 6310: Achieving Results Through Accountability Strategies

Credits: 5. Contact Hours: Lecture 5.

Accountability strategies for applying leadership theory to student achievement, governance, systems thinking, change agency, and communication and collaboration with various publics.

EDADM 6320: Using System Assets to Create a Culture of Learning

Credits: 3. Contact Hours: Lecture 3.

Leadership strategies to promote a culture of high student achievement; effective human capital management, including recruitment and induction of new personnel; and effective communication with parents and other patrons.

EDADM 6330: Career Induction Leadership Seminar

Credits: 1. Contact Hours: Lecture 1.

Development of entry plan for creating a culture of collaboration; professional growth plan for first year in new position; and authentic performance assessment of values and beliefs platform.

EDADM 6340: School Business Management and Accountability

Credits: 2. Contact Hours: Lecture 2.

Management of school operations; accountability and ethical business practices; risk management; school plant operations, food service and student transportation.

EDADM 6350: Ethical Governance and Policy

Credits: 3. Contact Hours: Lecture 3.

Explores ethics to support equitable systems-level administrative practice, with attention to the development of personal and professional codes of ethics and social justice. Examine constitutional, statutory, and judicial provisions as a basis for the legal operation of educational institutions which serve school boards, school personnel, students, and communities. Clinical field experience hours required in PK-12 school settings.

EDADM 6360: Culturally Responsive Leadership

Credits: 3. Contact Hours: Lecture 3.

Culturally Responsive Leadership as a pillar of social justice in educational settings. Historical origins of and emerging frameworks of Culturally Responsive Leadership; contextualizing how educational leaders can embed culturally responsive practices. Clinical field hours required in PK-12 school settings.

EDADM 6370: Equity in HR and Fiscal Management

Credits: 3. Contact Hours: Lecture 3.

Hiring of personnel and management of school operations; accountability and ethical business practices; risk management; school plant operations, food service and student transportation. Additional topics include legal governance, human resources, risk management insurance, support services: transportation, nutrition services, facility planning, and management and fiscal management. Clinical field experience hours are required in PK-12 school settings.

EDADM 6510: Ethics, Spirituality, and Social Justice in Administrative Practice

Credits: 3. Contact Hours: Lecture 3.

Exploration of ethical models and practice of educational administrators. Participants develop personal and professional codes of ethics: define concepts of care, spirituality, democracy, equity, diversity, and social justice; and explain how those concepts relate to students' academic and social success. Case studies offer opportunities to consider moral and legal consequences of decision-making. Participants develop their own vision of leadership. Offered even-numbered years.

EDADM 6900: Advanced Special Topics

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

EDADM 6910: Clinical Dilemmas of Practice

Credits: 1-3. Repeatable, maximum of 3 credits.

Prereq: Instructor Permission for Course

Supervised on-the-job field leadership experience in clinical dilemmas of practice. Offered on a satisfactory-fail basis only.

EDADM 6990: Dissertation Research

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Educational Leadership and Policy Studies (ELPS)

Courses primarily for graduate students, open to qualified undergraduates:

ELPS 5910: Social Justice Field Experience

Credits: 1-3.

Prereq: Instructor Permission for Course

Supervised field experience in equity and social justice inside/outside higher education. (Typically Offered: Fall, Spring, Summer)

Courses for graduate students:

ELPS 6150A: Thematic Seminars: Communication and Team Building

Credits: 1. Contact Hours: Lecture 1.

(Typically Offered: Fall, Spring, Summer)

ELPS 6150B: Thematic Seminars: Governance, Politics and Policies

Credits: 1. Contact Hours: Lecture 1.

(Typically Offered: Fall, Spring, Summer)

ELPS 6150C: Thematic Seminars: Law, Equity, Equality

Credits: 1. Contact Hours: Lecture 1.

(Typically Offered: Fall, Spring, Summer)

ELPS 6150D: Thematic Seminars: Ethics, Justice, and Caring

Credits: 1. Contact Hours: Lecture 1.

(Typically Offered: Fall, Spring, Summer)

ELPS 6150E: Thematic Seminars: Problem Solving and Planning

Credits: 1. Contact Hours: Lecture 1.

(Typically Offered: Fall, Spring, Summer)

ELPS 6150F: Thematic Seminars: Critical and Creative Thinking

Credits: 1. Contact Hours: Lecture 1.

(Typically Offered: Fall, Spring, Summer)

ELPS 6160: Capstone Experience

Credits: 3.

Prereq: Instructor Permission for Course

This experience is designed to explore a topic addressed in one of the thematic seminars. The product of the capstone experience is a written paper of sufficient quality to be submitted to a scholarly journal for review. (Typically Offered: Fall, Spring)

ELPS 6200: Education for Social Justice

Credits: 3. Contact Hours: Lecture 3.

Introduction to social justice theory, research, and practice from a variety of theoretical perspectives in the context of education and broader society. (Typically Offered: Fall)

ELPS 6210: Pedagogies of Dissent

(Cross-listed with WGS 6210).

Credits: 3. Contact Hours: Lecture 3.

Critical examination of the theoretical foundations of contemporary and historical pedagogical traditions that seek to challenge the status quo, expand justice, and deepen democracy. (Typically Offered: Spring)

ELPS 6220: Decolonizing Praxis

Credits: 3. Contact Hours: Lecture 3.

Critically probes the philosophical and historical foundations of indigenous epistemologies and knowledge systems. Examination of policy, social, theoretical, research, and P-20 educational issues from a decolonial perspective. (Typically Offered: Spring)

ELPS 6240: Critical Race Theory in Education

Credits: 3. Contact Hours: Lecture 3.

Exploration of the central tenets of critical race theory. Examination of policy, social and educational issues from a critical race perspective. (Typically Offered: Summer)

ELPS 6250: Gender and Sexuality in Education

Credits: 3. Contact Hours: Lecture 3.

Exploration of gender and sexuality in education. (Typically Offered: Summer)

ELPS 6260: Social Justice and Social Change in Education

Credits: 3. Contact Hours: Lecture 3.

An examination of how changes in the interest of social justice have occurred historically in education. Exploration of social movements and theories of social change. (Typically Offered: Fall)

ELPS 6300: Education Policy and Analysis

Credits: 3. Contact Hours: Lecture 3.

Introduction to current theoretical, practical, and research-based policy debates related to the P-20 educational system. Critical analysis and evaluation of government policies, initiatives, funding, and other regulatory levers related to education. Intensive reading and discussion of the nature of theory, evidence, practice of education policy. Offered even-numbered years. (Typically Offered: Spring)

ELPS 6510: Social Foundations of Education

Credits: 3. Contact Hours: Lecture 3.

Prereq: Admission to Ed.D. program

Introduction to the historical and contemporary landscape of P-20 schooling in the United States. Emphasis on topics and tensions in the relationship between school and society (e.g. equity of access to education and competing purposes of education) and the implications of these topics and tensions for teaching, learning, and leadership in schools across the P-20 continuum. Offered irregularly.

ELPS 6520: Organizational Theory in P-20 Systems

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate standing and admission to Ed.D. program

Theory of inclusive leadership and organizations for the Education Doctorate program in the School of Education. Topics for practitioner-scholars related to educational leadership, current issues in the field, and program success.

ELPS 6530: Contemporary Issues of Equity and Diversity

Credits: 3.

Contemporary issues of equity and diversity across P-20+ school settings. Relevant history, philosophy, theory, and research is highlighted to understand how equity and diversity is conceptualized, addressed, researched, and contextualized at micro and macro levels of educational settings. Offered irregularly.

ELPS 6540: Scholar-Practitioner Inquiry

Credits: 3. Contact Hours: Lecture 3.

Introductory doctoral research course addresses the fundamental concepts and procedures that form the foundations of empirical research in the social sciences and education. Orient scholar-practitioners regarding how to design an empirical research study that identifies a problem of practice, and developing the necessary knowledge and skills to complete an action research dissertation. (Typically Offered: Fall, Spring, Summer)

ELPS 6550: Qualitative Inquiry in P-20 Education

Credits: 3. Contact Hours: Lecture 3.

Prereq: Admission to Ed.D. program

Qualitative research approaches and methods for applied research in P-20 education settings; research designs, data collection, and data analysis with a focus on action research.

ELPS 6560: Statistics for P-20 Education

Credits: 3. Contact Hours: Lecture 3.

Prereq: Admission to Ed.D. program

Quantitative research approaches and methods for applied research in P-20 education settings; research designs, data collection, and data analysis with a focus on action research.

ELPS 6570: Dissertation in Practice Seminar

Credits: 3. Contact Hours: Lecture 3.

Prereq: Admission to Ed.D. program

Development of dissertation in practice proposal. Formulating research questions, theoretical/conceptual frameworks, literature review, research design, and methodology. Offered irregularly.

Electrical Engineering (EE)

Courses primarily for undergraduates:

EE 1660: Professional Programs Orientation

(Cross-listed with CPRE 1660).

Credits: Required. Contact Hours: Lecture 1.

(1-0) Overview of the nature and scope of electrical engineering and computer engineering professions. Overview of portfolios. Departmental rules, advising center operations, degree requirements, program of study planning, career options, and student organizations. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

EE 1850: Introduction to Electrical Engineering and Problem-Solving I

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: (MATH 1430 or satisfactory scores on mathematics placement examinations) OR (MATH 1650 or satisfactory scores on mathematics placement examinations)

Project based examples from electrical engineering. Systematic thinking process for engineering problem solving. Group problem solving. Mathematical, conceptual and computer-based projects. Solving engineering problems and presenting solutions through technical reports and oral presentations. Solutions of engineering problems using computation tools and basic programming. Satisfactory placement scores can be found at: <https://math.iastate.edu/academics/undergraduate/aleks/placement/>. Graduation Restriction: Only one of ENGR 1600, ABE 1600, AERE 1600, BME 1600, CE 1600, CHE 1600, CPRE 1850, EE 1850, IE 1480, ME 1600, and SE 1850 may count towards graduation. (Typically Offered: Fall, Spring)

EE 1860: Introduction to Electrical Engineering and Problem Solving II

Credits: 1.

Prereq: EE 1850

Project based and hands on continuation of 1850. Group skills needed to work effectively in teams. Individual interactive skills for small and large groups. Learning to use tools and methods for solving electrical engineering problems. (Typically Offered: Spring)

EE 2010: Electric Circuits

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: PHYS 2310 or PHYS 2310H; PHYS 2310L; credit or concurrent enrollment in MATH 2670

Emphasis on mathematical tools. Circuit elements (resistors, inductors, capacitors) and analysis methods including power and energy relationships. Network theorems. DC, sinusoidal steady-state, and transient analysis. AC power. Frequency response. Two port models. Diodes, PSPICE. Laboratory instrumentation and experimentation. Graduation Restriction: Credit for only EE 2010 or 4420 may be used towards graduation. (Typically Offered: Fall, Spring)

EE 2240: Signals and Systems I

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: EE 2010; MATH 2670

Mathematical preliminaries. Introduction to signals and systems. Signal manipulations. System properties. LTI systems, impulse response and convolution. Fourier Series representation and properties. Continuous and discrete-time Fourier Transforms and properties. Sampling and reconstruction. Modulation and demodulation. Applications and demonstrations using Matlab. (Typically Offered: Fall, Spring)

EE 2300: Electronic Circuits and Systems

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: EE 2010; MATH 2670

Frequency domain characterization of electronic circuits and systems, transfer functions, sinusoidal steady state response. Time domain models of linear and nonlinear electronic circuits, linearization, small signal analysis. Stability and feedback circuits. Operational amplifiers, device models, linear and nonlinear applications, transfer function realizations. A/D and D/A converters, sources of distortions, converter linearity and spectral characterization, applications. Design and laboratory instrumentation and measurements. (Typically Offered: Fall, Spring)

EE 2320: Professional and Ethical Issues in Electrical and Computer Engineering

(Cross-listed with CPRE 2320).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 2270 or EE 2850

Professional and ethical issues in electrical and computer engineering. Soft skills, including communication and leadership skills, and how they relate to the engineering profession. Case studies illustrating ethical decision making in an engineering context and differentiating between moral and professional ethics. Issues of diversity, equity, and inclusion in the engineering profession.

EE 2610: Transfer Orientation

(Cross-listed with CPRE 2610).

Credits: Required. Contact Hours: Lecture 1.

Introduction to the College of Engineering and the engineering profession specifically for transfer students. Information concerning university and college policies, procedures, and resources. Offered on a satisfactory-fail basis only.

EE 2850: Problem Solving Methods and Tools for Electrical Engineering

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Integration of field-specific computational tools for practically solving electrical engineering problems. Methods for systematically reducing problems into sequential steps compatible with computer based tools. Structuring computer programs for efficiency and maintainability. Integration of multi-platform operating systems and multi-vendor tools for solving engineering problems. Hands-on laboratory experiences using Matlab, C, and other computational tools.

EE 2940: Program Discovery

(Cross-listed with CPRE 2940).

Credits: Required. Contact Hours: Lecture 1.

Prereq: CPRE 1660 or EE 1660

The roles of professionals in computer and electrical engineering. Relationship of coursework to industry and academic careers. Issues relevant to today's world. Offered on a satisfactory-fail basis only.

EE 3030: Energy Systems and Power Electronics

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 2670; PHYS 2320 or PHYS 2320H; credit or concurrent enrollment in EE 2300

Structure of competitive electric energy systems. System operation and economic optimization. Mutual inductance, transformers. Synchronous generators. Balanced three-phase circuit analysis and power calculations. Network calculations and associated numerical algorithms. Two-port circuits. Voltage regulation. Resonance and power factor correction. DC and induction motors. Power electronic circuit applications to power supplies and motor drives. (Typically Offered: Fall, Spring)

EE 3110: Electromagnetic Fields and Waves

Credits: 4. Contact Hours: Lecture 4.

Prereq: EE 2010, MATH 2650, PHYS 2320, and Credit or concurrent enrollment in MATH 2670

Fundamentals and applications of electric and magnetic fields and materials. Electrostatics and magnetostatics, potentials, capacitance and inductance, energy, force, torque. Uniform plane electromagnetic waves, Poynting vector. Transmission lines: transient and sinusoidal steady-state conditions, reflection coefficient. (Typically Offered: Fall, Spring)

EE 3140: Electromagnetics for non Electrical Engineers

Credits: 3. Contact Hours: Lecture 3.

Prereq: PHYS 2320

Conceptual study of electromagnetism and its application in engineering and related fields. EM fundamentals, EM spectrum, radiation, radiating systems, wireless, modern concepts of physics, quantum computing, transmission lines, high speed effects, waveguides, GPS and other related phenomena will be discussed and explained with the application in mind. (Typically Offered: Fall, Spring)

EE 3210: Communication Systems I

Credits: 3. Contact Hours: Lecture 3.

Prereq: EE 2240

Frequency domain analysis, spectral filtering, bandwidth. Linear modulation systems. Angle modulation systems. Phase locked loop, super-heterodyne receiver. Sampling and pulse code modulation. Digital data transmission, line coding, pulse shaping, multiplexing. (Typically Offered: Fall)

EE 3220: Probabilistic Methods for Electrical Engineers

(Cross-listed with STAT 3220).

Credits: 3. Contact Hours: Lecture 3.

Prereq: EE 2240

Introduction to probability with applications to electrical engineering. Sets and events, probability space, conditional probability, total probability and Bayes' rule. Discrete and continuous random variables, cumulative distribution function, probability mass and density functions, expectation, moments, moment generating functions, multiple random variables, functions of random variables. Elements of statistics, hypothesis testing, confidence intervals, least squares. Introduction to random processes. (Typically Offered: Fall, Spring)

EE 3240: Signals and Systems II

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: EE 2240

Laplace and z-Transforms, properties and inverses. Applications to LTI systems, circuits, analog/digital filters, feedback systems, stability analysis and margins. MATLAB labwork covering these topics. (Typically Offered: Fall, Spring)

EE 3300: Integrated Electronics

(Cross-listed with CPRE 3300).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: CPRE 2810; EE 2010; credit or concurrent enrollment in EE 2300

Semiconductor technology for integrated circuits. Modeling of integrated devices including diodes, BJTs, and MOSFETs. Physical layout. Circuit simulation. Digital building blocks and digital circuit synthesis. Analysis and design of analog building blocks. Laboratory exercises and design projects with CAD tools and standard cells.

EE 3320: Semiconductor Materials and Devices

(Cross-listed with MATE 3320).

Credits: 3. Contact Hours: Lecture 3.

Prereq: CPRE and EE majors: EE 2300, MATE majors: MATE 3170

Introduction to semiconductor material and device physics. Quantum mechanics and band theory of semiconductors. Charge carrier distributions, generation/recombination, transport properties. Physical and electrical properties and fabrication of semiconductor devices such as MOSFETs, bipolar transistors, laser diodes and LED's. (Typically Offered: Spring)

EE 3330: Electronic Systems Design

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: CPRE 2810, EE 2300

Further topics in electronic systems design: Use of sensors and actuators. High-power amplifying and switching components. Linear and switched-mode power supplies. Linear and switched-mode amplifiers. Interfacing electronic components with programmable microcontrollers. Printed circuit board technology and design tools. Laboratory exercises and design projects incorporating printed circuit technology. (Typically Offered: Fall)

EE 3410: BioMEMs and Nanotechnology

(Cross-listed with BME 3410).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BME 2200

Overview of Micro-Electro-Mechanical-System (MEMS) technologies for bioengineering, fundamentals of microfluidic device design, fabrication, and characterization, survey of microfluidic functional building blocks for lab-on-a-chip applications including mixers, valves, channels, and chambers. Topics of nanotechnology in bioengineering, nanoscale building block technologies for bioengineering including self-assembling, surface chemical treatment, nano-imprinting, nano-particles, nano-tubes, nano-wires, and stimuli-responsive biomaterials.

EE 3510: Analysis of Energy Systems

Credits: 3. Contact Hours: Lecture 3.

Energy-scientific, engineering and economic foundations. Energy utilization-global and national. Sectoral analysis of energy consumption. Relationship of energy consumption and production to economic growth and environment. Technology for energy production. Economic evaluation of energy utilization and production. Scientific basis for global warming. Environmental impact of energy production and utilization. Renewable energy. Meets International Perspectives Requirement.

EE 3880: Sustainable Engineering and International Development

(Cross-listed with ABE 3880/ CE 3880).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Junior Classification in an Engineering Major

Multi-disciplinary approach to sustainable engineering and international development, sustainable development, appropriate design and engineering, feasibility analysis, international aid, business development, philosophy and politics of technology, and ethics in engineering. Engineering-based projects from problem formulation through implementation. Interactions with partner community organizations or international partners such as nongovernment organizations (NGOs). Course readings, final project/design report. Meets International Perspectives Requirement. (Typically Offered: Fall)

EE 3910: Open Laboratory and Design Studio

Credits: 2.

Prereq: EE 2240

Studio-based activity (guided problem-based learning and design) focusing on elements of design, measurement, data capture, and data interpretation. Team building, engineering professionalism, engineering process of review and critique, and presentation. Open design activities that may include working with other studios.

EE 3940: Program Exploration

(Cross-listed with CPRE 3940).

Credits: Required. Contact Hours: Lecture 1.

Prereq: CPRE 2940 or EE 2940

Exploration of academic and career fields for electrical and computer engineers. Examination of professionalism in the context of engineering and technology with competencies based skills. Introduction to professional portfolio development and construction. Offered on a satisfactory-fail basis only.

EE 4110: Wave Propagation and Transmission Lines

Credits: 3. Contact Hours: Lecture 3.

Prereq: EE 3110

Time varying Maxwell's equations; wave equation in an unbounded generally lossy (multi-layered) media; uniform plane waves, dielectric constant, propagation, attenuation and phase constants; wave impedance; phase and group velocities; wave polarization; reflection and transmission coefficients (at oblique incidence) at boundaries (conducting and dielectric); Doppler effect; transmission lines; propagation, attenuation, phase constants; phase velocity; characteristic impedance; load impedance and its influence; reflection and transmission coefficients; cascaded transmission lines; steady-state voltage and current; standing waves; SWR; Smith chart; matching techniques including, quarter-wave matching, single and double stub matching. (Typically Offered: Spring)

EE 4140: Microwave Engineering

(Dual-listed with EE 5140).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: EE 2300, EE 3110

Principles, analyses, and instrumentation used in the microwave portion of the electromagnetic spectrum. Wave theory in relation to circuit parameters. S parameters, couplers, discontinuities, and microwave device equivalent circuits. RF amplifier design, microwave sources, optimum noise figure and maximum power designs. Microwave filters and oscillators. (Typically Offered: Fall)

EE 4170: Electromagnetic Radiation, Antennas, and Propagation

(Dual-listed with EE 5170).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: EE 3110

Fundamental antenna concepts. Radiation from wire-and aperture-type sources. Radio transmission formulas. Wave and antenna polarization. Antenna arrays. Modern antenna topics. Practical antenna design. Antenna noise. Radiowave propagation in the presence of the earth and its atmosphere. Antenna measurements and computer aided analysis. (Typically Offered: Spring)

EE 4180: High Speed System Engineering Measurement and Testing

(Cross-listed with CPRE 4180).

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: EE 2300, EE 3110

Measurement of high speed systems and mixed signal systems. Measurement accuracy and error. Network analysis and spectrum analysis used in high speed measurement and testing. Test specification process and parametric measurement. Sampling and digital signal processing concepts. Design for testability. Testing equipment. Applications. (Typically Offered: Fall)

EE 4190: Magnetism and Magnetic Materials

(Dual-listed with MSE 5190/ EE 5190). (Cross-listed with MATE 4190).

Credits: 3. Contact Hours: Lecture 3.

Prereq: EE 3110 or MATE 3170 or PHYS 3640

Magnetic fields, flux density and magnetization. Magnetic materials, magnetic measurements. Magnetic properties of materials. Domains, domain walls, domain processes, magnetization curves and hysteresis. Types of magnetic order, magnetic phases and critical phenomena. Magnetic moments of electrons, theory of electron magnetism. Technological application, soft magnetic materials for electromagnets, hard magnetic materials, permanent magnets, magnetic recording technology, magnetic measurements of properties for materials evaluation. Offered odd-numbered years. (Typically Offered: Fall)

EE 4220: Communication Systems II

Credits: 4. Contact Hours: Laboratory 3, Lecture 3.

Prereq: EE 3210, EE 3220 and Credit or concurrent enrollment in EE 4230

Introduction to probability and random processes; Performance of analog systems with noise; Performance of digital communication with noise; optimum receivers, transmission impairments, and error rates; Introduction to information theory and coding: source coding, channel coding, channel capacity. In the lab - Construction and evaluation of modulators, demodulators and other components for analog and digital communications. Design, simulate, and evaluate wireless communication systems and their key components. Noise measurement.

EE 4230: Communication Systems Laboratory

Credits: 1. Contact Hours: Laboratory 3.

Prereq: EE 3210 and Credit or concurrent enrollment in EE 4220

Construction and evaluation of modulators, demodulators and other components for analog and digital communications. Design, simulate, and evaluate wireless communication systems and their key components. Noise measurement.

EE 4240: Introduction to Digital Signal Processing

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: EE 2240

Sampling and reconstruction. Concepts and mathematical tools in discrete-time signal and image processing with examples from communications, nondestructive evaluation (NDE), and medical imaging. Discrete-time correlation and matched-filter receivers. Discrete Fourier transform (DFT) and its fast implementation (FFT). 2-dimensional versions. Z transforms. Filter design. Realizations of discrete-time systems and quantization effects. Laboratory experiments illustrating DSP implementations and applications.

EE 4250: Machine learning: A Signal Processing Perspective

Credits: 3. Contact Hours: Lecture 2, Discussion 1.

Prereq: EE 3220/STAT 3220 or STAT 3300; and MATH 2070 or MATH 4070/5070

Background material review (probability, calculus, linear algebra), Key machine learning tools and techniques. Supervised Learning: Linear Regression, Logistic Regression, Generative algorithms for classification (Gaussian & discrete-valued case; Naive Bayes assumption), Support Vector Machines, Decision trees; Unsupervised Learning: principal components analysis (PCA), robust PCA, clustering; Introduction to Deep Learning and Neural Networks; Basic Learning Theory and Bias-Variance Tradeoff; introduction to key Bayesian estimation concepts (MMSE estimation, Kalman filter, hidden Markov models). (Typically Offered: Spring)

EE 4280: Image Analysis using Machine Learning

Credits: 3. Contact Hours: Laboratory 2, Lecture 2.

Repeatable.

Visual recognition tasks such as image classification, localization and detection are core to applications in image understanding. Developments in neural network (aka 'deep learning') approaches have advanced the performance of these state-of-the-art visual recognition systems. Explore deep learning architectures with a focus on learning end-to-end models for tasks such as image classification. Implement, train and debug neural networks and gain a detailed understanding of research in computer vision. Image recognition problem set-up, the learning algorithms (e.g. backpropagation), practical engineering tricks for training and fine-tuning the networks. Final course project. (Typically Offered: Fall)

EE 4320: Microelectronics Fabrication Techniques

(Dual-listed with EE 5320/ MSE 5320). (Cross-listed with MATE 4320).

Credits: 4. Contact Hours: Lecture 2, Laboratory 4.

Prereq: CPRE and EE majors: EE 2300, MATE majors: MATE 3170

Techniques used in modern integrated circuit fabrication, including diffusion, oxidation, ion implantation, lithography, evaporation, sputtering, chemical-vapor deposition, and etching. Process integration. Process evaluation and final device testing. Extensive laboratory exercises utilizing fabrication methods to build electronic devices. Use of computer simulation tools for predicting processing outcomes. Recent advances in processing CMOS ICs and micro-electro-mechanical systems (MEMS).

EE 4350: Analog VLSI Circuit Design

(Cross-listed with CPRE 4350).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: EE 3300

Basic analog integrated circuit and system design including design space exploration, performance enhancement strategies, operational amplifiers, references, integrated filters, and data converters. (Typically Offered: Spring)

EE 4360: Physics of Transistors

Credits: 3. Contact Hours: Lecture 3.

Prereq: EE 3320

Use of energy band diagrams to describe the behavior of junction devices, electron and hole currents in transistors, junction capacitance, parasitic and second-order effects, development of circuit models from the underlying physical behavior, heterojunction devices, high-speed and high-power applications, measurement techniques. (Typically Offered: Spring)

EE 4370: Electronic Properties of Materials

(Dual-listed with EE 5370/ MSE 5370). (Cross-listed with MATE 4370).

Credits: 3. Contact Hours: Lecture 3.

Prereq: EE 3320 or MATE 3170 or PHYS 3220

Magnetic fields, flux density and magnetization. Magnetic materials, magnetic measurements. Magnetic properties of materials. Domains, domain walls, domain processes, magnetization curves and hysteresis. Types of magnetic order, magnetic phases and critical phenomena. Magnetic moments of electrons, theory of electron magnetism. Technological application, soft magnetic materials for electromagnets, hard magnetic materials, permanent magnets, magnetic recording technology, biomedical applications of magnetism, magnetic evaluation of materials. (Typically Offered: Spring)

EE 4380: Optoelectronic Devices and Applications

(Dual-listed with EE 5380).

Credits: 3. Contact Hours: Lecture 3.

Prereq: EE 3110 and EE 3320

Transmission and reflection of electromagnetic plane waves. Propagation in dielectric and fiber optic waveguides. LED and laser operating principles and applications. Photodetectors and solar cells. Optical modulation and switching.

EE 4390: Nanoelectronics

Credits: 3. Contact Hours: Lecture 3.

Prereq: EE 3320 or MATE 3340

Concepts of quantum mechanics relevant to nanoelectronic devices, including quantization, tunneling, and transport; overview of some of the leading technologies for nanoelectronics, including carbon nanotubes, quantum dots, and molecular transistors; fabrication methods for building nanoelectronic devices. (Typically Offered: Spring)

EE 4420: Introduction to Circuits and Instruments

Credits: 2. Contact Hours: Lecture 1.5, Laboratory 1.

Prereq: MATH 2670; PHYS 2320; PHYS 2320L

Half-semester course. Basic circuit analysis using network theorems with time domain and Laplace transform techniques for resistive, resistive-inductive, resistive-capacitive, and resistive-inductive-capacitive circuits. Transient circuit behavior. Basic operational amplifiers and applications. Familiarization with common EE instrumentation and demonstration of basic principles. Graduation Restriction: Credit for only 2010 or 4420 may be counted toward graduation; credit FOR 4420 will not count toward graduation for EE or CPRE majors. (Typically Offered: Fall, Spring)

EE 4480: Introduction to AC Circuits and Motors

Credits: 2. Contact Hours: Lecture 1.5, Laboratory 1.

Prereq: Credit or enrollment in EE 4420

Half-semester course. Basics of DC machines, stepper motors, AC induction motors, and synchronous generators. AC steady state analysis, transformers, and three-phase circuit analysis. Credit For EE 4480 May Not Be Applied Toward A Degree In Either EE Or CPRE. (Typically Offered: Fall, Spring)

EE 4500: Biosensors

(Cross-listed with BME 4500).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BME 2200

Overview of biosensors and bioanalytical challenges; designing for performance including various analytical problems, ion-selective membranes, characteristics of enzymes and basics of bioaffinity sensing; fundamentals of bioselective layers including depositing films and membranes, surfaces for immobilization and bioselective agents; survey of different biosensing technologies including electroanalytical, biomembrane, optical, and acoustic-wave based sensors.

EE 4500L: Biosensors Laboratory

(Cross-listed with BME 4500L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: BME 2200; concurrent enrollment in BME 4500 or EE 4500

Laboratory course accompanying BME 4500. Design, fabrication, and characterization of various electrical, chemical, polymer, optical and acoustic sensors.

EE 4510: Engineering Acoustics

(Cross-listed with EM 4510/ ME 4510).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 2660 or MATH 2670; PHYS 2310 and 2310L

The basics of acoustic wave propagation in fluids with an emphasis on sound propagation in air. Topics include transmission and reflection of sound at a boundary; role of acoustic sources in directing sound fields; diffraction of sound around solid objects; reverberation of sound in a room; and the measurement of sound fields. (Typically Offered: Fall)

EE 4520: Electrical Machines and Power Electronic Drives

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: EE 3030, EE 3240

Basic concepts of electromagnetic energy conversion. DC motors and three-phase induction motors. Basic introduction to power electronics. Adjustable speed drives used for control of DC, induction, and AC motors. Experiments with converter topologies, DC motors, AC motors and adjustable speed drives. (Typically Offered: Spring)

EE 4550: Introduction to Energy Distribution Systems

Credits: 3. Contact Hours: Lecture 3.

Prereq: EE 3030 and Credit or concurrent enrollment in EE 3240

Overhead and underground distribution system descriptions and characteristics, load descriptions and characteristics, overhead line and underground cable models, distribution transformers, power flow and fault analysis, overcurrent protection, power factor correction, system planning and automation, and economics in a deregulated environment. (Typically Offered: Fall)

EE 4560: Power System Analysis I

Credits: 3. Contact Hours: Lecture 3.

Prereq: EE 3030 and Credit or concurrent enrollment in EE 3240

Power transmission lines and transformers, synchronous machine modeling, network analysis, power system representation, load flow. (Typically Offered: Fall)

EE 4570: Power System Analysis II

Credits: 3. Contact Hours: Lecture 3.

Prereq: EE 3030 and Credit or concurrent enrollment in EE 3240

Power system protection, symmetrical components, faults, stability. Power system operations including the new utility environment. (Typically Offered: Spring)

EE 4580: Economic Systems for Electric Power Planning

Credits: 3. Contact Hours: Lecture 3.

Prereq: EE 3030 or ECON 3010

Evolution of electric power industry. Power system operation and planning and related information systems. Linear and integer optimization methods. Short-term electricity markets and locational marginal prices. Risk management and financial derivatives. Basics of public good economics. Cost recovery models including tax treatment for transmission investments.

EE 4590: Electromechanical Wind Energy Conversion and Grid Integration
(Dual-listed with EE 5590).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or enrollment in EE 4520 and EE 4560

Summary of industry status and expected growth; power extraction from the air stream; operation and modeling of electric machines, and power electronics topologies for wind energy conversion; analysis of machine-grid power electronic circuits, controller interface, and collector (distribution) networks; treatment of harmonics, flicker, over/under-voltages, filters, low-voltage ride-through, and reactive compensation; relaying; effects on transmission expansion, planning and grid operation and coordination including variability, frequency control, reserves, and electricity markets; overview of storage technologies and hybrid configurations.

EE 4650: Digital VLSI Design

(Cross-listed with CPRE 4650).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: EE 3300

Digital design of integrated circuits employing very large scale integration (VLSI) methodologies. Technology considerations in design. High level hardware design languages, CMOS logic design styles, area-energy-delay design space characterization, datapath blocks: arithmetic and memory, architectures and systems on a chip (SOC) considerations. VLSI chip hardware design project. (Typically Offered: Fall)

EE 4750: Automatic Control Systems

Credits: 3. Contact Hours: Lecture 3.

Prereq: EE 3240

Stability and performance analysis of automatic control systems. The state space, root locus, and frequency response methods for control systems design. PID control and lead-lag compensation. Computer tools for control system analysis and design. (Typically Offered: Fall)

EE 4760: Control System Simulation

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: EE 4750

Theory and practice of linear, nonlinear, and logic control systems, with hands-on labs on Modeling and Control of: Motor (model identification and validation, speed and position control using PID), Double-hinged inverted pendulum (model identification and validation, balance control using linearization and state-feedback, and swing-up control using sliding-mode), Quadcopter (model identification and validation, navigation and obstacle avoidance control using PID), PLC Assembly-line (ladder logic control for start/stop, sorting, assembly, and discharge using constructs of XIC/XIO/Timer/Counter/OSF/FIFO). (Typically Offered: Spring)

EE 4880: Eddy Current Nondestructive Evaluation

(Dual-listed with EE 5880/ MSE 5880). (Cross-listed with MATE 4880).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 2650 and (MATE 2160 or MATE 2730 or MATE 3920 or EE 3110 or PHYS 3640)

Electromagnetic fields of various eddy current probes. Probe field interaction with conductors, crack and other material defects. Ferromagnetic materials. Layered conductors. Elementary inversion of probe signals to characterize defects. Special techniques including remote-field, transient, potential drop nondestructive evaluation and the use of Hall sensors. Practical assignments using a 'virtual' eddy current instrument will demonstrate key concepts. Offered odd-numbered years. (Typically Offered: Fall)

EE 4890: Survey of Remote Sensing Technologies

(Dual-listed with MTEOR 5890/ EE 5890/ ENSCI 5890/ GEOL 5890/ NREM 5890). (Cross-listed with MTEOR 4890/ ENSCI 4890/ GEOL 4890/ NREM 4890).

Credits: 3. Contact Hours: Lecture 3.

Electromagnetic-radiation principles, active and passive sensors, multispectral and hyperspectral sensors, imaging radar, SAR, thermal imaging, lidar. Examples of applications. Also offered online S. (Typically Offered: Fall)

EE 4890L: Satellite Remote Sensing Laboratory

(Dual-listed with MTEOR 5890L/ EE 5890L/ GEOL 5890L/ NREM 5890L).

(Cross-listed with MTEOR 4890L/ GEOL 4890L/ NREM 4890L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Completion or concurrent enrollment in MTEOR/GEOL/NREM/EE 4890/5890

Processing and analysis of satellite sensor data (optical and radar).

Provides practical applications in an environmental context. (Typically Offered: Fall)

EE 4900: Independent Study

Credits: 1-30. Repeatable.

Prereq: Senior classification in Electrical Engineering; Permission of Department

Investigation of an approved topic commensurate with the student's prerequisites.

EE 4900H: Independent Study: Honors

Credits: 1-30. Repeatable.

Prereq: Senior classification in Electrical Engineering; Permission of Department; Membership in the University Honors Program

Investigation of an approved topic commensurate with the student's prerequisites.

EE 4910: Senior Design Project I and Professionalism

(Cross-listed with CPRE 4910/ SE 4910).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: [(EE, CPRE, or CYBE MAJOR) AND (CPRE 3940 or EE 3940 or CPRE 2320 or EE 2320 or CPRE 2340 or CYBE 2340) AND (ENGL 3090 or ENGL 3140 or ENGL 3240H) AND (Credit or enrollment in CPRE 3080 or EE 3220)] OR [(SE MAJOR) AND (ENGL 3090 or ENGL 3140 or ENGL 3140H) AND (SE 3390) AND (Credit or enrollment in COMS 3520 or CPRE 3080)]

Preparing for entry to the workplace. Selected professional topics. Use of technical writing skills in developing project plan and design report; design review presentation. First of two-semester team-oriented, project design and implementation experience. (Typically Offered: Fall, Spring)

EE 4920: Senior Design Project II

(Cross-listed with CPRE 4920/ SE 4920).

Credits: 2. Contact Hours: Lecture 1, Laboratory 3.

Prereq: CPRE 4910 or EE 4910

Second semester of a team design project experience. Emphasis on the successful implementation and demonstration of the design completed in EE 4910, CPRE 4910, or SE 4910 and the evaluation of project results. Technical writing of final project report; oral presentation of project achievements; project poster. (Typically Offered: Fall, Spring)

EE 4940: Portfolio Assessment

(Cross-listed with CPRE 4940).

Credits: Required. Contact Hours: Lecture 1.

Prereq: CPRE 2320 or EE 2320 or CYBE 2340; credit or concurrent enrollment in CPRE 4910 or EE 4910

Portfolio update and evaluation. Portfolios as a tool to enhance career opportunities. Offered on a satisfactory-fail basis only.

EE 4960: Modern Optics

(Cross-listed with PHYS 4960).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or enrollment in PHYS 3220, PHYS 3650, and PHYS 4800

Review of wave and electromagnetic theory; topics selected from: reflection/refraction, interference, geometrical optics, Fourier analysis, dispersion, coherence, Fraunhofer and Fresnel diffraction, holography, quantum optics, nonlinear optics. (Typically Offered: Fall)

Courses primarily for graduate students, open to qualified undergraduates:

EE 5010: Analog and Mixed-Signal VLSI Circuit Design Techniques

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Design techniques for analog and mixed-signal VLSI circuits. Amplifiers; operational amplifiers, transconductance amplifiers, finite gain amplifiers and current amplifiers. Linear building blocks; differential amplifiers, current mirrors, references, cascading and buffering. Performance characterization of linear integrated circuits; offset, noise, sensitivity and stability. Layout considerations, simulation, yield and modeling for high-performance linear integrated circuits. (Typically Offered: Fall)

EE 5030: Power Management Integrated Circuits

Credits: 3. Contact Hours: Lecture 3.

Prereq: (EE 4350 or credit or concurrent enrollment in EE 5010) or Graduate Classification

Introducing in-depth chip-level power management integrated circuit (PMIC) designs, including switching power converters, linear regulators, charge pumps and other types of PMICs. Steady-state and dynamic response analysis and optimization of linear regulators and switching power converters with different control methodologies, such as voltage-/current-/band-band control. Chip-level circuit design considerations, optimizations and cadence simulations for PMICs, including system and block-level circuits, such as voltage reference, current source and current mirror, current sensor, ramp generator, non-overlapping power stage, and other circuits. Offered even-numbered years. (Typically Offered: Fall)

EE 5050: CMOS and BiCMOS Data Conversion Circuits

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Theory, design and applications of data conversion circuits (A/D and D/A converters) including: architectures, characterization, quantization effects, conversion algorithms, spectral performance, element matching, design for yield, and practical comparators, implementation issues. Offered even-numbered years. (Typically Offered: Spring)

EE 5060: Design of CMOS Phase-Locked Loops

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Analysis and design of phase-locked loops implemented in modern CMOS processes including: architectures, performance metrics, and characterization; noise and stability analysis; and design issues of phase-frequency detectors, charge pumps, loop filters (passive and active), voltage controlled oscillators, and frequency dividers.

EE 5070: VLSI Communication Circuits

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Phase-locked loops, frequency synthesizers, clock and data recovery circuits, theory and implementation of adaptive filters, low-noise amplifiers, mixers, power amplifiers, transmitter and receiver architectures. Offered odd-numbered years. (Typically Offered: Spring)

EE 5080: Filter Design and Applications

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Filter design concepts. Approximation and synthesis. Transformations. Continuous-time and discrete time filters. Discrete, active and integrated synthesis techniques.

EE 5090: Mixed-Signal IC Testing and Built In Self Test

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to mixed-signal IC testing; measurement uncertainty and test validity; IEEE standard test algorithms; high performance test and built-in self test challenges; new mixed-signal test algorithms and techniques to reduce data acquisition to relax instrumentation requirements, to simplify test setup, to improve test validity, and/or to enable co-testing of heterogeneous functions. (Typically Offered: Fall, Spring, Summer)

EE 5100: Topics in Electromagnetics

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

EE 5120: Advanced Electromagnetic Field Theory I

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Review of static electric and magnetic fields. Maxwell's equations. Circuit concepts and impedance elements. Propagation and reflection of plane waves in isotropic media. Guided electromagnetic wave. Characteristics of common waveguides and transmission lines. Propagation in anisotropic media. Special theorems and concepts. Radiation and scattering. (Typically Offered: Fall)

EE 5130: Advanced Electromagnetic Field Theory II

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Green's functions, perturbational and variational techniques. Analysis of microstrip lines and interconnects. Spectral domain approach, waves in layered media. Integral equations and method of moments. Inverse scattering. Electromagnetic applications. (Typically Offered: Spring)

EE 5140: Microwave Engineering

(Dual-listed with EE 4140).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Principles, analyses, and instrumentation used in the microwave portion of the electromagnetic spectrum. Wave theory in relation to circuit parameters. S parameters, couplers, discontinuities, and microwave device equivalent circuits. RF amplifier design, microwave sources, optimum noise figure and maximum power designs. Microwave filters and oscillators. (Typically Offered: Fall)

EE 5160: Computational Methods in Electromagnetics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Maxwell's equations. Differential equation based methods. Finite difference and finite difference time domain methods, boundary conditions. Finite element method and applications to the analysis of practical devices. Integral equation based methods. Electric and magnetic field integral equations. Matrix solvers. Fast solution methods. (Typically Offered: Spring)

EE 5170: Electromagnetic Radiation, Antennas, and Propagation

(Dual-listed with EE 4170).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Fundamental antenna concepts. Radiation from wire-and aperture-type sources. Radio transmission formulas. Wave and antenna polarization. Antenna arrays. Modern antenna topics. Practical antenna design. Antenna noise. Radiowave propagation in the presence of the earth and its atmosphere. Antenna measurements and computer aided analysis. (Typically Offered: Spring)

EE 5180: Microwave Remote Sensing

(Cross-listed with AGRON 5180/ MTEOR 5180).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Microwave remote sensing of Earth's surface and atmosphere using satellite-based or ground-based instruments. Specific examples include remote sensing of atmospheric temperature and water vapor, precipitation, ocean salinity, and soil moisture. Offered even-numbered years. (Typically Offered: Spring)

EE 5190: Magnetism and Magnetic Materials

(Dual-listed with EE 4190/ MATE 4190). (Cross-listed with MSE 5190).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Magnetic fields, flux density and magnetization. Magnetic materials, magnetic measurements. Magnetic properties of materials. Domains, domain walls, domain processes, magnetization curves and hysteresis. Types of magnetic order, magnetic phases and critical phenomena. Magnetic moments of electrons, theory of electron magnetism. Technological application, soft magnetic materials for electromagnets, hard magnetic materials, permanent magnets, magnetic recording technology, magnetic measurements of properties for materials evaluation. Offered odd-numbered years. (Typically Offered: Fall)

EE 5210: Advanced Communications

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Digital communication systems overview. Characterization of communication channels. Digital modulation and demodulation design and performance analysis. Channel capacity and error-control coding concepts. Waveform design for band-limited channels. Equalization. Wireless fading channels and performance. (Typically Offered: Fall)

EE 5220: Cognitive Radio Networks

(Cross-listed with CPRE 5220).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Topics on cognitive radio networks: Cognitive Radio Networks Architecture; Software Defined Radio Architecture; Spectrum Sensing; Spectrum management; Spectrum Sharing; Spectrum Mobility; Applications of Cognitive Radio Networks. Offered irregularly. (Typically Offered: Fall)

EE 5230: Random Processes for Communications and Signal Processing

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Axioms of probability; Repeated trials; Functions of a random variable and multiple random variables: covariance matrix, conditional distribution, joint distribution, moments, and joint moment generating function; Mean square estimation; stochastic convergence; Some important stochastic processes: Random walk, Poisson, Wiener, and shot noise; Markov chains; Power spectral analysis; Selected applications.

EE 5240: Digital Signal Processing

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Review: sampling and reconstruction of signals; discrete-time signals, systems, and transforms. Multi-rate digital signal processing and introduction to filter banks. Optimal linear filtering and prediction. Introductions to adaptive filtering and spectral estimation. Applications. (Typically Offered: Fall)

EE 5260: Deep Learning: Theory and Practice

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Review of basic theoretic tools such as linear algebra and probability. Machine learning basics will then be introduced to motivate deep learning networks. Different deep learning network architectures will be studied in detail, including their training and implementations. Applications and research problems will also be surveyed at the end of the class.

EE 5270: Detection and Estimation Theory

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Statistical estimation theory and performance measures: maximum likelihood estimation, Cramer-Rao bound, Bayesian estimation, optimal demodulation, signal design. Introduction to graphical models. Hidden Markov models and Kalman filter. Classical statistical decision theory, decision criteria, binary and composite hypothesis tests. Error probability and Chernoff bound. Applications. (Typically Offered: Spring)

EE 5290: Data Analytics in Electrical and Computer Engineering

(Cross-listed with CPRE 5290).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduces a variety of data analytics techniques - particularly those relevant for electrical and computer engineers - from a foundational perspective. Topics to be covered include techniques for classification, visualization, and parameter estimation, with applications to signals, images, matrices, and graphs. Emphasis will be placed on rigorous analysis as well as principled design of such techniques. (Typically Offered: Spring)

EE 5310: Micro and Nano Systems and Devices

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Fundamentals of modeling and design of micro-nanosystems and devices based on various operational mechanisms. Significant hands-on experience using commercial software COMSOL to design and model micro-nanosystems and devices for biomedical and biomedicine applications among others. Experimental hands-on experience to operate the fabricated micro-nanosystems and devices in the instructor's research lab.

EE 5320: Microelectronics Fabrication Techniques

(Dual-listed with EE 4320/ MATE 4320). (Cross-listed with MSE 5320).

Credits: 4. Contact Hours: Lecture 2, Laboratory 4.

Prereq: Graduate Standing or Permission of Instructor

Techniques used in modern integrated circuit fabrication, including diffusion, oxidation, ion implantation, lithography, evaporation, sputtering, chemical-vapor deposition, and etching. Process integration. Process evaluation and final device testing. Extensive laboratory exercises utilizing fabrication methods to build electronic devices. Use of computer simulation tools for predicting processing outcomes. Recent advances in processing CMOS ICs and micro-electro-mechanical systems (MEMS).

EE 5350: Physics of Semiconductors

(Cross-listed with PHYS 5350).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Basic elements of quantum theory, Fermi statistics, motion of electrons in periodic structures, crystal structure, energy bands, equilibrium carrier concentration and doping, excess carriers and recombination, carrier transport at low and high fields, space charge limited current, photo-conductivity in solids, phonons, optical properties, amorphous semiconductors, heterostructures, and surface effects. Laboratory experiments on optical properties, carrier lifetimes, mobility, defect density, doping density, photo-conductivity, diffusion length of carriers.

EE 5360: Physics of Semiconductor Devices

(Cross-listed with PHYS 5360).

Credits: 3. Contact Hours: Lecture 3.

Prereq: EE 5350

P-n junctions, band-bending theory, tunneling phenomena, Schottky barriers, heterojunctions, bipolar transistors, field-effect transistors, negative-resistance devices and optoelectronic devices.

EE 5370: Electronic Properties of Materials

(Dual-listed with EE 4370/ MATE 4370). (Cross-listed with MSE 5370).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Magnetic fields, flux density and magnetization. Magnetic materials, magnetic measurements. Magnetic properties of materials. Domains, domain walls, domain processes, magnetization curves and hysteresis. Types of magnetic order, magnetic phases and critical phenomena. Magnetic moments of electrons, theory of electron magnetism. Technological application, soft magnetic materials for electromagnets, hard magnetic materials, permanent magnets, magnetic recording technology, biomedical applications of magnetism, magnetic evaluation of materials. (Typically Offered: Spring)

EE 5380: Optoelectronic Devices and Applications

(Dual-listed with EE 4380).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Transmission and reflection of electromagnetic plane waves. Propagation in dielectric and fiber optic waveguides. LED and laser operating principles and applications. Photodetectors and solar cells. Optical modulation and switching.

EE 5410X: Biomedical Optical Imaging and Spectroscopy

Credits: 3. Contact Hours: Lecture 3.

Introduction to medical imaging. Review of systems and signals, image quality. Image reconstruction. Optical properties of tissue. Light-tissue interaction. Numerical modelling of photon transport. Radiative transport equation. Diffusion model. Optical coherence tomography. Diffuse optical tomography. Photoacoustic imaging.

EE 5520: Energy System Planning

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Characteristics of bulk energy conversion, storage, and transport technologies. Environmental legislation. Modeling of electricity markets. Evaluation of sustainability and resiliency. Types of planning analyses: economic, multi-sector, long-term, national. Planning tools and associated optimization methods.

EE 5530: Steady State Analysis

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Power flow, economic dispatch, unit commitment, electricity markets, automatic generation control, sparse matrix techniques, interconnected operation, voltage control. (Typically Offered: Fall)

EE 5540: Power System Dynamics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Dynamic performance of power systems with emphasis on stability. Modeling of system components and control equipment. Analysis of the dynamic behavior of the system in response to small and large disturbances. (Typically Offered: Spring)

EE 5550: Advanced Energy Distribution Systems

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Transient models of distribution components, automated system planning and distribution automation, surge protection, reliability, power quality, power electronics and intelligent systems applications.

EE 5560: Power Electronic Systems

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Converter topologies, AC/DC, DC/DC, DC/AC, AC/AC. Converter applications to do motor drives, power supplies, AC motor drives, power system utility applications (var compensators) and power quality.

EE 5590: Electromechanical Wind Energy Conversion and Grid Integration

(Dual-listed with EE 4590).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Summary of industry status and expected growth; power extraction from the air stream; operation and modeling of electric machines, and power electronics topologies for wind energy conversion; analysis of machine-grid power electronic circuits, controller interface, and collector (distribution) networks; treatment of harmonics, flicker, over/under-voltages, filters, low-voltage ride-through, and reactive compensation; relaying; effects on transmission expansion, planning and grid operation and coordination including variability, frequency control, reserves, and electricity markets; overview of storage technologies and hybrid configurations.

EE 5650: Systems Engineering and Analysis

(Cross-listed with AERE 5650/ IE 5650).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Classification or Permission of Department

Introduction to organized multidisciplinary approach to designing and developing systems. Concepts, principles, and practice of systems engineering as applied to large integrated systems. Life cycle costing, scheduling, risk management, functional analysis, conceptual and detail design, test and evaluation, and systems engineering planning and organization. Graduation Restrictions: Not available for degrees in industrial engineering.

EE 5660: Avionics Systems Engineering

(Cross-listed with AERE 5660).

Credits: 3. Contact Hours: Lecture 3.

Avionics functions. Applications of systems engineering principles to avionics. Top down design of avionics systems. Automated design tools. (Typically Offered: Spring)

EE 5700: Systems Engineering Analysis and Design

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Selected topics in abstract algebra, linear algebra, real analysis, functional analysis, and optimization methods in electrical engineering.

EE 5710: Introduction to Convex Optimization

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to convex optimization problems emerging in electrical engineering. Efficiently solving convex optimization problems with the use of interior point algorithms software. Review of linear algebra, convex functions, convex sets, convex optimization problems, duality, disciplined convex programming, applications to optimal filtering, estimation, control and resources allocations, sensor network, distributed systems.

EE 5730: Random Signal Analysis and Kalman Filtering

(Cross-listed with AERE 5730/ ME 5730).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Elementary notions of probability. Random processes. Autocorrelation and spectral functions. Estimation of spectrum from finite data. Response of linear systems to random inputs. Discrete and continuous Kalman filter theory and applications. Smoothing and prediction. Linearization of nonlinear dynamics. (Typically Offered: Fall)

EE 5740: Optimal Control

(Cross-listed with AERE 5740/ ME 5740).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

The optimal control problem. Variational approach. Pontryagin's principle, Hamilton-Jacobi equation. Dynamic programming. Time-optimal, minimum fuel, minimum energy control systems. The regulator problem. Structures and properties of optimal controls. (Typically Offered: Spring)

EE 5750: Introduction to Robust Control

(Cross-listed with AERE 5750/ ME 5750).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to modern robust control. Model and signal uncertainty in control systems. Uncertainty description. Stability and performance robustness to uncertainty. Solutions to the H₂, H_∞, and L₁ control problems. Tools for robustness analysis and synthesis.

EE 5760: Digital Feedback Control Systems

(Cross-listed with AERE 5760/ ME 5760).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Sampled data, discrete data, and the z-transform. Design of digital control systems using transform methods: root locus, frequency response and direct design methods. Design using state-space methods. Controllability, observability, pole placement, state estimators. Digital filters in control systems. Microcomputer implementation of digital filters. Finite wordlength effects. Linear quadratic optimal control in digital control systems. Simulation of digital control systems. (Typically Offered: Fall)

EE 5770: Linear Systems

(Cross-listed with AERE 5770/ ME 5770/ MATH 5770).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Linear algebra review. Least square method and singular value decomposition. State space modeling of linear continuous-time systems. Solution of linear systems. Controllability and observability. Canonical description of linear equations. Stability of linear systems. State feedback and pole placements. Observer design for linear systems. (Typically Offered: Fall)

EE 5780: Nonlinear Systems

(Cross-listed with AERE 5780/ ME 5780/ MATH 5780).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Linear vs nonlinear systems. Phase plane analysis. Bifurcation and center manifold theory. Lyapunov stability. Absolute stability of feedback systems. Input-output stability. Passivity theory and feedback linearization. Nonlinear control design techniques. (Typically Offered: Spring)

EE 5810: Quantum Information Theory

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 2070 or MATH 3170

Overview of quantum information theory. Introduction to the basic principles of quantum mechanics; formulation of quantum channels; trace and fidelity distance measures; quantum entropy and its relation to classical entropy; information measures for quantum channels; quantum communication and quantum entanglement assisted classical communication. (Typically Offered: Fall)

EE 5880: Eddy Current Nondestructive Evaluation

(Dual-listed with EE 4880/ MATE 4880). (Cross-listed with MSE 5880).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Electromagnetic fields of various eddy current probes. Probe field interaction with conductors, crack and other material defects. Ferromagnetic materials. Layered conductors. Elementary inversion of probe signals to characterize defects. Special techniques including remote-field, transient, potential drop nondestructive evaluation and the use of Hall sensors. Practical assignments using a 'virtual' eddy current instrument will demonstrate key concepts. Offered odd-numbered years. (Typically Offered: Fall)

EE 5890: Survey of Remote Sensing Technologies

(Dual-listed with MTEOR 4890/ EE 4890/ ENSCI 4890/ GEOL 4890/ NREM 4890). (Cross-listed with MTEOR 5890/ ENSCI 5890/ GEOL 5890/ NREM 5890).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Electromagnetic-radiation principles, active and passive sensors, multispectral and hyperspectral sensors, imaging radar, SAR, thermal imaging, lidar. Examples of applications. Also offered online S. (Typically Offered: Fall)

EE 5890L: Satellite Remote Sensing Laboratory

(Dual-listed with MTEOR 4890L/ EE 4890L/ GEOL 4890L/ NREM 4890L). (Cross-listed with MTEOR 5890L/ GEOL 5890L/ NREM 5890L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Processing and analysis of satellite sensor data (optical and radar). Provides practical applications in an environmental context. (Typically Offered: Fall)

EE 5900A: Special Topics: Electromagnetic Theory

Credits: 1-6. Repeatable.

Prereq: Instructor Permission for Course

Formulation and solution of theoretical or practical problems in electrical engineering.

EE 5900B: Special Topics: Control Systems

Credits: 1-6. Repeatable.

Prereq: Instructor Permission for Course

Formulation and solution of theoretical or practical problems in electrical engineering.

EE 5900E: Special Topics: Computer Engineering

Credits: 1-6. Repeatable.

Prereq: Instructor Permission for Course

Formulation and solution of theoretical or practical problems in electrical engineering.

EE 5900F: Special Topics: Electric Power

Credits: 1-6. Repeatable.

Prereq: Instructor Permission for Course

Formulation and solution of theoretical or practical problems in electrical engineering.

EE 5900G: Special Topics: Electrical Materials

Credits: 1-6. Repeatable.

Prereq: Instructor Permission for Course

Formulation and solution of theoretical or practical problems in electrical engineering.

EE 5900H: Special Topics: Electronic Devices and Circuits

Credits: 1-6. Repeatable.

Prereq: Instructor Permission for Course

Formulation and solution of theoretical or practical problems in electrical engineering.

EE 5900I: Special Topics: Signal Processing

Credits: 1-6. Repeatable.

Prereq: Instructor Permission for Course

Formulation and solution of theoretical or practical problems in electrical engineering.

EE 5920: Seminar in Electrical Engineering

Credits: 1-4. Contact Hours: Lecture 4.

Repeatable, maximum of 8 times.

Prereq: Instructor Permission for Course

Technical seminar presentations on topics in various areas in electrical engineering. It will have the following sections, corresponding to graduate study areas in the department: Bioengineering; Communications, signal processing, and machine learning; Electric power and energy systems; Electromagnetic, microwave, and nondestructive evaluation; Microelectronics and photonics; Systems and controls; and VLSI. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

EE 5950: Independent Study

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

Investigation of an approved topic commensurate with the student's prerequisites. (Typically Offered: Fall, Spring, Summer)

EE 5980: Electrical and Computer Engineering Learning Community Seminar

(Cross-listed with CPRE 5980).

Credits: Required. Contact Hours: Lecture 1.

Prereq: Graduate Standing or Permission of Instructor

Introduction to graduate study in Electrical and Computer Engineering at Iowa State University. Building networks, introduction to core requirements, and tools and techniques for success. Graduation Restriction: ECpE. Offered on a satisfactory-fail basis only.

EE 5990: Creative Component

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Courses for graduate students:

EE 6170: Advanced Topics in Antenna Analysis and Design

Credits: 3. Contact Hours: Lecture 3.

Introduction to several advanced topics related to antenna design, analysis, and fabrication; beyond what is covered in EE 4170 or EE 5170 which primarily addresses fundamental foundations of antenna theory, analysis, and design. Topics include: Radiation integrals and methods; Polarization, in a comprehensive manner; antenna synthesis and continuous sources; Integral equations, self and mutual impedances, and vector effective length; Aperture antennas and field calculation fundamentals; Near-field to far-field transformation; Microstrip antennas; and Reconfigurable antenna fundamentals. Assignments will involve the use of numerical electromagnetic solvers such as HFSS and CST Microwave Studio. Expands skill sets in the area of numerical EM analysis, which is a critical issue for practical and advanced antenna design problems. (Typically Offered: Fall)

EE 6210: Coding Theory

Credits: 3. Contact Hours: Lecture 3.

Fundamentals of error-control coding techniques: coding gain, linear block codes. Galois fields. Cyclic codes: BCH, Reed-Solomon. Convolutional codes and the Viterbi algorithm. Trellis-coded modulation. Iterative decoding. Recent developments in coding theory.

EE 6220: Information Theory

Credits: 3. Contact Hours: Lecture 3.

Information system overview. Entropy and mutual information. Data Compression and source encoding. Discrete memoryless channel capacity. Noisy channel coding theorem. Rate distortion theory. Waveform channels. Advanced topics in information theory.

EE 6230: High-Dimensional Probability and Linear Algebra for Machine Learning

(Cross-listed with MATH 6230).

Credits: 3. Contact Hours: Lecture 3.

Key topics from non-asymptotic random matrix theory: Bounds on minimum and maximum singular values of many classes of high-dimensional random matrices, and on sums of a large number of random matrices. Chaining. Other linear algebra and probability concepts commonly used in Theoretical Machine Learning research. Discussion of recent papers in this area.

EE 6530: Advanced Topics in Electric Power System Engineering

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Advanced topics of current interest in electric power system engineering.

EE 6740: Advanced Topics in Systems Engineering

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Advanced topics of current interest in the areas of control theory, stochastic processes, digital signal processing, and image processing.

EE 6930: Entrepreneurship for Graduate Students in Science and Engineering

(Cross-listed with AGRON 6930/ BCB 6930/ ENGR 6930/ GENET 6930/ ME 6930).

Credits: 1. Contact Hours: Lecture 3.

Repeatable, maximum of 2 credits.

Understanding key topics of starting a technology based company, from development of technology-led idea to early-stage entrepreneurial business. Concepts discussed include: entrepreneurship basics, starting a business, funding your business, protecting your technology/ business IP. Subject matter experts and successful, technology-based entrepreneurs will provide real world examples from their experience with entrepreneurship. Learn about the world class entrepreneurship ecosystem at ISU and Central Iowa. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

EE 6970: Engineering Internship

(Cross-listed with CPRE 6970).

Credits: Required. Repeatable.

One semester and one summer maximum per academic year professional work period. Offered on a satisfactory-fail basis only.

EE 6990: Research

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Engineering (ENGR)

Courses primarily for undergraduates:

ENGR 1010: Engineering Orientation

Credits: Required. Contact Hours: Lecture 1.

Introduction to the College of Engineering and the engineering profession. Information concerning university and college policies, procedures, and resources. Undeclared sections: Considerations in choosing an engineering curriculum. Opportunities to interact with departments. Declared sections: Introduction to major-specific topics. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

ENGR 1040: LEAD Program Orientation

Credits: 1. Contact Hours: Lecture 1.

Orientation for LEAD Learning/Living Community participants. Introduction to college and university resources, tools and techniques to promote academic, professional and social/cultural development and success. Focus on building support networks with peers, faculty, and staff. Introduction to core engineering competencies including but not limited to initiative, communication, teamwork, and cultural adaptability. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

ENGR 1050: LEAD Program Seminar

Credits: 1. Contact Hours: Lecture 1.

Seminar for LEAD Learning/Living Community participants. Focus on professional development and exposure to various engineering disciplines through hands-on lab experiences, industry visits and networking opportunities with alumni, faculty, and staff. Development of core competencies: engineering/technical knowledge, communication and teamwork. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

ENGR 1310: Learning Community Seminar

Credits: Required. Contact Hours: Lecture 1.

Peer-mentored review of course topics in engineering undeclared learning communities. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

ENGR 1500: Foundations of Leadership Development and Learning

Credits: 1. Contact Hours: Lecture 1.

Leadership development with focus on global context and awareness of events shaping the context. Exposure to theory of leadership with examples. Necessary characteristics of a leader, and strategies for leadership skills development. Exposure to non-traditional career paths for engineers. Outline of personalized leadership development. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

ENGR 1600: Engineering Problems with Computer Applications**Laboratory**

Credits: 3.

Prereq: MATH 1430 or satisfactory score of 76 on mathematics placement exam

Solving engineering problems and presenting solutions through technical reports. Significant figures. Use of SI units. Graphing and curve-fitting. Flowcharting. Introduction to mechanics, statistics and engineering economics. Use of spreadsheet programs to solve and present engineering problems. Solution of engineering problems using computer programming languages. (The honors section includes application of programming to mobile robotics). Satisfactory placement scores can be found at: <https://math.iastate.edu/academics/undergraduate/aleks/placement/>. Graduation Restriction: Only one of ENGR 1600, ABE 1600, AERE 1600, CE 1600, CHE 1600, CPRE 1850, EE 1850, IE 1480, ME 1600, and SE 1850 may count towards graduation. (Typically Offered: Fall, Spring, Summer)

ENGR 2030: Engineering Career and Employment Preparation

Credits: 1. Contact Hours: Lecture 1.

Development of practical career knowledge and skills such as understanding employers of engineers, determining career goals, identifying employers of interest, developing effective application materials, applying for positions, networking, interviewing, and evaluating offers. Overview of professional resources and tools available to aid in the employment process. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

ENGR 2500: Leadership in Engineering Teams

Credits: 1. Contact Hours: Lecture 1.

Building and sustaining decision-making engineering teams. Students will explore the interrelated processes of discerning purpose, thinking systemically, developing reflective judgment, and exercising leadership by mobilizing and setting the direction for adaptive change within a team. Industry based examples and information from engineering and natural resource sciences will be infused into the course. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

ENGR 2650: Survey of the Impacts of Engineering Activity

Credits: 3. Contact Hours: Lecture 3.

Survey of the economic, environmental, societal, and political benefits and problems resulting from engineering activity. Effects of engineering projects on human health, social structures, and the environment. Examination of improvements in economic opportunities and quality of life resulting from engineering activity. Case studies of the effects of engineering activity. (Typically Offered: Fall, Spring)

ENGR 3200: International Experience Report

Credits: 3.

Critique of work/study abroad experience as it relates to professional development. Taken the semester after completion of work abroad or study abroad. Written report and presentation. Meets International Perspectives Requirement. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

ENGR 3270: Voices of Public Policy

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification in engineering

Role and impact of legislative process, partisan politics, government, lobbyists, the media, expert testimony and grassroots activism on public policy. Critical analysis of context; of claims, assumptions, premises, and evidence of both sides; represented and disenfranchised populations; the ethical issues to develop personal position and courses of action to impact public policy process. (Typically Offered: Fall)

ENGR 3500: Dean's Leadership Seminar

Credits: 1. Contact Hours: Lecture 1.

Prereq: Sophomore classification in engineering

Understanding the complexities of leadership in building an organization, decision-making styles, communication, managing change, building trust, shared responsibility leadership, creating legacy, prioritizing, effective use of authority, conflict, ethics, integrity, transparency, accountability. Selection based on demonstrated commitment to leadership development. Graduation Restriction: May not apply toward a degree in Engineering. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

ENGR 3960: Summer Internship

Credits: Required. Repeatable.

Prereq: Permission of Engineering Career Services

Professional work period of at least 10 weeks during the summer. Students must register for the course prior to commencing work. Offered on a satisfactory-fail basis only. (Typically Offered: Summer)

ENGR 3970: Engineering Condensed Internship

Credits: Required. Repeatable.

Prereq: Permission of Engineering Career Services

Professional work period less than 10 weeks. Students must register for the course prior to commencing work. Offered on a satisfactory-fail basis only. (Typically Offered: Summer)

ENGR 3980: Cooperative Education

Credits: Required. Repeatable.

Prereq: Permission of Engineering Career Services

Professional work period during the fall or spring semester. One semester per academic or calendar year. Students must register for the course prior to commencing work. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

ENGR 4300: Entrepreneurial Product Engineering

(Cross-listed with IE 4300).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior classification

Process of innovative product development in both entrepreneurial and intra-preneurial settings. Define, prototype and validate a product concept based on competitive bench-marking, market positioning and customer requirement evaluation in a target market into a product design that is consistent with defined business goals and strategies. Combination of lecture, discussion, problem solving and case study review. (Typically Offered: Fall, Spring)

ENGR 4340X: Entrepreneurial Product Engineering Design Project

(Cross-listed with IE 4340X).

Credits: 0-99. Contact Hours: Laboratory 4, Lecture 1.

Repeatable.

Prereq: IE 4300 or ENGR 4300

Open-ended design project related to creating, validating and launching a new engineered product into the marketplace. Fundamentals related to launching new engineered products in an Entrepreneurial way. Students submit new product ideas or select from a list of company supplied ideas. Application of engineering design principles including product definition, competitive evaluation, requirements evaluation, product design, manufacturing design, manufacturing costing, prototype creation, field validation, user evaluation. (Typically Offered: Spring)

ENGR 4900E: Entrepreneurship

Credits: 1-3. Repeatable, maximum of 3 credits.

Prereq: Junior or senior classification in Engineering; College approval

(Typically Offered: Fall, Spring)

ENGR 4900L: Independent Study

Credits: 1-3. Repeatable, maximum of 3 credits.

Leadership. (Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

ENGR 5380: Foundations of Engineering Education

(Cross-listed with AERE 5380/ HGED 5380).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to the field of engineering education, with an emphasis on engineering education history, existing challenges, teaching and learning pedagogies and theories, research opportunities, and research methodologies. The course goal is to develop students as scholars and to have students think critically about engineering and education. Students will apply the knowledge gained from this course to propose a research project related to their own discipline. The proposal is intended to help students learn and apply the key elements of engineering education research. This course is intended for students with a variety of interests and career goals, including those interested in learning to conduct engineering education research, exploring research discoveries about teaching and learning, and engaging with the engineering education community. (Typically Offered: Fall)

Courses for graduate students:

ENGR 6930: Entrepreneurship for Graduate Students in Science and Engineering

(Cross-listed with AGRON 6930/ BCB 6930/ EE 6930/ GENET 6930/ ME 6930).

Credits: 1. Contact Hours: Lecture 3.

Repeatable, maximum of 2 credits.

Understanding key topics of starting a technology based company, from development of technology-led idea to early-stage entrepreneurial business. Concepts discussed include: entrepreneurship basics, starting a business, funding your business, protecting your technology/ business IP. Subject matter experts and successful, technology-based entrepreneurs will provide real world examples from their experience with entrepreneurship. Learn about the world class entrepreneurship ecosystem at ISU and Central Iowa. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

Engineering Mechanics (EM)

Courses primarily for undergraduates:

EM 3000 M 00: Engineering Mechanics Military Transfer Credit

Credits: 0-99. Contact Hours: Lecture 0.

Repeatable.

(Typically Offered: Fall, Spring, Summer)

EM 3240: Mechanics of Materials

Credits: 3. Contact Hours: Lecture 3.

Prereq: CE 2740

Plane stress, plane strain, stress-strain relationships, and elements of material behavior. Application of stress and deformation analysis to members subject to centric, torsional, flexural, and combined loadings. Elementary considerations of theories of failure, buckling. (Typically Offered: Fall, Spring, Summer)

EM 3270: Mechanics of Materials Laboratory

Credits: 1. Contact Hours: Laboratory 2.

Prereq: EM 3240

Experimental determination of mechanical properties of selected engineering materials. Experimental verification of assumptions made in 3240. Use of strain measuring devices. Preparation of reports. (Typically Offered: Fall, Spring)

EM 3620: Principles of Nondestructive Testing

(Cross-listed with MATE 3620).

Credits: 3. Contact Hours: Lecture 3.

Prereq: PHYS 1320 OR PHYS 2320 or PHYS 2320H

Radiography, ultrasonic testing, magnetic particle inspection, eddy current testing, dye penetrant inspection, and other techniques. Physical bases of nondestructive tests, materials to which applicable, effects of material condition, types of defects detectable, calibration standards, and reliability safety precautions. (Typically Offered: Fall, Spring)

EM 3620L: Nondestructive Testing Laboratory

(Cross-listed with MATE 3620L).

Credits: 1. Contact Hours: Laboratory 2.

Prereq: Credit or enrollment in MATE 3620 or EM 3620

Application of nondestructive testing techniques to the detection and sizing of flaws in materials and to the characterization of material's microstructure. Included are experiments in hardness, dye penetrant, magnetic particle, x-ray, ultrasonic and eddy current testing. (Typically Offered: Fall, Spring)

EM 4170: Experimental Mechanics

(Dual-listed with EM 5170/ AERE 5170). (Cross-listed with AERE 4170).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: EM 3240, and MATE 2730

Introduction to fundamental concepts for force, displacement, stress and strain measurements for structures and materials applications. Strain gage theory and application. Full field deformation measurements with laser interferometry and digital image processing. Advanced experimental concepts at the micro- and nano-scale regimes. Selected laboratory experiments. Offered even-numbered years. (Typically Offered: Fall)

EM 4240: Intermediate Mechanics of Materials

Credits: 3. Contact Hours: Lecture 3.

Prereq: EM 3240

Analysis of stresses, strains, and deflections. Torsion and bending of unsymmetrical members. Analysis of thick wall pressure vessels and shrink fit problems. Dynamic load effects, fatigue and fracture mechanics introduction. Work-strain energy methods. (Typically Offered: Fall, Spring)

EM 4250: Introduction to the Finite Element Method

Credits: 3. Contact Hours: Lecture 3.

Prereq: EM 3240 and MATH 2660 or MATH 2670

Introduction of finite element analysis through applications to one-dimensional, steady-state problems such as elastic deformation, heat and fluid flow, consolidation, beam bending, and mass transport. Transient heat conduction and wave propagation. Two-dimensional triangular and quadrilateral elements. Plane problems of torsion, thermal and potential flow, stress analysis. Simple computer programs for one- and two-dimensional problems. (Typically Offered: Spring)

EM 4510: Engineering Acoustics

(Cross-listed with EE 4510/ ME 4510).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 2660 or MATH 2670; PHYS 2310 and 2310L

The basics of acoustic wave propagation in fluids with an emphasis on sound propagation in air. Topics include transmission and reflection of sound at a boundary; role of acoustic sources in directing sound fields; diffraction of sound around solid objects; reverberation of sound in a room; and the measurement of sound fields. (Typically Offered: Fall)

EM 4800: Ultrasonic Nondestructive Evaluation

(Cross-listed with AERE 4800/ MATE 4800).

Credits: 3. Contact Hours: Lecture 3.

Prereq: EM 3240 or MATE 3190; MATH 2660 or MATH 2670; PHYS 2320

Introduction to stress/strain, Hooke's law, and elastic wave propagation in two dimensions in isotropic media. Ultrasonic plane-wave reflection and transmission; and simple straight-crested guided waves. Transducer construction, behavior, and performance. Simple signal analysis and discrete signal processing. The last few weeks of the course are devoted to case studies. (Typically Offered: Spring)

EM 4900: Independent Study

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

EM 4900H: Independent Study: Honors

Credits: 1-30. Repeatable.

Prereq: Permission of Instructor; Membership in the University Honors Program

(Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

EM 5100: Continuum Mechanics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to Cartesian tensors as linear vector transformations. Kinematics of continuous deformations, Lagrangian and Eulerian descriptions of motion. Fundamental equations or balance laws of continuous media, linear and angular momentum balance. Conservation laws of momentum and energy. Introduction to constitutive equations of classical elastic solids and simple fluids. Formulations and solutions of some canonical problems. (Typically Offered: Fall)

EM 5140: Advanced Mechanics of Materials

(Cross-listed with AERE 5140).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Theory of stress and strain, stress-strain relationships. Unsymmetrical bending, curved beams, shear center. Torsion of thin-walled noncircular sections. Equilibrium, compatibility equations. Airy stress functions. Membrane stresses in shells, thick-walled cylinders. (Typically Offered: Fall)

EM 5160: Applied Elasticity and Mechanics of Deformable Solids

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Fundamental mechanics of linear elasticity, formulation and solution of simple elastostatic boundary value problems. Kinematics of small deformations, constitutive equations for isotropic and anisotropic media. Field equations for elastic solids, plane strain/plane stress and some classic analytical solutions such as Boussinesq, Hertz, Kirsch, Lamé, and Mitchell. Stress functions and potential methods and introduction to finite elements. (Typically Offered: Spring)

EM 5170: Experimental Mechanics

(Dual-listed with EM 4170/ AERE 4170). (Cross-listed with AERE 5170).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Introduction to fundamental concepts for force, displacement, stress and strain measurements for structures and materials applications. Strain gage theory and application. Full field deformation measurements with laser interferometry and digital image processing. Advanced experimental concepts at the micro- and nano-scale regimes. Selected laboratory experiments. Offered even-numbered years. (Typically Offered: Fall)

EM 5180: Waves in Elastic Solids with Applications to Ultrasonic Nondestructive Evaluation

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Propagation of bulk waves, surface waves, and guided waves in isotropic and anisotropic elastic media. Transmission and reflection of waves at plane and curved interfaces. Radiation of sources with application to ultrasonic transducer beam modeling. Elastic wave scattering from cracks and inclusions. Reciprocity principles and their use in the development of an ultrasonic measurement model. Characterization and measurement of material attenuation. (Typically Offered: Fall)

EM 5250: Finite Element Analysis

(Cross-listed with AERE 5250).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Variational and weighted residual approach to finite element equations. Emphasis on two- and three-dimensional problems in solid mechanics. Isoparametric element formulation, higher order elements, numerical integration, imposition of constraints and penalty, convergence, and other more advanced topics. Use of two- and three-dimensional computer programs. Dynamic and vibrational problems, eigenvalues, and time integration. Introduction to geometric and material nonlinearities. (Typically Offered: Spring)

EM 5260: Boundary Element Methods in Engineering

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introductory boundary element methods through plane problems. Singular integrals, Cauchy principal values, integral representations and boundary integrals in one dimension. Direct and indirect formulations. Plane potential and elastostatic problems. Higher order elements, numerical integration. Regularizations. Body forces and infinite regions. Specialized fundamental solutions, half-plane and axisymmetric problems. Diffusion and wave problems. Coupling with finite elements. Offered even-numbered years. (Typically Offered: Fall)

EM 5430: Introduction to Random Vibrations and Nonlinear Dynamics

(Cross-listed with ME 5430).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Vibrations of continuous systems. Nonlinear vibration phenomena, perturbation expansions; methods of multiple time scales and slowly-varying amplitude and phase. Characteristics of random vibrations; random processes, probability distributions, spectral density and its significance, the normal or Gaussian random process. Transmission of random vibration, response of simple single and two-degree-of-freedom systems to stationary random excitation. Fatigue failure due to random excitation. Offered odd-numbered years. (Typically Offered: Spring)

EM 5480: Advanced Engineering Dynamics

Credits: 3. Contact Hours: Lecture 3.

Prereq: EM 3450, MATH 2660 or MATH 2670

3-D kinematics and dynamics of particles and rigid bodies. Coordinate systems, calculus of variations. Lagrange's equations with constraints, modified Euler's equations, torque-free motion of rigid bodies in 3-D, moment equations with constraints. Offered even-numbered years. (Typically Offered: Spring). (Typically Offered: Spring)

EM 5500: Nondestructive Evaluation

(Cross-listed with MSE 5500).

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Principles of five basic NDE methods and their application in engineering inspections. Materials behavior and simple failure analysis. NDE reliability, and damage-tolerant design. Advanced methods such as acoustic microscopy, laser ultrasonics, thermal waves, and computed tomography are analyzed. Computer-based experiments on a selection of methods: ultrasonics, eddy currents, x-rays are assigned for student completion. (Typically Offered: Spring)

EM 5640: Fracture and Fatigue

(Cross-listed with AERE 5640/ ME 5640/ MSE 5640).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Materials and mechanics approach to fracture and fatigue. Fracture mechanics, brittle and ductile fracture, fracture and fatigue characteristics, fracture of thin films and layered structures. Fracture and fatigue tests, mechanics and materials designed to avoid fracture or fatigue. Offered even-numbered years. (Typically Offered: Fall)

EM 5660: Phase Transformation in Elastic Materials

(Cross-listed with ME 5660).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Continuum thermodynamics and kinetics approaches to phase transformations. Phase field approach to stress- and temperature-induced martensitic transformations and twinning at the nanoscale. Nucleation and growth. Nanostructural evaluation. Analytical and numerical solutions. Surface stresses and energy. Surface-induced phase transformations. Large Strain formulation. (Typically Offered: Spring)

EM 5670: Nanomechanics of Materials

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Continuum theoretical and computational approaches to material deformation and nanostructure evolution. Thermodynamics and kinetics. Nucleation and growth. Surface and interface tension and phenomena. Chemical reactions, phase transformations, and dislocation evolution. (Typically Offered: Spring)

EM 5690: Mechanics of Composite and Combined Materials

(Cross-listed with AERE 5690/ MSE 5690).

Credits: 3. Contact Hours: Lecture 3.

Prereq: EM 3240

Mechanics of fiber-reinforced materials. Micromechanics of lamina. Macromechanical behavior of lamina and laminates. Strength and interlaminar stresses of laminates. Failure criteria. Stress analysis of laminates. Thermal moisture and residual stresses. Joints in composites. Offered even-numbered years. (Typically Offered: Spring)

EM 5700: Wind Engineering

(Cross-listed with AERE 5700).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ABE 3780 and ME 3450

Atmospheric circulations, atmospheric boundary layer wind, bluff-body aerodynamics, aeroelastic phenomena, wind-tunnel and full-scale testing, wind-load code and standards, effect of tornado and thunderstorm winds, design applications. Offered odd-numbered years. (Typically Offered: Spring)

EM 5800: Phase Transformations and Plasticity

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Continuum approaches to phase transformations and plasticity at nano-, micro-, and macroscales. Interaction between phase transformations and plasticity and different scales. Temperature-, stress-, and strain-induced phase transformations. Transformation-induced plasticity. Thermodynamics and kinetics. Nucleation and growth. Large strain formulation. High pressure phenomena and theories. (Typically Offered: Fall)

EM 5840: High Pressure Mechanics and Phase Transformations

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Techniques for producing static high pressure and measurements. Traditional and rotational diamond anvil cell. Phase diagrams. Pressure, stress, and plastic strain induced phase transformations: continuum thermodynamics and kinetics. Elasticity and plastic flow under high pressure. Transformation pressure hysteresis. Material synthesis and search for new phases. Interaction between phase transformations and plasticity under high pressure. High pressure mechanochemistry. Multiscale modeling.

EM 5860: Micromechanics of Structural Changes in Materials

Credits: 3. Contact Hours: Lecture 2, Discussion 1.

Prereq: Graduate Standing or Permission of Instructor

Continuum and micromechanical approaches to material deformation, phase transformations, and microstructure evolution. Thermodynamics and kinetics. Eshelby inclusion. Interface propagation and reorientation. Microscale phase field approach. Large strain formulation. Phase transformations, chemical reactions, twinning, and fracture. (Typically Offered: Fall)

EM 5900F: Engineering Mechanics Special Topics: Introduction to Dislocation and Plasticity

Credits: 1-4. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

(Typically Offered: Fall, Spring, Summer)

EM 5900H: Engineering Mechanics Special Topics: Mechanics of Thin Films and Adhesives

Credits: 1-4. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

EM 5900I: Engineering Mechanics Special Topics: Mechanics of Cellular and Porous Media

Credits: 1-4. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

EM 5900J: Engineering Mechanics Special Topics: Other

Credits: 1-4. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

EM 5990: Creative Component

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

Courses for graduate students:**EM 6900N: Engineering Mechanics Special Topics: Advanced Experimental Methods**

Credits: 1-6. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

EM 6900O: Engineering Mechanics Special Topics: Advanced Wave Propagation

Credits: 1-6. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

EM 6900P: Engineering Mechanics Special Topics: Advanced Materials

Credits: 1-6. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

EM 6900Q: Engineering Mechanics Special Topics: Advanced Computational Methods

Credits: 1-6. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

EM 6900R: Engineering Mechanics Special Topics: Reliability and Failure

Credits: 1-6. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall)

EM 6900S: Engineering Mechanics Special Topics: Other

Credits: 1-6. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

EM 6970: Engineering Internship

Credits: Required. Repeatable.

One semester and one summer maximum per academic year professional work period. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

EM 6990: Research

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

English (ENGL)

Courses primarily for undergraduates:**ENGL 0100: Intensive English**

Credits: 0. Contact Hours: Lecture 21.

Intensive English. (Typically Offered: Fall, Spring, Summer)

ENGL 0100A: Intensive English

Credits: 0. Contact Hours: Lecture 15.

Intensive English. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

ENGL 0100B: Intensive English

Credits: 0. Contact Hours: Lecture 10.

Intensive English. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

ENGL 0100C: Intensive English

Credits: 0. Contact Hours: Lecture 5.

Intensive English. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

ENGL 0100D: Intensive English

Credits: 0. Contact Hours: Lecture 2.5.

Intensive English. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

ENGL 0990S: Nonnative Speaking

Credits: 0.

Open to all interested international students. (Typically Offered: Fall, Spring)

ENGL 1010B: English for Native Speakers of Other Languages: Academic English

Credits: 3. Contact Hours: Lecture 3.

For undergraduates: Completion of ENGL 1010 requirement prepares students for ENGL 1500. For graduates: Completion of ENGL 1010 satisfies the English requirement of the Graduate College. ENGL 1010 courses are limited to students who are nonnative speakers of English. See English Requirement for International Students in Index for additional information about placement exam. Graduation Restriction: Credit from ENGL 1010 does not count toward graduation. (Typically Offered: Fall, Spring)

ENGL 1010C: English for Native Speakers of Other Languages: Academic English II--Undergraduates

Credits: 3. Contact Hours: Lecture 3.

Prereq: (Score of 2+ on EPT for ENGL 1010B OR Credit in ENGL 1010B) AND Undergraduate Student

For undergraduates: Completion of ENGL 1010 requirement prepares students for ENGL 1500. For graduates: Completion of ENGL 1010 satisfies the English requirement of the Graduate College. ENGL 1010 courses are limited to students who are nonnative speakers of English. See English Requirement for International Students in Index for additional information about placement exam. Graduation Restriction: Credit from ENGL 1010 does not count toward graduation. (Typically Offered: Fall, Spring)

ENGL 1010D: English for Native Speakers of Other Languages: Academic English II--Graduates

Credits: 3. Contact Hours: Lecture 3.

Prereq: (Score of 2+ on EPT for ENGL 1010B OR Credit in ENGL 1010B) AND Graduate Student

Available P/NP to graduate students at their department's option.

For undergraduates: Completion of ENGL 1010 requirement prepares students for ENGL 1500. For graduates: Completion of ENGL 1010 satisfies the English requirement of the Graduate College. ENGL 1010 courses are limited to students who are nonnative speakers of English. See English Requirement for International Students in Index for additional information about placement exam. Graduation Restriction: Credit from ENGL 1010 does not count toward graduation. (Typically Offered: Fall, Spring)

ENGL 1200: Computers and Language

(Cross-listed with LING 1200).

Credits: 3. Contact Hours: Lecture 3.

Introduction to the use of linguistic knowledge in computer applications today and the basic computational techniques used in such applications. The development of these techniques throughout the history of computational linguistics. How the study of language has contributed to the advancement of technology and how certain computational problems have influenced the way linguists study language.

ENGL 1500: Critical Thinking and Communication

Credits: 3. Contact Hours: Lecture 3.

Prereq: [(Overall EPT Score 2+ OR Passing ESL Course Grade) AND (Membership in EPT Advisory Group)] OR (Not Member of EPT Advisory Group)

Application of critical reading and thinking abilities to topics of civic and cultural importance. Introduction of basic oral, visual, and electronic communication principles to support writing development. Initiation of communication portfolio. Concurrent enrollment in LIB 1600 is recommended. (Typically Offered: Fall, Spring, Summer)

ENGL 2010: Introduction to Literature

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or concurrent enrollment in ENGL 1500

Introduction to the diversity of literary texts. Students will explore work across different genres (drama, poetry, short fiction, the novel) and traditions (Indigenous, postcolonial, global, British, American). Recommended for nonmajors.

ENGL 2070: Introduction to Creative Writing

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or concurrent enrollment in ENGL 1500

Course introduces students to the fundamentals of writing fiction, poetry, and creative nonfiction. Extensive readings in all three genres. Students learn creative processes through writing exercises, workshops, and conferences. (Typically Offered: Fall, Spring)

ENGL 2140: Introduction to Technical Communication

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 1500.

A broad introduction to the culture of professional work as a technical communicator, with particular emphasis on principles and best practices for developing and managing technical information and digital media. Examination of user-centered design, the history of the discipline, cross-cultural communication, and the ethics of communicating complex information to lay audiences. Study and practice of team-based collaboration, project management, and technical editing. (Typically Offered: Fall)

ENGL 2190: Introduction to Linguistics

(Cross-listed with LING 2190).

Credits: 3. Contact Hours: Lecture 3.

Introduction to linguistic concepts and principles of linguistic analysis with English as the primary source of data. Sound and writing systems, sentence structure, vocabulary, and meaning. Issues in the study of usage, regional and social dialects, language acquisition, and language change. (Typically Offered: Fall, Spring)

ENGL 2200: Descriptive English Grammar

(Cross-listed with LING 2200).

Credits: 3. Contact Hours: Lecture 3.

Overview of grammatical structures and functions. Parts of speech; phrase, clause, and sentence structure; sentence types and sentence analysis; rhetorical grammar and sentence style; terminology. Not a remedial, English composition, or ESL course. (Typically Offered: Fall, Spring)

ENGL 2220: Artificial Intelligence and Writing

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 1500

Introduction to artificial intelligence (AI) and writing. Students will learn how to find and use AI technologies such as ChatGPT to write for specific purposes, genres, and media; create effective AI prompts and search for accurate information; and navigate the ethical issues of integrating AI-generated and processed content into authored works. (Typically Offered: Fall)

ENGL 2250: Survey of British Literature to 1800

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500

Survey of British Literature from its beginnings to 1800. Representative works studied in their historical, cultural, and literary contexts that span nearly 900 years of shifts in religious, political, ethnic, and philosophical cultures.

ENGL 2260: Survey of British Literature since 1800

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500

Representative works studied in their historical, cultural, and literary contexts, including attention to the impact and legacy of the British empire on its former colonies, i.e., postcolonial literature.

ENGL 2270: Survey of American Literature to 1865

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500

Survey of American literature from its beginnings (including Indigenous and conquest literatures) through the end of the Civil War. Representative works studied in their historical, cultural, and literary contexts, including attending to the diversity (ethnic, cultural, religious, philosophical, etc.) of American literature and culture.

ENGL 2280: Survey of American Literature since 1865

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500

Survey of American literature from the Civil War to the present. Representative works studied in their historical, cultural, and literary contexts, including attention to the diversity (ethnic, cultural, religious, philosophical, etc.) of American literature and culture.

ENGL 2370: Survey of Film History

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit in or enrollment in ENGL 1500 or 2500

Survey of U.S. and international film history from its beginnings in the late nineteenth century to the present.

ENGL 2400: Introduction to American Indian Literature

(Cross-listed with AMIN 2400).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit in or enrollment in ENGL 1500 or 2500

Survey of American Indian Literature of varying genres, including fiction, non-fiction, poetry, film, drama, and media. Focuses on interdisciplinary approaches to American Indian cultural, social, and environmental issues. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall)

ENGL 2450X: Climate Change in Literature, Film, and Popular Culture

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Narratives of climate change through Literature, Film, and Popular Culture; how narratives shape understanding, behavior, and culture. Literary texts contextualized with readings from other disciplines. How narratives explain climate change, and how we might reimagine narratives to create healthier and more resilient futures.

ENGL 2500: Written, Oral, Visual, and Electronic Composition

Credits: 3. Contact Hours: Lecture 3.

Prereq: [(Overall EPT Score 2+ OR Passing ESL Course Grade) AND (Membership in EPT Advisory Group) AND (credit or enrollment in LIB 1600) AND (credit or exemption from ENGL 1500)] OR [(Credit or exemption from ENGL 1500) AND (Credit or enrollment in LIB 1600)]

Analyzing, composing, and reflecting on written, oral, visual, and electronic (WOVE) discourse within academic, civic, and cultural contexts. Emphasis on supporting a claim and using primary and secondary sources. Continued development of communication portfolio. Graduation Restriction: The University requires a minimum grade of C in ENGL 2500 to meet the Communication Proficiency graduation requirement; some majors/degree programs may set higher standards. (Typically Offered: Fall, Spring, Summer)

ENGL 2500H: Written, Oral, Visual, and Electronic Composition: Honors

Credits: 3. Contact Hours: Lecture 3.

Prereq: Member of University Honors Program AND [(Overall EPT Score 2+ OR Passing ESL Course Grade) AND (Membership in EPT Advisory Group) AND Credit or enrollment in LIB 1600]] OR [ENGL 1500 AND Credit or enrollment in LIB 1600]

In-depth analysis, composition, and reflection on written, oral, visual, and electronic (WOVE) discourse within academic, civic, and cultural contexts. Emphasis on argumentation: developing claims, generating reasons, providing evidence. Individual sections organized by special topics. Development of communication portfolio. Graduation Restriction: The University requires a minimum grade of C in ENGL 2500 to meet the Communication Proficiency graduation requirement; some majors/degree programs may set higher standards. (Typically Offered: Fall)

ENGL 2600: Introduction to Literary Study

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or concurrent enrollment in ENGL 1500.

Introduction to the basic principles of literary study, including strategies for analyzing poetry, fiction, nonfiction, film, drama, and media. Emphasis on writing critical essays and conducting research. Designed for English majors.

ENGL 2750: Analysis of Popular Culture Texts

(Cross-listed with SPCM 2750).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or concurrent enrollment in ENGL 2500

Analysis of how information and entertainment forms persuade and manipulate audiences. Study of several forms that may include newspapers, speeches, television, film, advertising, fiction, and magazines. Special attention to verbal and visual devices. (Typically Offered: Fall, Spring)

ENGL 3020: Business Communication

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500 and Junior classification

Rhetorical concepts and processes to successfully communicate individually and collaboratively via written, oral, visual, and electronic modes across a range of business disciplines. Covers strategies for analyzing audiences internal and external to an organization in order to communicate positive, neutral, and negative messages clearly, completely, correctly, and ethically; save an audience's time; and create goodwill. (Typically Offered: Fall, Spring, Summer)

ENGL 3020H: Business Communication: Honors

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500 and Junior classification; Membership in the University Honors Program

Theory, principles and processes of effective written, oral, visual, and electronic communication typically encountered in business and the professions. Extensive practice in many areas of workplace communication, including letter, memo, and email correspondence; short proposals and reports; policies and procedures; job packet including letters of application and resumes; website analysis; brochures; and individual and team presentations. (Typically Offered: Fall, Spring, Summer)

ENGL 3030: Free-Lance Writing for Popular Magazines

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500; Sophomore classification

Practical workshop in writing nonfiction articles for popular magazines. Emphasis on writing, market research, preparation of manuscripts, methods of submission. Major goal of the course is production of marketable material. (Typically Offered: Spring)

ENGL 3040: Creative Writing: Fiction

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500; Sophomore classification

Progresses from practice in basic techniques of fiction writing to fully developed short stories. Emphasis on writing, analytical reading, workshop criticism, and individual conferences. (Typically Offered: Fall, Spring)

ENGL 3050: Creative Writing: Nonfiction

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500; Sophomore classification

Workshop in writing imaginative essays, both critical and personal. Analytical reading, development of literary techniques. Individual and small group conferences. (Typically Offered: Fall, Spring)

ENGL 3060: Creative Writing: Poetry

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500; Sophomore classification

Progresses from traditional to contemporary forms. Emphasis on writing, analytical reading, workshop criticism, and individual conferences. (Typically Offered: Fall, Spring)

ENGL 3080: Write Like a Woman

(Cross-listed with WGS 3080).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500

Writing and reading interpretive fiction written by women. Emphasis on stories that embody a female literary life, gender-specific ways of creating characters and conflicts, analytical reading and writing, workshop criticism and shared commentaries. Includes multi-modal projects. (Typically Offered: Fall)

ENGL 3090: Proposal and Report Writing

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500 and Junior classification

Rhetorical concepts and processes to individually and collaboratively develop proposals for business, governmental, nonprofit, or other organizations and to report on the work completed both orally and in writing. Emphasizes the structure and classification of proposal and report types, qualitative and quantitative research methods, audience analysis, document design, and data visualization. (Typically Offered: Fall, Spring)

ENGL 3100: Rhetorical Analysis

(Cross-listed with SPCM 3100).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500

Fundamental principles of rhetorical criticism. Focus on selected theories for analyzing cultural texts, including essays, speeches, film, technical and scientific documents, and websites. Emphasis on identifying artifacts, formulating research questions, applying methodologies, and understanding and practicing critical analysis through discussion and in writing. (Typically Offered: Fall, Spring)

ENGL 3120: Communicating Science and Public Engagement

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500 and Junior classification

Rhetorical concepts, processes, and strategies to successfully communicate individually and collaboratively via written, oral, visual, and electronic modes in disciplines in and related to science. Emphasizes the strategies for analyzing and adapting to audiences about scientific topics and disciplines. Covers developing and designing documentation, presenting scientific data visually, and communicating results orally. (Typically Offered: Fall, Spring, Summer)

ENGL 3130: Rhetorical Website Design

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500

Rhetorical principles of multimodal composing in hypertextual environments. Focus on writing according to web style guidelines, employing cascading stylesheets for layout and design, and using principles of information architecture to determine optimal site structure. Final project involves constructing interactive client site using latest web standards.

ENGL 3140: Technical Communication

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500 and Junior classification

Rhetorical concepts and processes to successfully communicate technical information individually and collaboratively via written, oral, visual, and electronic modes. Emphasizes the major strategies for analyzing expert and lay audiences and adapting information to those audiences. Covers developing and designing usable technical documentation, visualizing data, and presenting technical information orally. (Typically Offered: Fall, Spring, Summer)

ENGL 3140H: Technical Communication: Honors

Credits: 3. Contact Hours: Lecture 3.

Prereq: Membership in the University Honors Program

Theories, principles, and processes of effective written, oral, visual, and electronic communication of technical information. Attention to major strategies for analyzing and adapting to audiences in various communication situations and composing technical discourse including organizing visual and verbal information. Extensive practice in many areas of technical communication, including instructions and procedures, proposals and reports, website analysis and design, and individual and team presentations. (Typically Offered: Fall, Spring, Summer)

ENGL 3150: Creative Writing: Screenplays

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500; Sophomore classification

Stresses master scene technique of writing fully developed screenplays. Emphasis on movie techniques, writing, workshop criticism, analytical reading and viewing, and individual conferences. (Typically Offered: Fall)

ENGL 3160: Creative Writing: Playwriting

(Cross-listed with THTRE 3160).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500; Sophomore classification

Progresses from production of scenes to fully developed one-act plays. Emphasis on action, staging, writing, analytical reading, workshop criticism, and individual conferences. (Typically Offered: Spring)

ENGL 3180: Introduction to ESL methods and materials

(Cross-listed with LING 3180).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2190 or LING 2190

Introduction to methods and materials for teaching English as a Second Language (ESL) for elementary and secondary students. Strategies and resources for teaching reading, writing, speaking and listening skills. Elementary Education students must take this course in the same semester as either EDUC 2800S or EDUC 4800S. (Typically Offered: Fall)

ENGL 3190: Studies in Language and Diversity

(Cross-listed with LING 3190).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Prereq: ENGL 2500

Special topics related to the role of language and linguistics in US diversity, such as Dialects and American literature, American English Accents, Legal and Social Aspects of English-only Laws in the US. Connections between language use and social diversity. (Typically Offered: Fall)

ENGL 3200: Topics in Linguistic Structure

(Cross-listed with LING 3200).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Prereq: ENGL 2190/LING 2190 or ENGL 2200/LING 2200

Special topics related to the study of linguistic structure. Focus on language structure in areas not covered in detail by existing courses. Topics include field linguistics, morphology, forensic linguistics, neurolinguistics, semantics, non-English phonology, acoustic phonetics, linguistic universals, and historical linguistics. (Typically Offered: Spring)

ENGL 3220: Language and Society

(Cross-listed with LING 3220).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2190 or LING 2190

Introduction to variation in language use in society. Survey of factors affecting language use, including background characteristics of language users, location, and purpose of interaction in addition to institutional, state, and national language policies. (Typically Offered: Spring)

ENGL 3240: Introduction to Teaching ESL Literacy

(Cross-listed with LING 3240).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2190 or LING 2190

Introduction to the issues and methods involved in teaching literacy skills to English as a second language (ESL) learners. The nature of literacy and materials and methods for developing ESL literacy at the middle school, high school, and adult ages across multiple levels of competency. (Typically Offered: Fall)

ENGL 3250: Teaching Methods for ESL Learners: Oral Communication Skills

(Cross-listed with LING 3250).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2190 or LING 2190

Issues and methods in teaching oral communication skills (listening, speaking, pronunciation) to English as a second language (ESL) learners. The nature of oral language ability. Materials and Methods for developing oral communication skills at middle school, high school, and adult contexts. (Typically Offered: Spring)

ENGL 3300: Science Fiction

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500

Focused study of science fiction from its origins to the present. Highlights the genre's connections to issues related to gender, sexuality, race, empire, and environmentalism. May include study of cyberpunk, Afrofuturism, cli-fi, etc.

ENGL 3320: Visual Communication of Quantitative Information

(Cross-listed with STAT 3320).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500; (STAT 1010 or STAT 1040 or STAT 1050 or STAT 2010 or STAT 2310 or STAT 3050 or STAT 3220 or STAT 3300)

Communicating quantitative information using visual displays; visualizing data; interactive and dynamic data displays; evaluating current examples in the media; color, perception, and representation in graphs; interpreting data displays.

ENGL 3350: Studies in Film

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: ENGL 2500

Focused study of film that explores a specific cinematic genre, style, period, or theme. (Typically Offered: Spring)

ENGL 3390: Literary Theory and Criticism

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2600; 3 additional credits from (ENGL 2250-2270, ENGL 2400, ENGL 3100, ENGL 3400, ENGL 3440-3470, ENGL 3490, ENGL 4400-4410, ENGL 4450, ENGL 3520-3550, ENGL 3600, ENGL 3620, ENGL 3640, ENGL 3730, ENGL 3750, ENGL 3760, ENGL 3760A, ENGL 3760B, ENGL 3890, ENGL 4900A, ENGL 3950A)

Focused examination of the history and recent trends in literary theory and criticism (e.g., postcolonialism, queer theory, disability studies, ecocriticism).

ENGL 3450: Women's Literature

(Cross-listed with WGS 3450).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500

Focused study of literature by women and about women that focuses on a particular genre (fiction, non-fiction, poetry, film, drama, media), author, or theme.

ENGL 3460: American Indian Literature

(Cross-listed with AMIN 3460).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500

Focused study of American Indian literature of varying genres, including fiction, non-fiction, poetry, film, drama, and media. Examines interdisciplinary approaches to American Indian cultural, social, and environmental issues. Meets U.S. Cultures and Communities Requirement.

ENGL 3470: African American Literature

(Cross-listed with AFAM 3470).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500

Focused study of literature by African American writers. May include focus on a particular genre (fiction, non-fiction, poetry, film, drama, media), author, event, movement, or theme.

ENGL 3490: Multicultural Literatures of the United States

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500

Focused study of literature by writers from U.S. multicultural groups. May include literature of several groups or focus upon one (such as Asian Americans, African Americans, Latinx Americans, American Indians). May also include focus on a particular genre (fiction, non-fiction, poetry, film, drama, media), event, movement, or theme.

ENGL 3500: Rhetorical Traditions

(Cross-listed with CLST 3500/ SPCM 3500).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500

Ideas about the relationship between rhetoric and society in contemporary and historical contexts. An exploration of classical and contemporary rhetorical theories in relation to selected topics that may include politics, gender, race, ethics, education, science, or technology. (Typically Offered: Spring)

ENGL 3520: Queer Literature

(Cross-listed with WGS 3520).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500

Focused study of literary portrayals of queer lives and relationships from many different genres. Attention to changing definitions and representations of sexual orientation and LGBTQ identities over time.

ENGL 3530: World Literature: Western Foundations through Renaissance

(Cross-listed with CLST 3530).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500

Representative works of drama, poetry, and prose from ancient times through the mid-seventeenth century. Consideration of Western traditions within global contexts. Attention to religious and ethnic diversity; oral, manuscript, and print cultures; political authority; and the impact of translation on form, meaning, and reception of texts. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

ENGL 3540: World Literature: Seventeenth Century to the Present

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500

Global literatures in their various cultural and aesthetic contexts. Representative works, oral and written literature, including poetry, fiction, nonfiction, and drama. Meets International Perspectives Requirement. (Typically Offered: Spring)

ENGL 3550: Literature and the Environment

(Cross-listed with ENVS 3550).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500

Focused study of texts that address a wide range of environmental issues, including the relationship between humans and natural/urban environments, views of other-than-human beings, food, climate change, extinction, and social and racial justice. Assignments for the course may include research, exams, writing, and/or individual/group projects.

ENGL 3600: Studies in American Literature to 1800

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: ENGL 2500; Sophomore classification

Selected readings in American literature from its beginnings through the colonial period; may reflect themes, genres, or social and cultural contexts.

ENGL 3620: Studies in 19th Century American Literature

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: ENGL 2500; Sophomore classification

Selected readings in American literature of the 19th century; may reflect themes, genres, or social and cultural contexts.

ENGL 3640: Studies in American Literature: 1900 to the Present

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: ENGL 2500; Sophomore classification

Selected readings in American literature since 1900; may reflect themes, genres, or social and cultural contexts.

ENGL 3700: Shakespeare

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500

Focused study of Shakespeare's plays and how they participate in cultural and political contexts – both in Shakespeare's time and our own. Includes staging activities, film presentations, and attention to pedagogy. Assignments for the course may include analytical essays (no research required), film presentations, marginalia, and individual/group projects. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

ENGL 3730: Studies in British Literature: The Middle Ages

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: ENGL 2500; Sophomore classification

Selected readings in medieval literature from its beginnings through the fifteenth century; may reflect themes, genres, or social and cultural contexts.

ENGL 3750: Studies in British Literature: The Restoration and 18th Century

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: ENGL 2500; Sophomore classification

Selected readings in British literature from 1660 to 1800; may reflect themes, genres, or social and cultural contexts. Meets International Perspectives Requirement.

ENGL 3760A: Studies in British Literature: Romantic

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500; Sophomore classification

Selected readings from British literature from the late eighteenth century to about 1900; may reflect themes, genres, or social and cultural contexts. Meets International Perspectives Requirement.

ENGL 3760B: Studies in British Literature: Victorian

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500; Sophomore classification

Selected readings from British literature from the late eighteenth century to about 1900; may reflect themes, genres, or social and cultural contexts. Meets International Perspectives Requirement.

ENGL 3770: Latina/o/x Life Stories: Memoirs and Oral History

(Cross-listed with SPAN 3770/ USLS 3770).

Credits: 3. Contact Hours: Lecture 3.

Prereq: USLS 2110 or ENGL 2500

Study and archive Latinx life stories through traditional coursework, digital humanities and community outreach with local schools. Analysis of the extensive realities of Latinx communities in Iowa through the study, writing, tutorial work, and production of memoirs and oral histories.

ENGL 3890: Postcolonial Literature

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500; Sophomore classification

Focused study of literatures from previously (or continuously) colonized nations. May be broadly focused, or specific to the literature of one of the following areas: Africa, South Asia, the Caribbean, and the Middle East. Irish and immigrant British writers may also be included. Assignments for the course may include exams, written reflections and/or discussion boards, short essays, posters, and/or individual/group projects. Meets International Perspectives Requirement.

ENGL 3930: The History of Children's Literature

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500

Focused study of the development of English and American children's literature through the present day. Includes readings in animal stories, fantasy, and realism, including contemporary social issues. (Typically Offered: Fall)

ENGL 3950A: Study and Travel: Literature

Credits: 1-30.

Prereq: Instructor Permission for Course

Supervised study of an appropriate area of the discipline while traveling in a foreign country or in the U.S. Special fees apply. Meets International Perspectives Requirement. (Typically Offered: Summer)

ENGL 3950B: Study and Travel: Creative Writing

Credits: 1-30.

Prereq: Instructor Permission for Course

Supervised study of an appropriate area of the discipline while traveling in a foreign country or in the U.S. Special fees apply. Meets International Perspectives Requirement. (Typically Offered: Summer)

ENGL 3950C: Study and Travel: Linguistics

Credits: 1-30.

Prereq: Instructor Permission for Course

Supervised study of an appropriate area of the discipline while traveling in a foreign country or in the U.S. Special fees apply. Meets International Perspectives Requirement. (Typically Offered: Summer)

ENGL 3950D: Study and Travel: Rhetoric and Professional Communication

Credits: 1-30.

Prereq: Instructor Permission for Course

Supervised study of an appropriate area of the discipline while traveling in a foreign country or in the U.S. Special fees apply. Meets International Perspectives Requirement. (Typically Offered: Summer)

ENGL 3950E: Study and Travel: Teacher Education

Credits: 1-30.

Prereq: Instructor Permission for Course

Supervised study of an appropriate area of the discipline while traveling in a foreign country or in the U.S. Special fees apply. Meets International Perspectives Requirement. (Typically Offered: Summer)

ENGL 3960: Teaching the Reading of Young Adult Literature

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500

Critical study and evaluation of themes, genres, and cultures found in young adult literature. Strategies of effective reading; instructional strategies including discussion techniques and use of technology; matching texts to reader needs and proficiencies. Evaluation of fiction, nonfiction, and media-based materials for use in school programs. Lesson planning. (Typically Offered: Fall, Spring)

ENGL 3970: Practice and Theory of Teaching Writing in the Secondary Schools

Credits: 3. Contact Hours: Lecture 3.

Prereq: Concurrent enrollment in EDUC 3800

Introduction to teaching secondary language arts. Current theories and practices in the teaching of writing to secondary school students. Theories of rhetoric, approaches to teaching, lesson design and planning. Evaluating writing. Students must have initiated the application process for the teacher education program and initiated a background check with the state of Iowa Department of Criminal Investigation. (Typically Offered: Fall, Spring)

ENGL 4040: Creative Writing Workshop: Fiction

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: ENGL 3040

Individual projects in short fiction on a workshop and conference basis. Readings in short fiction. Discussion of elements of narrative such as plot, point of view, characterization, theme, setting. (Typically Offered: Fall, Spring)

ENGL 4050: Creative Writing Workshop: Nonfiction

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: ENGL 3050

Individual projects in memoir, immersion journalism, character studies, and/or the personal essay on a workshop and conference basis. Readings in creative nonfiction. (Typically Offered: Fall, Spring)

ENGL 4060: Creative Writing Workshop--Poetry

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: ENGL 3060

Individual projects in poetry on a workshop and conference basis. Readings in poetry. Discussion of poetic elements such as image, sound, internal structure, rhythm, tone, figurative language. (Typically Offered: Fall, Spring)

ENGL 4100: Language as Data

(Cross-listed with LING 4100).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior standing

Methods of discovering language patterns in text documents solve practical text analysis problems in the disciplines. Fundamentals of linguistics and its role in text analysis. Practice writing R scripts to perform text analysis and visualize textual data. (Typically Offered: Spring)

ENGL 4110: Technology, Rhetoric, and Professional Communication

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 3100; (ENGL 3020, ENGL 3090, ENGL 3130, or ENGL 3140); Junior classification

Seminar course on the implication of technologies, especially computer technology, for the writing and reading of business, technical, and academic texts. Extensive reading, discussion, and writing on selected technology-related topics. (Typically Offered: Fall, Spring, Summer)

ENGL 4150: Business and Technical Editing

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 3020, ENGL 3090, or ENGL 3140; Junior Classification

Editing concepts and processes for choosing the appropriate level of editing for the particular rhetorical situation. Covers using editorial tools such as copy-marking symbols, developing style sheets and guides, and managing document production. Emphasizes developing an editorial eye for verbal and visual details in order to achieve accuracy, consistency, correctness, and completeness. (Typically Offered: Spring)

ENGL 4160: Visual Aspects of Business and Technical Communication

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 3020, ENGL 3090, or ENGL 3140; Junior Classification

Rhetorical strategies and perceptual principles for designing print and digital visual elements such as diagrams and graphs and integrating those visual elements into business and technical communications. Covers strategies for employing visual elements such as typeface, page and screen layout, and illustrations in order to make communications more usable. (Typically Offered: Fall)

ENGL 4170E: Student Teaching: English and Literature

(Dual-listed with EDUC 5170E). (Cross-listed with EDUC 4170E).

Credits: 1-30. Repeatable.

Prereq: Admitted to the Educator Preparation Program

Full-time teaching in secondary English: long term and unit planning, lesson planning, classroom teaching practice in English language arts. (Typically Offered: Fall, Spring)

ENGL 4180: Seminar in Rhetoric and Writing

(Cross-listed with SPCM 4180).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 3100/SPCM 3100 and Junior classification

Intensive study of a selected topic that bridges theory and practice in rhetoric, writing studies, and related fields. Topics may include argumentation, public memory, rhetorical genre, critical/cultural rhetorics, and other topics. (Typically Offered: Spring)

ENGL 4200: History of the English Language

(Cross-listed with LING 4200).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2190/LING 2190 and ENGL 2200/LING 2200

Comparison of English to other languages by family background and by type. Analysis of representative Old, Middle, Early Modern and present-day English texts, including both literary works and non-literary documents. (Typically Offered: Fall, Spring)

ENGL 4220: Women, Men, and the English Language

(Cross-listed with LING 4220/ WGS 4220).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2190 or LING 2190

The ways men and women differ in using language in varied settings and the ways in which language both creates and reflects gender divisions. (Typically Offered: Spring)

ENGL 4250: Second Language Learning and Teaching

(Cross-listed with LING 4250).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2190/LING 2190 and Junior classification

The process of second language learning and principles and techniques of teaching second languages. Learning and teaching in specific situations and for particular purposes. Current applications of technology in teaching and assessment. (Typically Offered: Spring)

ENGL 4370: Grammatical Analysis

(Cross-listed with LING 4370).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (ENGL 2190 or LING 2190); (ENGL 2200 or LING 2200); Junior classification

Theories and methods for analysis of syntax and morphology. (Typically Offered: Fall)

ENGL 4400: Seminar in British Literature

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: Junior standing

Selected authors, movements, eras, or genres in British literature. Readings in criticism; required research paper.

ENGL 4410: Seminar in American Literature

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: Junior standing

Selected authors, movements, eras, or genres in American literature. Readings in criticism; required research paper.

ENGL 4450: Seminar: Literature/Film Crossing Boundaries

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: Junior classification or above

Intensive study of selected literature and/or film that bridges traditional genre, period, national, or disciplinary boundaries. Readings in criticism; required research paper.

ENGL 4500: Seminar in Literary Genres

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: Junior standing

Intensive study of drama, film, fiction, poetry, or prose. Selected movements, eras, or national traditions. Readings in criticism; required research paper.

ENGL 4600: Seminar in Gender and Ethnicity

(Cross-listed with WGS 4600).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: Junior standing

Selected readings of various authors, movements, eras, or genres. Readings in criticism; required research paper.

ENGL 4770: Seminar in Technical Communication

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: ENGL 3020, ENGL 3090, or ENGL 3140

Intensive study of a selected topic that bridges theory and practice in technical communication. Required project that contributes to the understanding of an emerging issue in the profession.

ENGL 4870: Internship in Business, Technical, and Professional Communication

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: Permission of Instructor; Junior classification

An opportunity to write, edit, and design business and technical documents in a professional setting. Projects might include reports, proposals, manuals, brochures, newsletters. (Typically Offered: Fall, Spring, Summer)

ENGL 4900A: Independent Study: Literature

Credits: 1-30. Repeatable, maximum of 9 credits.

Prereq: 9 credits in English beyond ENGL 2500; Junior classification;

Department Permission

Designed to meet the needs of students who wish to study in areas other than those in which courses are offered. Graduation Restriction: No more than 9 credits of ENGL 4900 may be used toward graduation. (Typically Offered: Fall, Spring, Summer)

ENGL 4900B: Independent Study: Linguistics

(Cross-listed with LING 4900B).

Credits: 1-30. Repeatable, maximum of 9 credits.

Prereq: 9 credits in English beyond ENGL 2500; Junior classification;

Department Permission

Designed to meet the needs of students who wish to study in areas other than those in which courses are offered. Graduation Restriction: No more than 9 credits of ENGL 4900 may be used toward graduation. (Typically Offered: Fall, Spring)

ENGL 4900C: Independent Study: Rhetoric, Teaching of Composition

Credits: 1-30. Repeatable, maximum of 9 credits.

Prereq: 9 credits in English beyond ENGL 2500; Junior classification;

Department Permission

Designed to meet the needs of students who wish to study in areas other than those in which courses are offered. Graduation Restriction: No more than 9 credits of ENGL 4900 may be used toward graduation. (Typically Offered: Fall, Spring, Summer)

ENGL 4900D: Independent Study: Criticism and Theory of Literature

Credits: 1-30. Repeatable, maximum of 9 credits.

Prereq: 9 credits in English beyond ENGL 2500; Junior classification;

Department Permission

Designed to meet the needs of students who wish to study in areas other than those in which courses are offered. Graduation Restriction: No more than 9 credits of ENGL 4900 may be used toward graduation. (Typically Offered: Fall, Spring, Summer)

ENGL 4900E: Independent Study: Instructional Methods and Research

Credits: 1-30. Repeatable, maximum of 9 credits.

Prereq: 9 credits in English beyond ENGL 2500; Junior classification;

Department Permission

Designed to meet the needs of students who wish to study in areas other than those in which courses are offered. Graduation Restriction: No more than 9 credits of ENGL 4900 may be used toward graduation. (Typically Offered: Fall, Spring, Summer)

ENGL 4900F: Independent Study: Creative Writing

Credits: 1-30. Repeatable, maximum of 9 credits.

Prereq: 9 credits in English beyond ENGL 2500; Junior classification;

Department Permission

Designed to meet the needs of students who wish to study in areas other than those in which courses are offered. Graduation Restriction: No more than 9 credits of ENGL 4900 may be used toward graduation. (Typically Offered: Fall, Spring)

ENGL 4900G: Independent Study: Business/Technical Communication

Credits: 1-30. Repeatable, maximum of 9 credits.

Prereq: 9 credits in English beyond ENGL 2500; Junior classification;

Department Permission

Designed to meet the needs of students who wish to study in areas other than those in which courses are offered. Graduation Restriction: No more than 9 credits of ENGL 4900 may be used toward graduation. (Typically Offered: Fall, Spring)

ENGL 4900H: Independent Study: Honors

Credits: 1-30. Repeatable, maximum of 9 credits.

Prereq: 9 credits in English beyond ENGL 2500; Junior classification;

Department Permission; Membership in the University Honors Program

Designed to meet the needs of students who wish to study in areas other than those in which courses are offered or who desire to integrate a study of literature or language with special problems in major fields. Graduation Restriction: No more than 9 credits of ENGL 4900 may be used toward graduation. (Typically Offered: Fall, Spring)

ENGL 4920: Undergraduate Teaching Experience

Credits: 1-30. Repeatable, maximum of 9 credits.

Prereq: 9 credits in English beyond ENGL 2500; Junior classification;

Department Permission

Teaching assistant experience. (Typically Offered: Fall, Spring, Summer)

ENGL 4930: Advanced Creative Writing Workshop-Multi-Genre

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: ENGL 3040, ENGL 3050 or ENGL 3060 and Junior classification

Advanced workshop of individual creative writing projects in short fiction, nonfiction, and poetry. Readings and discussion of published examples of short fiction, nonfiction, and poetry by authors of national and international note. Extensive discussion and written analysis of elements of craft across genres. (Typically Offered: Fall, Spring)

ENGL 4940: Practice and Theory of Teaching Literature in the Secondary Schools

(Dual-listed with ENGL 5940X).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 3100; ENGL 3970; 9 additional credits in ENGL beyond ENGL 2500; PSYCH 3330

Current theories and practices in the teaching of literature to secondary school students. Integrating literary study and writing. Preparation and selection of materials. Classroom presentation. Unit planning. 4940 students must have initiated the application process for the teacher education program and initiated a background check with the state of Iowa Department of Criminal Investigation. 5940 students must have initiated a background check with the State of Iowa Department of Criminal Investigation. 4940: Concurrent enrollment in EDUC 4800 and SPED 4010 required. 5940: concurrent enrollment in EDUC 5910E. (Typically Offered: Fall, Spring)

ENGL 4970: Capstone Assessment

Credits: 1. Contact Hours: Lecture 1.

Prereq: Junior or Senior classification; Department Permission

Must be taken in conjunction with a 4000-level English course. (Typically Offered: Fall, Spring)

Courses primarily for graduate students, open to qualified undergraduates:

ENGL 5000: Teaching Multimodal Composition

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to the teaching of ISUComm Foundation Courses. Foundational and relevant newer composition theory and pedagogical methods related to ISUComm Foundation Courses objectives and their classroom enactment, including development of assignments and supporting activities, and evaluation of student projects. Required of all new teaching assistants teaching ISUComm Foundation Courses. (Typically Offered: Fall)

ENGL 5010: Introduction to Research in Rhetoric, Composition, and Professional Communication

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Survey of the major rhetorical, qualitative, and quantitative methods used in research on communication and language in academic and nonacademic settings.

ENGL 5030: Composition Theory

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

In-depth consideration of the theory and practice of composition pedagogy. Opportunities for actual classroom application.

ENGL 5040: Theory and Practice of Teaching Advanced Composition

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Theory of teaching technical, business, and science communication courses combined with practical matters related to such courses, including curriculum planning, assignment design, assessment of student work, and online teaching. (Typically Offered: Fall)

ENGL 5050: User Experience Architecture and Testing

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Seminar course examining user experience (UX) interface design and development in technical communication. Focus is on the UX project cycle: creating user interfaces, conducting user research, system testing, and implementing data-driven results.

ENGL 5060: Professional Communication Theory

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to professional communication as a discipline, with emphasis on theories of communication and discourse that inform professional communication research and on trends and developments in that research and the field.

ENGL 5080: Writing for Academic Publication

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: Graduate Standing or Permission of Instructor

Hands-on practice in writing academic discourse for publication; rhetorical analyses of student-selected academic journals; discussion of current trends in academic writing; professional perspectives on the referee process and on journal editorial decision making. Focus on the writing of selected short pieces (opinion essays, standard reviews, conference-length papers) and of article-length manuscripts.

ENGL 5100: Introduction to Computers in Applied Linguistics

(Cross-listed with LING 5100).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Use of software and web applications for language teaching, linguistic analysis, and statistical analysis. Issues and problems in applied linguistics related to computer methods. (Typically Offered: Fall)

ENGL 5110: Introduction to Linguistic Analysis

(Cross-listed with LING 5110).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Principles and methods of linguistic analysis with emphasis on phonology, morphology, and syntax. Description of linguistic variation and current theoretical approaches to linguistics. (Typically Offered: Fall)

ENGL 5120: Second Language Acquisition

(Cross-listed with LING 5120).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Theory, methods, and results of second language acquisition research with emphasis on approaches relevant to second language teaching.

ENGL 5130: Language Assessment Practicum

(Cross-listed with LING 5130).

Credits: 3.

Prereq: Graduate Standing or Permission of Instructor

Advanced practicum in language assessment. (Typically Offered: Fall, Spring, Summer)

ENGL 5140: Sociolinguistics

(Cross-listed with LING 5140).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Theories and methods of examining language in its social setting. Analysis of individual characteristics (e.g., age, gender, ethnicity, social class, region), interactional factors (e.g., situation, topic, purpose) and national policies affecting language use.

ENGL 5150: Statistical Natural Language Processing

(Cross-listed with HCI 5150/ LING 5150).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to computational techniques involving human language and speech in applications such as information retrieval and extraction, automatic text categorization, word prediction, intelligent Web searching, spelling and grammar checking, speech recognition and synthesis, statistical machine translation, n-grams, POS-tagging, word-sense disambiguation, on-line lexicons and thesauri, markup languages, corpus analysis, and Python programming language.

ENGL 5160: Methods of Formal Linguistic Analysis

(Cross-listed with LING 5160).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Data and knowledge structures for formal representation of natural language and speech data. Designing and implementing algorithms for automating linguistic analysis tasks. Conceptual issues for natural language and speech processing programming. Offered even-numbered years. (Typically Offered: Spring)

ENGL 5170: Corpus Linguistics

(Cross-listed with LING 5170).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Corpus linguistics methods of language analysis, including corpus design, construction and annotation; data in corpus studies; tools and methods of analysis. Corpus methods applied in vocabulary, grammar, register and dialect variation, language change, pragmatics, semantics, stylistics, language learning and teaching, and language testing. Offered even-numbered years. (Typically Offered: Spring)

ENGL 5190: Second Language Assessment

(Cross-listed with LING 5190).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Principles of second language assessment including reliability, validity, authenticity and practicality. Constructing, scoring, interpreting, and evaluating second language tests for a variety of situations. (Typically Offered: Spring)

ENGL 5200: Computational Analysis of English

(Cross-listed with HCI 5200/ LING 5200).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Concepts and practices for analysis of English by computer with emphasis on the applications of computational analysis to problems in applied linguistics such as corpus analysis and recognition of learner language in computer-assisted learning and language assessment.

ENGL 5210: Teaching of Literature and the Literature Curriculum

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Examination of the roles of the literary work, reader, and teacher in literary study. Responses to literature. Place of literature in language arts. Study and development of curriculum materials for middle school, high school, and college levels of instruction.

ENGL 5220: Literary Theory and Criticism

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Examination of the history of and/or recent trends in literary theory and criticism (e.g., postcolonialism, queer theory, disability studies).

ENGL 5230: Introduction to Old English Language and Literature

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introductory study of Old English language and literature in prose and poetry, including extracts from Beowulf. Some attention to Anglo-Saxon culture.

ENGL 5240: Literacy: Issues and Methods for Nonnative Speakers of English

(Cross-listed with LING 5240).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Theoretical and practical issues and techniques in the teaching of literacy in a variety of contexts, involving children and adults at basic skill levels and teens and adults in academic and vocational programs. Offered even-numbered years. (Typically Offered: Fall)

ENGL 5250: Research and Teaching of Second Language Pronunciation

(Cross-listed with LING 5250).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Theoretical and practical issues and techniques in the teaching of second language pronunciation as it relates to other areas of language, especially listening and speaking skills. Topics will include segmental and suprasegmental features; intelligibility; pronunciation in language assessment; classroom, technology and individual instruction; and research issues. Topics will be relevant to those intending to teach or research in various contexts. Offered odd-numbered years. (Typically Offered: Fall)

ENGL 5260: Technology for Language Learning

(Cross-listed with LING 5260).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Theory, research, and practice in computer use for teaching nonnative speakers of English. Methods for planning and evaluating computer-based learning activities. Offered odd-numbered years. (Typically Offered: Spring)

ENGL 5270: Discourse Analysis

(Cross-listed with LING 5270).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Methods and theoretical foundations for linguistic approaches to discourse analysis. Applications of discourse analysis to the study of texts in a variety of settings, including academic and research contexts. Offered odd-numbered years. (Typically Offered: Spring)

ENGL 5280: English for Specific Purposes

(Cross-listed with LING 5280).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Issues and techniques in analyzing, teaching, and assessing English for specific purposes. Topics include theories of specific purpose language use, analysis of learner needs in target language contexts, and corpus-informed syllabus and materials development for teaching and assessment.

ENGL 5290: Content Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Strategies for developing and delivering multimodal content via online digital media. Focus on the principles of database design, interface development, usability testing, and collaborative content management within professional communication settings.

ENGL 5300: Technology and Oral Language

(Cross-listed with LING 5300).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Structure and description of oral language and discourse. How spoken language is linguistically described, analyzed, and taught for research and for education. Using technology to record, transcribe, and analyze spoken language at all levels of linguistic structure. Offered even-numbered years. (Typically Offered: Fall)

ENGL 5310: Topics in the Study of Literature

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: Graduate Standing or Permission of Instructor

Intensive study of literary genres, periods, movements, or themes (e.g., The African American Novel, Allegory, Science Fiction).

ENGL 5320: American Literature to 1865

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: Graduate Standing or Permission of Instructor

Selected texts in American literature from Beginnings to the Civil War. Study may include Native American literature, the literature of European conquest, Colonial and Revolutionary periods, Early Republic, and Jacksonian Era, in critical and cultural contexts.

ENGL 5330: British Literature to 1830

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: Graduate Standing or Permission of Instructor

Selected texts from the Medieval, Renaissance, Restoration, Eighteenth-Century, and/or Romantic periods, in critical and cultural contexts.

ENGL 5340: American Literature 1865 to the Present

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: Graduate Standing or Permission of Instructor

Selected texts in American literature from the Civil War to the present. Study may include Realism, Naturalism, Modernism, and Postmodernism, with significant attention to race/ethnicity, gender, and identity, and to contemporary critical views. Range of authors and genres.

ENGL 5350: British Literature 1830 to the Present

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: Graduate Standing or Permission of Instructor

Selected texts from the Victorian, Edwardian, Modernist, and/or Contemporary periods, in critical and cultural contexts.

ENGL 5360: Preparing Publishable Thesis Chapters

(Cross-listed with GRST 5360).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Instructor Permission for Course

Reporting original research results within the norms for writing of a student's discipline. Emphasis on preparing thesis/dissertation chapters that will be both acceptable to the Graduate College and ready for submission to a refereed journal in the student's discipline. Focus on reporting results from student-generated original research, norms for discourse within disciplines, and how thesis chapters differ from journal manuscripts. (Typically Offered: Fall, Spring)

ENGL 5370: Corpus Approaches to Grammatical Analysis

(Cross-listed with LING 5370).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Corpus-informed analysis of syntax in authentic writing and speech, with emphasis on approaches used in applied linguistics.

ENGL 5380: Fiction

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: Graduate Standing or Permission of Instructor

Selected fiction writers in English; range of authors and genres. Emphasis on both male and female writers; attention to the relationships between fiction and cultural change.

ENGL 5390: Poetry

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: Graduate Standing or Permission of Instructor

Selected poets writing in English, considered in representative groups.

ENGL 5400: Drama

(Cross-listed with SPCM 5400).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: Graduate Standing or Permission of Instructor

Primary texts in dramatic genres from various literary periods, in critical and cultural contexts. Frequently concentrates on the English Renaissance and the Shakespearean stage.

ENGL 5420: Technical Editing and Publication Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Overview of theory and research in technical editing and publication management with substantial practice in applying theory and research findings. Focus on document production process, levels of edit, development of accessible, translatable, and inclusive documents, and sustainable publication practices.

ENGL 5430: The Study of Environmental Literature

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: Graduate Standing or Permission of Instructor

Intensive study of environmental literary genres, periods, figures, movements, or themes: e.g., Ecofeminism, Imagining Natural Disaster, Material Ecocriticism, Environmental Justice, Posthumanism.

ENGL 5450: Women's Literature

(Cross-listed with WGS 5450).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: Graduate Standing or Permission of Instructor

Primary texts by women writers; historical, thematic, formal, or theoretical approaches; secondary readings; e.g., Nineteenth-Century Women Writers; American Women's Personal Narratives; Southern Women Writers of the U.S.

ENGL 5460: Issues in the Study of Literature

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: Graduate Standing or Permission of Instructor

Intensive study of current and emerging topics and problems concerning literature and its relationship to theory and to language study; e.g., Theory of Metaphor; Renegotiating the Canon; Feminist Theory.

ENGL 5470: The History of Rhetorical Theory from the Classical Era to the Present

(Cross-listed with SPCM 5470).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Rhetorical theory from the classical period of ancient Greece through to the 20th century; attention to rhetoric's relation to the nature of knowledge, communication, practice, and pedagogy.

ENGL 5480: Cultural and Critical Theories of Communication and Rhetoric

(Cross-listed with SPCM 5480).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Contemporary theories that address the production, reception, and critical evaluation of cultural artifacts and communicative events; these theories address power, ideology, and the norms of public discourse. Theories covered may include Postmodernism, Feminist Theory, Public Sphere Theory, as well as Critical Race Theory, Social Justice Theory, Disability Theory, Queer Theory, and/or Intercultural Theories of Communication and Rhetoric.

ENGL 5490: Multimedia and Interaction Design

(Cross-listed with SPCM 5490).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Rhetorical principles of interactive multimedia design, such as those in streaming multimedia as part of workplace documents. Practical understanding of the computer applications used in interactive multimedia development. Focus on theoretical and practical elements of producing multimedia for training in both education and industry. Work with interactive hypertext, digital audio, and nonlinear video editing.

ENGL 5500: Creative Writing: Craft and Professional Practice

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate students in Creative Writing and Environment MFA Program OR Instructor Permission

Students develop an understanding of craft and environmental writing across genres (poetry, fiction, nonfiction, drama), as well as learn about editing and publication practice through the lens of a working literary magazine, Flyway: Journal of Writing and Environment. Other course activities may include an environmental field trip, presentations on the production practices of leading literary journals, individual editing projects, and pragmatic guidance for finding publication outlets for polished creative work. (Typically Offered: Fall)

ENGL 5510: Master Workshop

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

An advanced multigenre creative writing workshop. Students work intensively on book-length manuscripts of fiction, creative nonfiction, scriptwriting, or poetry.

ENGL 5520: Workshop: Scriptwriting

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 12 credits.

*Prereq: Graduate students in Creative Writing and Environment MFA Program
OR Instructor Permission*

Individual projects in dramatic writing. Focus on writing for stage, screen, and/or new media. Readings in dramatic literature. Discussion of elements such as plot, character, dialogue, structure, theme, and visual storytelling.

ENGL 5540: Workshop: Fiction

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 12 credits.

Prereq: Graduate Standing or Permission of Instructor

Individual projects in fiction on a workshop and conference basis.

Readings in short fiction. Discussion of elements of narrative such as plot, point of view, characterization, theme, setting.

ENGL 5550: Workshop: Nonfiction

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 12 credits.

Prereq: Graduate Standing or Permission of Instructor

Individual projects in memoir, immersion journalism, character studies, and/or the personal essay on a workshop and conference basis. Readings in creative nonfiction.

ENGL 5560: Workshop: Poetry

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 12 credits.

Prereq: Graduate Standing or Permission of Instructor

Individual projects in poetry on a workshop and conference basis. Readings in poetry. Discussion of poetic elements such as image, sound, internal structure, rhythm, tone, figurative language.

ENGL 5570: Studies in Creative Writing

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 12 credits.

Prereq: Graduate Standing or Permission of Instructor

Special topics course on ideas, issues, and techniques in creative writing. Subject matter may include specific genres, aspects of the creative writing process, or themes of particular interest. Significant readings and written work required; previous workshop experience helpful.

ENGL 5580: Teaching Creative Writing

Credits: 3. Contact Hours: Lecture 3.

*Prereq: Graduate students in Creative Writing and Environment MFA Program
OR Instructor Permission*

Pedagogical approaches that are effective for grade-school through adult-education creative writing teaching. Writing exercises, workshops, text evaluation, and visits from creative writers.

ENGL 5590: Creative Writing Teaching Internship

Credits: 1-3. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Students assist in an introductory creative writing course, primarily evaluating manuscripts and facilitating workshops. Some students may facilitate community-based creative writing workshops.

ENGL 5600: Environmental Field Experience

Credits: 3. Repeatable, maximum of 6 credits.

*Prereq: Graduate students in Creative Writing and Environment MFA Program
OR Instructor Permission*

Students spend a term on a project that requires fieldwork. Projects might include working for a federal, state, or private non-profit environmental organization or farm, or living and working in a specified natural area.

ENGL 5610: Methods for Scholarship in Literature and the Humanities

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Intensive study of research methods and perspectives concerning the study of literature and the humanities at the master's level. Introduction to resources and techniques of research, the structure of academic articles, and strategies for argument in academic communication.

ENGL 5620: Topics in the Study of Film

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: Graduate Standing or Permission of Instructor

Intensive study of cinematic genres, periods, movements, or themes; e.g., The Musical, Classical Hollywood Cinema, Structural Film, Art and Cinema. General emphasis will be on American, British, and other Anglophone cinemas. (Typically Offered: Spring)

ENGL 5630A: Research Methods in Rhetoric, Composition, and Professional Communication: Qualitative Research

Credits: 3. Contact Hours: Lecture 3.

Prereq: Senior or graduate classification

Theory and application of qualitative communication research, including research design, data collection, ethical issues, data analysis, and reporting results. Offered even-numbered years. (Typically Offered: Spring)

ENGL 5630B: Research Methods in Rhetoric, Composition, and Professional Communication: Quantitative Research

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Application of quantitative research designs, such as surveys and experiments; data collection techniques; essential statistical analysis; and write-up of results. Develop ethical research practices for human subjects in research. Analyze quantitative research design principles in professional communication studies. Offered odd-numbered years. (Typically Offered: Spring)

ENGL 5630C: Research Methods in Rhetoric, Composition, and Professional Communication: Rhetorical Analysis

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Extended practice in close textual analysis of various kinds of rhetorical artifacts. Attention to important theoretical concepts used in rhetorical analysis and to historical controversies over the scope and function of rhetorical analysis. (Typically Offered: Spring)

ENGL 5690: Grant Writing

(Cross-listed with GRST 5690).

Credits: 1. Contact Hours: Lecture 1.

Prereq: Graduate Standing or Permission of Instructor

Writing a winning proposal. (Typically Offered: Spring)

ENGL 5860: Visual Rhetoric in Professional Communication

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Rhetorical theory and research in graphics, document design, and related principles of visual communication. Methods of designing texts, data displays, illustrations, and other visual elements in business and technical communication.

ENGL 5870: Internship in Professional Communication

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: Graduate Standing or Permission of Instructor

An opportunity to write, edit, and design documents in a professional setting. (Typically Offered: Fall, Spring, Summer)

ENGL 5880: Supervised Practice Teaching in Teaching English as a Second Language

(Cross-listed with LING 5880).

Credits: 3. Contact Hours: Lecture 1, Laboratory 5.

Prereq: Graduate Standing or Permission of Instructor

Intensive observation of ESL instruction and supervised practice in teaching learners of English in a context appropriate to the student teacher's goals. Graduation Restriction: ENGL 5880 cannot be used for teacher licensure. (Typically Offered: Fall, Spring)

ENGL 5890: Supervised Practicum in Literary Editing

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

An opportunity to edit literary texts and gain experience in a literary publishing setting. (Typically Offered: Fall, Spring, Summer)

ENGL 5900A: Special Topics: Literature

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

ENGL 5900B: Special Topics: Teaching English as a Second Language (TESL)/Applied Linguistics

(Cross-listed with LING 5900B).

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

ENGL 5900C: Special Topics: Composition and Rhetoric

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

ENGL 5900E: Special Topics: Rhetoric and Professional Communication

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

ENGL 5900F: Special Topics: Creative Writing

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

ENGL 5900G: Special Topics: Applied Linguistics and Technology

(Cross-listed with LING 5900G).

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

ENGL 5910A: Directed Readings: Literature

Credits: 1-30. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

(Typically Offered: Fall, Spring, Summer)

ENGL 5910B: Directed Readings: Teaching English as a Second Language (TESL)/Applied Linguistics

(Cross-listed with LING 5910B).

Credits: 1-30. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

(Typically Offered: Fall, Spring, Summer)

ENGL 5910C: Directed Readings: Composition and Rhetoric

Credits: 1-30. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

(Typically Offered: Fall, Spring, Summer)

ENGL 5910E: Directed Readings: Rhetoric and Professional Communication

Credits: 1-30. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

(Typically Offered: Fall, Spring, Summer)

ENGL 5910F: Directed Readings: Creative Writing

Credits: 1-30. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

(Typically Offered: Fall, Spring, Summer)

ENGL 5910G: Directed Readings: Applied Linguistics and Technology

(Cross-listed with LING 5910G).

Credits: 1-30. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

(Typically Offered: Fall, Spring, Summer)

ENGL 5920A: Core Studies: Rhetoric

(Cross-listed with SPCM 5920A).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Prereq: Graduate Standing or Permission of Instructor

Seminar on topics central to the fields of rhetoric and professional communication or composition. (Typically Offered: Fall, Spring, Summer)

ENGL 5920B: Core Studies: Composition

(Cross-listed with SPCM 5920B).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Prereq: Graduate Standing or Permission of Instructor

Seminar on topics central to the fields of rhetoric and professional communication or composition. (Typically Offered: Fall, Spring, Summer)

ENGL 5920C: Core Studies: Professional Communication

(Cross-listed with SPCM 5920C).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Prereq: Graduate Standing or Permission of Instructor

Seminar on topics central to the fields of rhetoric and professional communication or composition. (Typically Offered: Fall, Spring, Summer)

ENGL 5940X: Practice and Theory of Teaching Literature in the Secondary Schools

(Dual-listed with ENGL 4940).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 4940; ENGL 3100; ENGL 3970; 9 additional credits in ENGL beyond ENGL 2500; PSYCH 3330; Admission to the MAT Program

Portfolio review. Current theories and practices in the teaching of literature to secondary school students. Integrating literary study and writing. Preparation and selection of materials. Classroom presentation. Unit planning. (ENGL 4940: Taken concurrently with EDUC 4800, Cr. 2, and SPED 4010; 5940X: taken concurrently with EDUC 5910E.) ENGL 4940 students must have initiated the application process for the teacher education program and initiated a background check with the State of Iowa Department of Criminal Investigation. ENGL 5940X students must have initiated a background check with the State of Iowa Department of Criminal Investigation. (Typically Offered: Fall, Spring)

ENGL 5950A: Graduate Study and Travel: Literature

Credits: 1-30. Contact Hours: Lecture 30.

Prereq: Graduate Standing or Permission of Instructor

Supervised study of an appropriate area of the discipline while traveling in a foreign country or in the U.S. Special fees apply. (Typically Offered: Fall, Spring, Summer)

ENGL 5950B: Graduate Study and Travel: Creative Writing

Credits: 1-30. Contact Hours: Lecture 30.

Prereq: Graduate Standing or Permission of Instructor

Supervised study of an appropriate area of the discipline while traveling in a foreign country or in the U.S. Special fees apply. (Typically Offered: Fall, Spring, Summer)

ENGL 5950C: Graduate Study and Travel: Linguistics

Credits: 1-30. Contact Hours: Lecture 30.

Prereq: Graduate Standing or Permission of Instructor

Supervised study of an appropriate area of the discipline while traveling in a foreign country or in the U.S. Special fees apply. (Typically Offered: Fall, Spring, Summer)

ENGL 5950D: Graduate Study and Travel: Rhetoric and Professional Communication

Credits: 1-30. Contact Hours: Lecture 30.

Prereq: Graduate Standing or Permission of Instructor

Supervised study of an appropriate area of the discipline while traveling in a foreign country or in the U.S. Special fees apply. (Typically Offered: Fall, Spring, Summer)

ENGL 5950E: Graduate Study and Travel: Teacher Education

Credits: 1-30. Contact Hours: Lecture 30.

Prereq: Graduate Standing or Permission of Instructor

Supervised study of an appropriate area of the discipline while traveling in a foreign country or in the U.S. Special fees apply. (Typically Offered: Fall, Spring, Summer)

ENGL 5990: Creative Component

Credits: 3. Repeatable.

Prereq: Instructor Permission for Course

Creative Component. (Typically Offered: Fall, Spring, Summer)

Courses for graduate students:

ENGL 6030: Seminar in Composition Theory

Credits: 3. Contact Hours: Lecture 3.

Exploration of relationships between theory and practice in current pedagogy. Intensive examination of contemporary theories of poststructuralism, new media, feminism, postcolonialism, or cultural studies and their impact on current pedagogical practice. Participation in pedagogical research and theory building.

ENGL 6110: Seminar in Rhetorical Theory

(Cross-listed with SPCM 6110).

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Rhetorical theory, criticism, and/or practice in relation to a historical period or a particular theoretical issue.

ENGL 6230A: Research Methods in Applied Linguistics: Quantitative

(Cross-listed with LING 6230A).

Credits: 3. Contact Hours: Lecture 3.

Survey of quantitative research methods used in applied linguistics. Offered odd-numbered years. (Typically Offered: Spring)

ENGL 6230B: Research Methods in Applied Linguistics: Qualitative

(Cross-listed with LING 6230B).

Credits: 3. Contact Hours: Lecture 3.

Survey of qualitative research methods used in applied linguistics. Offered even-numbered years. (Typically Offered: Spring)

ENGL 6260: Computer-Assisted Language Testing

(Cross-listed with LING 6260).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 5190 or LING 5190

Principles and practices for the use and study of computers and the Internet in second language assessment. Offered even-numbered years. (Typically Offered: Spring)

ENGL 6300: Seminar in Applied Linguistics

(Cross-listed with LING 6300).

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Topic changes each semester. Topics include advanced methods in natural language processing, technology and literacy in a global context, feedback in CALL programs, technology and pronunciation, and advances in language assessment.

ENGL 6310: Administration and Organization of Multimodal Writing Programs

Credits: 3. Contact Hours: Lecture 3.

Survey of the major components of writing instruction in academic and nonacademic settings. History, theory, organization, and evaluation of writing programs. Guided observation of writing program functions at various institutions and businesses.

ENGL 6990: Research

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Research. (Typically Offered: Fall, Spring, Summer)

Entomology (ENT)

Courses primarily for undergraduates:

ENT 2010: Introduction to Insects

Credits: 1. Contact Hours: Lecture 2.7.

Biological and ecological aspects of insects. Offered online only. 5 weeks. (Typically Offered: Fall, Spring)

ENT 2110: Insects and Society

Credits: 2. Contact Hours: Lecture 2.7.

The importance of insects in human well-being. Insect-human interactions. Primarily for non-science and non-agriculture majors. Offered online only. 11 weeks. (Typically Offered: Fall, Spring)

ENT 2140: Insects in Forensic Science

Credits: 3. Contact Hours: Lecture 3.

Introduction to the use of insects as evidence in court and how they can assist in solving crimes. Topics covered include basic insect biology, systematics, behavior, with emphasis on applications of forensic entomology. Offered even-numbered years. (Typically Offered: Fall)

ENT 2200: Introduction to Forensic Science

(Cross-listed with CJ 2200).

Credits: 3. Contact Hours: Lecture 3.

Study of fundamental forensic science techniques and procedures covering types of physical, chemical, and biological evidence and how this information is used in the legal system. Assessment of crime scenes and various forensic specialties will be introduced. (Typically Offered: Spring)

ENT 2400: Hemp: Potential and Constraints for a New Crop

(Cross-listed with AGRON 2400).

Credits: 2. Contact Hours: Lecture 2.

Repeatable.

History, biology, and agronomy of hemp as it is allowed to be grown in Iowa. (Typically Offered: Spring)

ENT 2830: Pesticide Application Certification

(Cross-listed with AGRON 2830/ FOR 2830/ HORT 2830).

Credits: 2. Contact Hours: Lecture 2.

Core background and specialty topics in agricultural, and horticultural pesticide applicator certification. Students can select certification categories and have the opportunity to obtain pesticide applicator certification at the completion of the course. Commercial pesticide applicator certification is emphasized. (Typically Offered: Spring)

ENT 3580: Bee Biology, Management, and Beekeeping

(Cross-listed with BIOL 3580).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Introductory (2000-level) biology coursework or permission of an instructor

Bee diversity and evolution, ecology, role as pollinators, behavior, anatomy, and development. Management of bees as agricultural pollinators and honey producers, focusing on honey bees. Working with live bee hives and demonstration of practical beekeeping skills will occur during several field trips to local hives. (Typically Offered: Fall)

ENT 3700: Insect Biology

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: BIOL 1010 or BIOL 2110

Structure, physiology, evolution, behavior, life histories, and recognition of insects. Collection required. (Typically Offered: Fall)

ENT 3720: Livestock Entomology

Credits: 2. Contact Hours: Lecture 2.

Classroom and off-campus videotape sections. 12 weeks. Recognition, biology, behavior, economic importance, and management of insects and other arthropods affecting livestock and poultry production. Offered odd-numbered years. (Typically Offered: Spring)

ENT 3740: Insects and Our Health

(Cross-listed with MICRO 3740).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 3 credits in Biological Sciences

Identification, biology, and significance of insects and arthropods that affect the health of humans and animals, particularly those that are vectors of disease. Meets International Perspectives Requirement. (Typically Offered: Spring)

ENT 3740L: Insects and Our Health Laboratory

(Cross-listed with MICRO 3740L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Credit or concurrent enrollment in ENT 3740 or MICRO 3740

Laboratory and field techniques for studying medical or public health entomology, including: collection, identification and maintenance of medically significant arthropods and experimental design and execution related to the biology of arthropods or arthropod-pathogen interactions. Offered even-numbered years. (Typically Offered: Spring)

ENT 3750: Plant Protection Using Natural Enemies

(Dual-listed with ENT 5750).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENT 3700 or ENT 3760

Overview of the biology, ecology, and classification of insect pathogens, predators, and parasitoids. Discussion of the use of these organisms in plant protection, including an emphasis on genetic alteration of natural enemies. Offered even-numbered years. (Typically Offered: Spring)

ENT 3760: Fundamentals of Entomology and Pest Management

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: BIOL 1010 or BIOL 2110

Introduction to entomology and insect-pest management, including life processes, ecology, economics, tactics of population suppression, and ecological backlash. (Typically Offered: Spring)

ENT 4250: Aquatic Insects

(Dual-listed with ENT 5250/ AECL 5250). (Cross-listed with AECL 4250).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: BIOL 3120

Morphology, ecology, diversity, and significance of aquatic insects, with emphasis on the collection, curation and identification of taxa in local streams and lakes. Offered odd-numbered years. (Typically Offered: Spring)

ENT 4350: Entomology Field Trip

(Cross-listed with AECL 4350).

Credits: 2. Repeatable, maximum of 2 credits.

Prereq: BIOL 3120; Permission of Instructor

Field trip to study insects of major terrestrial and aquatic ecosystems.

Location and duration vary. ENT 3700 or ENT 4250 recommended.

Offered irregularly. (Typically Offered: Spring, Summer)

ENT 4500: Pesticides in the Environment

(Dual-listed with ENT 5500/ TOX 5500). (Cross-listed with TOX 4500).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 6 credits of BIOL or Permission of Instructor

Fate and significance of pesticides in soil, water, plants, animals, and the atmosphere. (Typically Offered: Spring)

ENT 4520: Integrated Management of Diseases and Insect Pests of Turfgrasses

(Dual-listed with PLP 5520/ ENT 5520/ HORT 5520). (Cross-listed with PLP 4520/ HORT 4520).

Credits: 3. Contact Hours: Lecture 3.

Prereq: HORT 3510

Identification and biology of important diseases and insect pests of turfgrasses. Development of integrated pest management programs in various turfgrass environments. Offered even-numbered years. (Typically Offered: Spring)

ENT 4710: Insect Ecology

(Dual-listed with ENT 5710).

Credits: 3.

Prereq: 9 credits of BIOL

The contribution of insects to ecosystem function is staggering. This course will focus on insect population ecology, predator-prey interaction and chemical ecology. The role insects in nutrient cycling, pollination and pest management will be discussed with case studies used to highlight the applied nature of insect ecology and its relationship to agriculture.

Offered even-numbered years. (Typically Offered: Fall)

ENT 4900E: Independent Study: Research or Work Experience

Credits: 1-3. Repeatable, maximum of 9 credits.

Prereq: 15 credits in biological sciences, Junior or Senior classification;

Permission of Instructor

Graduation Restriction: A maximum of 9 credits of all (university-wide)

4900 courses may be applied toward graduation. (Typically Offered: Fall, Spring, Summer)

ENT 4900U: Independent Study: Laboratory teaching experience

Credits: 1-3. Repeatable, maximum of 9 credits.

Prereq: Instructor Permission for Course

For students registering to be undergraduate laboratory assistants.

Graduation Restriction: A maximum of 9 credits of all (university-wide)

4900 courses may be applied toward graduation.

Courses primarily for graduate students, open to qualified undergraduates:

ENT 5110: Integrated Management of Tropical Crops

(Cross-listed with HORT 5110/ PLP 5110).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (ENT 3700 or ENT 3760 or HORT 2210 or PLP 4080 or PLP 4160) or Graduate Classification

Applications of Integrated Crop management principles (including plant pathology, entomology, and horticulture) to tropical cropping systems.

Familiarization with a variety of tropical agroecosystems and Costa Rican culture is followed by a 10-day tour of Costa Rican agriculture during spring break, then writeup of individual projects. Offered odd-numbered years. Meets International Perspectives Requirement. (Typically Offered: Spring)

ENT 5250: Aquatic Insects

(Dual-listed with ENT 4250/ AECL 4250). (Cross-listed with AECL 5250).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: BIOL 3120 or graduate standing

Morphology, ecology, diversity, and significance of aquatic insects, with emphasis on the collection, curation and identification of taxa in local streams and lakes. Offered odd-numbered years. (Typically Offered: Spring)

ENT 5300: Ecologically Based Pest Management Strategies

(Cross-listed with AGRON 5300/ SUSAG 5300/ PLP 5300).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Durable, least-toxic strategies for managing weeds, pathogens, and insect pests, with emphasis on underlying ecological processes. Offered odd-numbered years. (Typically Offered: Fall)

ENT 5500: Pesticides in the Environment

(Dual-listed with ENT 4500/ TOX 4500). (Cross-listed with TOX 5500).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 9 credits in BIOL or Graduate Classification

Fate and significance of pesticides in soil, water, plants, animals, and the atmosphere. (Typically Offered: Spring)

ENT 5520: Integrated Management of Diseases and Insect Pests of Turfgrasses

(Dual-listed with PLP 4520/ ENT 4520/ HORT 4520). (Cross-listed with PLP 5520/ HORT 5520).

Credits: 3. Contact Hours: Lecture 3.

Prereq: HORT 3510 or Graduate Classification

Identification and biology of important diseases and insect pests of turfgrasses. Development of integrated pest management programs in various turfgrass environments. Offered even-numbered years. (Typically Offered: Spring)

ENT 5550: Insect Physiology

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: ENT 3700 or Graduate Classification

Life processes of the insects, including reviews of current problems in insect physiology. Offered even-numbered years. (Typically Offered: Spring)

ENT 5680: Advanced Systematics

(Cross-listed with EEOB 5680).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Principles and practice of systematic biology; taxonomy, nomenclature and classification of plants and animals; sources and interpretation of systematic data; speciation; fundamentals of phylogenetic systematics. (Typically Offered: Spring)

ENT 5700: Plant-Insect Interaction

Credits: 2. Contact Hours: Lecture 2.

Prereq: 9 credits in BIOL or Graduate Classification

Physiological, behavioral, ecological, and evolutionary factors that govern interactions between insects and plants, applications of this knowledge to agriculture, and important results from the study of natural systems. Additional topics covered during the semester include: tritropic interactions, biological control of plants by insects, and pollination biology. Student-led discussions and draws on both the primary and secondary literature. Offered odd-numbered years. (Typically Offered: Fall)

ENT 5710: Insect Ecology

(Dual-listed with ENT 4710).

Credits: 3.

Prereq: 9 credits in BIOL or Graduate Classification

The contribution of insects to ecosystem function is staggering. This course will focus on insect population ecology, predator-prey interaction and chemical ecology. The role insects in nutrient cycling, pollination and pest management will be discussed with case studies used to highlight the applied nature of insect ecology and its relationship to agriculture. Offered even-numbered years. (Typically Offered: Fall)

ENT 5740: Medical Entomology

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: 9 credits in BIOL or Graduate Classification

Identification, biology, and significance of insects and other arthropods that attack people and animals, particularly those that are vectors of disease. Offered even-numbered years. (Typically Offered: Spring)

ENT 5750: Plant Protection Using Natural Enemies

(Dual-listed with ENT 3750).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENT 3700 or ENT 3760 or Graduate Classification

Overview of the biology, ecology, and classification of insect pathogens, predators, and parasitoids. Discussion of the use of these organisms in plant protection, including an emphasis on genetic alteration of natural enemies. Offered even-numbered years. (Typically Offered: Spring)

ENT 5760: Systematic Entomology

Credits: 5. Contact Hours: Lecture 3, Laboratory 6.

Prereq: ENT 3700 or Graduate Classification

Classification, distribution, and natural history of insects, including fundamentals of phylogenetic systematics, biogeography, taxonomic procedures, and insect collection and curation. Offered even-numbered years. (Typically Offered: Fall)

ENT 5810: Experience in Plant Science Extension and Outreach

(Cross-listed with AGRON 5810/ PLP 5810/ HORT 5810).

Credits: 1.

Prereq: Graduate Standing or Permission of Instructor

A supervised learning experience in several extension delivery methods used in the plant sciences. Participation in Iowa State University-based extension programs that may include field crops horticulture, or Master Gardener programming. Offered odd-numbered years. (Typically Offered: Summer)

ENT 5900A: Special Topics: Biological Control and Pathology

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Special Topics: Biological Control and Pathology. (Typically Offered: Fall, Spring, Summer)

ENT 5900B: Special Topics: Chemical Ecology and Behavior

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Special Topics: Chemical Ecology and Behavior. (Typically Offered: Fall, Spring, Summer)

ENT 5900C: Special Topics: Ecology and Pest Management

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Special Topics: Ecology and Pest Management. (Typically Offered: Fall, Spring, Summer)

ENT 5900D: Special Topics: Evolution and Systematics

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Special Topics: Evolution and Systematics. (Typically Offered: Fall, Spring, Summer)

ENT 5900E: Special Topics: Special Research Topics

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Special Topics: Special Research Topics. (Typically Offered: Fall, Spring, Summer)

ENT 5900F: Special Topics: Medical and Veterinary Entomology

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Special Topics: Medical and Veterinary Entomology. (Typically Offered: Fall, Spring, Summer)

ENT 5900G: Special Topics: Molecular Entomology

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Special Topics: Molecular Entomology. (Typically Offered: Fall, Spring, Summer)

ENT 5900I: Special Topics: Toxicology

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Special Topics: Toxicology. (Typically Offered: Fall, Spring, Summer)

ENT 5900K: Special Topics: Teaching Experience

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Special Topics: Teaching Experience. (Typically Offered: Fall, Spring, Summer)

ENT 5900L: Special Topics: Extension Internship

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Independent Study. (Typically Offered: Fall, Spring, Summer)

ENT 5900M: Special Topics: Immature Insects

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Special Topics: Immature Insects. (Typically Offered: Fall, Spring, Summer)

ENT 5900N: Special Topics: Population Genetics

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Special Topics: Population Genetics. (Typically Offered: Fall, Spring, Summer)

Courses for graduate students:

ENT 6000: Seminar

Credits: 1. Contact Hours: Lecture 1.

Presentation of research results. (Typically Offered: Fall, Spring, Summer)

ENT 6750: Insecticide Toxicology

(Cross-listed with TOX 6750).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: ENT 5550 or TOX 5010 or Graduate Classification

Principles of insecticide toxicology; classification, mode of action, metabolism, and environmental effects of insecticides. Offered even-numbered years. (Typically Offered: Fall)

ENT 6990: Research

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Research. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

Entrepreneurship (ENTSP)

Courses primarily for undergraduates:

ENTSP 3100: Entrepreneurship and Innovation

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Introduction to the entrepreneurial process, from the creation and discovery of entrepreneurial opportunities to starting viable business ventures. Develops core entrepreneurial and innovation skills instrumental for business startups as well as for established businesses, and fosters fundamental understanding of how to organize, structure, finance, market and launch new ventures. Opportunities to apply introduced skills, tools and frameworks through class projects and exercises. (Typically Offered: Fall, Spring)

ENTSP 3130: Feasibility Analysis for New Ventures

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENTSP 3100

Focuses on the knowledge and practical skills required for developing an idea for a new business venture, researching potential markets, analyzing competition, conducting formal feasibility analyses, and considering business plan implications. Includes discussion of basic business functions in terms of their application to conducting feasibility analyses and to exploiting related business opportunities. (Typically Offered: Fall, Spring)

ENTSP 3200: Corporate Entrepreneurship

(Cross-listed with MGMT 3200).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Introduces entrepreneurial approaches aimed at the identification, development and exploitation of technical and organizational innovations, the management of new product or process developments, and the effective management of new ventures. Focuses on mid-size to large corporations, especially in the manufacturing and service industries. Develops an awareness and understanding of the range, scope, and complexity of issues related to the creation of a corporate environment that is supportive of entrepreneurial endeavors as well as the effective implementation of technological and organizational innovations in corporate settings. (Typically Offered: Fall, Spring)

ENTSP 3670: International Entrepreneurship

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Introduces the essentials of two key components of international entrepreneurship: operating an entrepreneurial firm in an international environment, and starting and developing a new venture in an international market. Topics include choosing and entering an international market, organizing international ventures, and other issues related to managing the business and employees in an international context. Offers students the opportunity to create an international business plan for their own business idea or an existing company. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

ENTSP 3810: Managing Family Businesses

(Cross-listed with MGMT 3810).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Introduction to the important role family businesses play in the domestic and global economies as well as the complex and unique challenges and opportunities encountered by such businesses and their family members and other employees. Explores best practices for successfully managing family businesses.

ENTSP 4100: Social Entrepreneurship

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Introduces the role of entrepreneurship in helping to solve social issues and societal problems, and the idea of social entrepreneurs as pursuers of the public good and as change agents in the social sector. Emphasis on how entrepreneurial topics such as innovation and opportunity recognition can be leveraged to address social problems, as well as on the planning and launch of new non-profit or not-for-profit ventures. (Typically Offered: Fall, Spring)

ENTSP 4310: New Venture Financing

(Cross-listed with FIN 4310).

Credits: 3. Contact Hours: Lecture 3.

Prereq: FIN 3100 or [(ENTSP 3130 or MGMT 3130) and FIN 3010]

Exploration of the foundations of financing entrepreneurial companies. Emphasis on the roles of the entrepreneurs, venture capitalists, and limited partners in the full financing cycle of early-stage ventures, including pitching and raising capital, deal sourcing and due diligence, deal structuring, and post-investment management. Extensive use of case studies and interactive presentations to a mock investor-based board of directors to illustrate the key concepts and processes involved in start-up financing. (Typically Offered: Spring)

ENTSP 4540: Entrepreneurial Marketing

(Cross-listed with MKT 4540).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MKT 3400

Basic understanding of marketing for those interested in creating or working for a start-up or an innovation-oriented company or consultancy. Relevant to marketing roles in entrepreneurial firms across both B2B and B2C markets. Integrates theory and practice, and provides insight into how entrepreneurs take both strategic and tactical marketing decisions in uncertain business environments. For hands-on perspective, incorporates projects involving real-world marketing problems confronting start-ups, and guest talks from entrepreneurs and frequent case analyses. (Typically Offered: Fall)

ENTSP 4550X: Current Issues in Entrepreneurship

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENTSP 3100

Designed to complement the required curriculum in the Entrepreneurship (ENTSP) major. Explores a rotating selection of cutting edge and timely topics in the areas of new venture creation, social entrepreneurship, and intrapreneurship, with an emphasis on the application of entrepreneurial knowledge and skills to the challenges facing today's organizations and new ventures. Develops an awareness and understanding of the range, scope, and complexity of issues related to entrepreneurial mindsets and the creation of new ventures in different contexts and in our post-pandemic world. Opportunities to apply introduced knowledge, skills, and tools through class projects and exercises.

ENTSP 4600X: Franchising Strategy

(Cross-listed with MKT 4600X).

Credits: 3. Contact Hours: Lecture 3.

Go-to-market practices with focus on franchising. Connecting franchising with other sister disciplines (entrepreneurship, marketing, and retailing). Developing and managing a franchise from a franchisor's standpoint and understanding franchising from a franchisee's standpoint. (Typically Offered: Spring)

ENTSP 4610: Entrepreneurship and Accounting Information

(Dual-listed with ACCT 5610). (Cross-listed with ACCT 4610).

Credits: 3. Contact Hours: Lecture 3.

Accounting information recording, dissemination, and use by entrepreneurs. Introduces pro forma financials, venture capital, private equity, and state and federal regulations for business creation and formation. Other topics include intrapreneurship, intellectual property, information privacy, cybersecurity, and internal controls, including managing the risk of embezzlement.

ENTSP 4800: Applied Entrepreneurship: Executing New Ventures

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENTSP 3100; ENTSP 3130; or currently enrolled in the Master of Entrepreneurship (MEP) Program

Focuses on application-oriented and experiential learning of best practices for starting and advising new business ventures. Students identify, propose and attempt to execute an experiential learning project, such as developing and presenting a business model for a new venture, launching a new venture, or similar entrepreneurial experience. Requires extensive work outside the classroom.

ENTSP 4850: Trends in Entrepreneurship

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENTSP 3100

A broad examination of historical, literary, and business perspectives on entrepreneurship. The entrepreneurial process is studied by examining the role of individuals, new ventures, and established organizations in the discovery, evaluation, and exploitation of economic opportunities. Emphasis is placed on tracing the evolution of entrepreneurship theories over time, as well as analyzing current trends related to the study of entrepreneurship. (Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

ENTSP 5200: Corporate Entrepreneurship, Innovation and Technology Management

(Cross-listed with MGMT 5200).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate classification

Management of venture creation and innovation at large and established organizations. New ideas, concepts, and techniques on how to stimulate and exploit innovative activities to make established firms not only more responsive and flexible, but also more proactive and opportunity-creating. Related approaches combine activities targeted at the individual, team, organization, industry, regional, national and global level. Introduction to how today's large and established corporations (1) identify, develop and exploit innovative opportunities, (2) manage product development processes, and (3) create, spin-in, spin-off and manage new innovative ventures. This case-based course introduces emerging, non-traditional, evidence-based approaches, such as agile product development, design-thinking, entrepreneurial leadership, entrepreneurial ecosystems, open innovation and blue-ocean strategies. (Typically Offered: Fall, Spring, Summer)

ENTSP 5660: Entrepreneurship and New Venture Startup

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Classification or Permission of Instructor

The essentials of starting and operating a new business. Topics include current research on entrepreneurial perspective, starting and developing a new business, financing the venture, managing the growing firm, and special issues. (Typically Offered: Fall, Spring, Summer)

ENTSP 5670: Launching International Ventures

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Classification or Permission of Instructor

Essentials of operating international ventures. Topics include identifying and evaluating international business opportunities, choosing among international markets and modes of international entry, building an international organization, managing across cultures, financing international ventures, and recognizing the major issues related to starting a venture in a non-US context. International entry plan for an international new venture or an existing business. (Typically Offered: Fall, Spring, Summer)

ENTSP 5700: Launching your Startup: Proof of Concept and Financial Viability

Credits: 3.

Prereq: Graduate Standing or Permission of Instructor

Designed to aid students who are actively pursuing a venture that has progressed beyond the ideation stage of development – and is possibly launched or launch-imminent. Addresses operational challenges in launching a new venture in its very formative stage. Attention is devoted to business formation, risk management, recordkeeping, go-to-market strategy. Examines how start-up and small/medium-size companies reach the marketplace and sustain their businesses, within highly-competitive industries. Recognition is given to the need of management to operate flexibly in these environments. (Typically Offered: Spring)

ENTSP 5830: Formulating and Implementing Innovation Strategies

(Cross-listed with MGMT 5830).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MGMT 5040 or permission of instructor

Key strategies, models, and tools to foster and drive organizational innovation. Analysis of industry dynamics, sources and types of innovations, timing of entry; formulation of innovation strategies; developing innovation portfolios and collaboration strategies, protecting innovation; implementing technological innovation strategy, including new product development and deployment strategy. Essential traits of innovative strategic leaders. Critical analysis and discussion of cases focused on entrepreneurship and innovation and project requiring hands-on practical application of course concepts.

ENTSP 5900X: Independent Study - MEP

Credits: 3.

Prereq: Enrolled in the Master of Entrepreneurship (MEP) Program

Independent study that facilitates the exploration of new venture ideas and/or the development of a particular startup idea over the course of a semester or summer session. Students will work with a faculty mentor to pursue new venture ambitions by exploring, assessing, and developing new venture ideas. (Typically Offered: Fall, Spring, Summer)

ENTSP 5910X: Services Internship- MEP

Credits: 3.

Prereq: Enrolled in the Master of Entrepreneurship (MEP) Program

Opportunity to build entrepreneurial experience and develop entrepreneurial skills through participation in a Pappajohn Center or Graduate Career Services internship with a startup or small business. (Typically Offered: Fall, Spring, Summer)

ENTSP 5920X: CYstarters Summer Accelerator - MEP

Credits: 6.

Prereq: Enrolled in the Master of Entrepreneurship (MEP) Program

Involvement in the CYstarters program will help students assess and develop a new venture idea through partnership with Pappajohn Center staff and entrepreneurs-in-residence in this 11-week summer program. Explore and advance a startup idea, aided by the many resources provided by the Ames entrepreneurial ecosystem. (Typically Offered: Summer)

ENTSP 5930X: Independent Business Venture - MEP

Credits: 3.

Prereq: Enrolled in the Master of Entrepreneurship (MEP) Program

Independent study to facilitate the exploration, assessment, and development of a startup idea. Students will work with an ISU faculty member to advance a new venture idea and build towards important entrepreneurial milestones. (Typically Offered: Fall, Spring, Summer)

ENTSP 5940X: Startup Factory - MEP

Credits: 6. Contact Hours: Lecture 6.

Prereq: Enrolled in the Master of Entrepreneurship (MEP) Program

Involvement in the ISU Startup Factory Program will help students examine, validate, and develop new venture ideas. Receive training, resources, guidance, and access to a large network of mentors, alumni, and advisors in this 16-week startup incubator program.

Courses for graduate students:**ENTSP 6050: Seminar in Strategic Management**

(Cross-listed with MGMT 6050).

Credits: 3. Contact Hours: Lecture 3.

Critical review of theory and research in the field of strategic management. Introduction to representative conceptual and empirical research. Review theories that provide the foundation for management research, and review current research in associate research streams. The review will cover fundamental questions in strategy. Offered odd-numbered years. (Typically Offered: Fall)

ENTSP 6060: Historical Foundations of Entrepreneurship Research

(Cross-listed with MGMT 6060).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Enrollment in MGMT PhD program

Seminal readings, theoretical perspectives, and historical roots of Entrepreneurship research. A broad variety of core foundational theories, perspectives, and approaches are discussed.

ENTSP 6070: Current Topics in Entrepreneurship Research

(Cross-listed with MGMT 6070).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Enrollment in MGMT PhD program

Current theoretical perspectives and methodological approaches in entrepreneurship research. Current entrepreneurship research is inherently interdisciplinary such that we will draw on insight from scholars across a range of disciplines. Offered even-numbered years. (Typically Offered: Spring)

ENTSP 6090: Organizational Research Methods

(Cross-listed with MGMT 6090).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Enrollment in ENTSP or MGMT PhD program or permission of instructor.

Solid methodological foundation that will prepare you to be a productive producer and educated consumer of scientific research in the field of Management, Entrepreneurship, and other related disciplines. Introduction to numerous concepts and techniques with relevance to your future scholarship in this domain. Conceptual underpinnings necessary to appreciate the strengths and limitations of various approaches used in these fields and the interplay between theoretical advancement and rigorous empirical investigation. (Typically Offered: Fall)

ENTSP 6110X: Seminar in Entrepreneurship Topics

Credits: 3. Contact Hours: Lecture 3.

Semil readings that canvas the theoretical perspectives and historical roots of entrepreneurship research. A broad variety of core foundational theories, perspectives, and approaches discussed. Topics include the domain of entrepreneurship, foundations and theories of entrepreneurship, the role of opportunities and resources in the entrepreneurial process, the entrepreneur and new venture emergence, cultural and environmental influences on entrepreneurship, family business, corporate entrepreneurship, entrepreneurial orientation, social capital, entrepreneurial learning, and venture financing. Offered even-numbered years. (Typically Offered: Fall)

ENTSP 6120: Seminar in Micro Management Topics

(Cross-listed with MGMT 6120).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Ivy College of Business PhD student or instructor permission

Foundation in micro research including domains of organizational behavior (OB) and human resource management (HR). Discuss classic micro topics (e.g., job performance), as well as topics that exemplify recent advances within the OB/HR literatures (e.g., big data). Multiple levels of analysis and consider how micro topics complement other areas of management research (i.e., entrepreneurship and macro topics). Theory and empirical research within the applied context of the OB/HR environment. Emphasize a systematic and scientific approach to deepening collective knowledge and understanding of topics. (Typically Offered: Fall)

ENTSP 6200AX: Special Topics: Resources and Capabilities

Credits: 1. Contact Hours: Lecture 3.

Provide students with a deeper content knowledge of innovation. Analysis of classic and recent readings in Strategic Management of Innovation. Topics include an introduction to the main theories of innovation, technology strategy, types and measurement of innovation, ambidexterity, the influence of strategic leadership on innovation, and innovation challenges in established firms. Multiple levels of analysis and consideration of how these topics emerge across different areas of management (micro and macro) and entrepreneurship research. Theory and empirical research embedded within the applied context of the strategic management innovation field. Emphasis on systematic and scientific approach to deepening our knowledge and understanding of topics. (Typically Offered: Spring)

ENTSP 6200BX: Entrepreneur Well-Being

Credits: 1. Contact Hours: Lecture 3.

Provides deeper content knowledge of entrepreneur well-being. Covers the broad goals of entrepreneur well-being research and examines differences between two critical types of well-being: hedonic and eudaimonic. Addresses why entrepreneurs can achieve and entrepreneur working environments can produce well-being outcomes distinct from those seen by non-entrepreneurs in more traditional waged work environments. Addresses the different coping behaviors used by entrepreneurs, as well as the complex relationship between well-being and venture performance. Approaches course topics from multiple levels of analysis and considers how these topics emerge across different areas of management (micro and macro) and entrepreneurship research. Emphasis on a systematic and scientific approach to deepening knowledge and understanding of topics. (Typically Offered: Fall)

ENTSP 6200CX: Self-Regulation and Entrepreneurship

Credits: 1. Contact Hours: Lecture 3.

Provide content knowledge regarding the importance of self-regulation to entrepreneurs. Explore existing research from a number of domains (primarily psychology and entrepreneurship) that has explored various aspects of self-regulation. Understand connections between various self-regulatory mechanisms and how those individual capabilities potentially relate to a host of entrepreneurial behaviors and outcomes. Examine course topics from multiple levels of analysis and consider how these topics emerge across different areas of management (micro and macro) and entrepreneurship research. Blend of theory and empirical research within the applied context of the management field. Emphasis on a systematic and scientific approach to deepening knowledge and understanding of topics. (Typically Offered: Fall)

ENTSP 6200DX: Special Topics: Crafting Research Ideas

(Cross-listed with MGMT 6200DX).

Credits: 1. Contact Hours: Lecture 3.

Role as a scholar is more than publishing research. The purpose of scholarship is to add to usable knowledge - which means knowledge that can be used to solve real - world problems. To publish an article, students need to convince other scholars of the quality of their research. To create usable knowledge, you need to solve a problem that managers face and communicate that solution to managers. Most managers do not read academic journals, so the publication of an article does not guarantee that anyone who needs the knowledge will find it. Introduction an ideal form of scholarship that Andy Van de Ven calls 'engaged scholarship.' This form of scholarship requires the rigorous theory and methods by adds the additional component of connecting research to practitioners throughout the research process. (Typically Offered: Spring)

ENTSP 6200EX: Special Topics: Effective Academic Writing

(Cross-listed with MGMT 6200EX).

Credits: 1. Contact Hours: Lecture 3.

Provide skills and training necessary to navigate the professional landscape of the management and entrepreneurship fields. Discussion of effective academic writing, focusing on the discipline of management (but certainly applicable beyond this field). Blend of theory, research and practice focused on understanding one's role as a scholar, the implications of scholarly work, and successful advancement through career stages. (Typically Offered: Spring)

ENTSP 6200FX: Special Topics: Professional Development in Management and Entrepreneurship Research

(Cross-listed with MGMT 6200FX).

Credits: 1. Contact Hours: Lecture 3.

Repeatable, maximum of 2 times.

Provide skills and training necessary to navigate the professional landscape of the management/entrepreneurship fields. Includes topics such as research collaborations and networking, the peer review process, ethics, scholarly writing, presenting scholarly work, developing a research identity, understanding the research process, receiving and utilizing feedback, and navigating career milestones. Blend of theory, research, and practice focused on understanding one's role as a scholar, the implications of scholarly work, and successful advancement through career stages. (Typically Offered: Fall)

ENTSP 6200GX: Special Topics: Bayesian Analysis in Management and Entrepreneurship Research

(Cross-listed with MGMT 6200GX).

Credits: 1. Contact Hours: Lecture 3.

Provides a deeper understanding of research methodology. Introduces the fundamental concepts of Bayesian statistics as an advanced methodology to empirically investigate entrepreneurship and management phenome. Analytical topics include Bayes theorem, prior specification, likelihood functions, Markov Chain Monte Carlo simulations, analysis diagnostics, and posterior distributions. Application topics include Bayesian point estimates, intervals, predictions and hypothesis tests. Contrasts Bayesian approaches with frequentist paradigms such as statistical null-hypothesis significance tests. Designed to complement knowledge of MGMT 6090 Organizational Research Methods. Focus on exercises and discussions regarding how to collect, analyze and interpret empirical data to develop and advance micro- and macro-level theories in management and entrepreneurship. (Typically Offered: Fall)

ENTSP 6200HX: Applied Social Network Perspectives

(Cross-listed with MGMT 6200HX).

Credits: 1. Contact Hours: Lecture 3.

Provide a deeper content knowledge of social networks in organizational contexts. Cover conceptual foundations of the social network perspective, including how it fundamentally differs from other research perspectives. Explore important implications of various social network attributes and processes in the context of contemporary organizational scholarship. Discuss research design and empirical considerations associated with this perspective. Consider course topics from multiple levels of analysis and consider how these topics emerge across different areas (i.e., micro and macro) of management and entrepreneurship research. Blend of theory and empirical research within the applied context of the management field. Emphasis on a systematic and scientific approach to deepening knowledge and understanding of topics. (Typically Offered: Spring)

ENTSP 6200IX: Mergers and Acquisitions

(Cross-listed with MGMT 6200IX).

Credits: 1. Contact Hours: Lecture 3.

Provide a deeper content knowledge of mergers and acquisitions (M&As). Cover various M&A topics (premiums, deal completion, CEO characteristics, post-merger integration, acquisition performance, etc.), theoretical frameworks, as well as relevant findings of M&A research. Consider course topics from multiple levels of analysis and consider how these topics emerge across different areas of management (micro and macro) and entrepreneurship research. Blend of theory and empirical research within the applied context of the management field. Emphasis on a systematic and scientific approach to deepening knowledge and understanding of topics. (Typically Offered: Spring)

ENTSP 6200JX: Artificial Intelligence, Machine Learning and Big Data in Management and Entrepreneurship Research

(Cross-listed with MGMT 6200JX).

Credits: 1. Contact Hours: Lecture 3.

Repeatable, maximum of 2 times.

Provide a deeper understanding of research methodology implications of artificial intelligence, machine learning and big data for management and entrepreneurship scholars. Introduce students to the fundamental concepts and emerging capabilities of artificial intelligence and machine learning and investigate their applications in the context of data collection, data analysis and communication of research findings. Explore broader implications of these technologies for the objects of management research: organizations and their members. Designed to complement knowledge students can gain in MGMT 6090 Organizational Methods and ENTSP/MGMT 6200GX Bayesian Aalysis in management and Entrepreneurship Research. (Typically Offered: Fall, Spring, Summer)

ENTSP 6200KX: How to Manage the Revise and Resubmit Process

(Cross-listed with MGMT 6200KX).

Credits: 1. Contact Hours: Lecture 3.

Prereq: Enrollment in the PhD Program

Provide skills and training necessary to navigate the professional landscape of the management and entrepreneurship fields. Explore how to successfully manage the R&R (revise and resubmit process) at scholarly journals. Discussion of the purpose and stages of the peer review process. Blend of theory, research, and practice focused on understanding one's role as a scholar, the review process and implications of reviewing, and successful advancement through career stages. (Typically Offered: Spring)

ENTSP 6200L: Stakeholder Theory in Entrepreneurship Research

Credits: 1. Contact Hours: Lecture 3.

Provide content knowledge of stakeholder theory as it applies to entrepreneurship research. Gain a better understanding of the current research in stakeholder theory and build new insights in entrepreneurship research. Understand how entrepreneurship creates value for customers, suppliers, employees, communities, financiers, and the environment in general. Blend of theory and empirical research within the applied context of the entrepreneurship field. Emphasis on a systematic and scientific approach to deepening knowledge and understanding of topics. (Typically Offered: Fall, Spring)

ENTSP 6200MX: Ethics and Values in Management and Entrepreneurship

(Cross-listed with MGMT 6200MX).

Credits: 1. Contact Hours: Lecture 3.

Provides content knowledge of business ethics, especially the variety of behavioral ethics. Offers an exposure to business ethics literature, experiments with blending different methodology with substantive content and develops interesting research questions related to business ethics & values. Evaluate course topics from multiple levels of analysis and consider how these topics emerge across different areas of management (micro and macro) and entrepreneurship research. Blend of theory and empirical research within the applied context of the management field. Emphasis on a systematic and scientific approach to deepening knowledge and understanding of topics. (Typically Offered: Spring)

ENTSP 6200N: Family Business

Credits: 1. Contact Hours: Lecture 3.

Provide content knowledge of family business. Family businesses are uniquely complex enterprises—that range from small to large corporations and that are characterized by involving the dominant family logic into the management and governance of the firm. Examine current and future research directions of family-owned businesses. Learn (1) the strategic advantages of family businesses and (2) how leaders navigate the challenges posed by these organizations. Blend of theory and empirical research within the applied context of the entrepreneurship field. Emphasis on a systematic and scientific approach to deepening knowledge and understanding of topics. (Typically Offered: Fall, Spring)

ENTSP 6200O: Entrepreneurial Characteristics

Credits: 1. Contact Hours: Lecture 3.

Provide content knowledge of entrepreneurial characteristics. Examine the qualities associated with entrepreneurs. Explore how different characteristics influence entrepreneurial outcomes. Blend of theory and empirical research within the applied context of the entrepreneurship field. Emphasis on a systematic and scientific approach to deepening knowledge and understanding of topics. (Typically Offered: Fall, Spring)

Environmental Engineering (ENVE)

Courses primarily for undergraduates:

ENVE 1200: Environmental Engineering Learning Community

Credits: 1.

Integration of first-year students into the Environmental Engineering program. Assignments and activities involve personal and leadership skill development, teamwork, academic planning and career readiness. Completed both individually and in learning teams under the direction of instructors and peer mentors. (Typically Offered: Fall)

ENVE 1900: Introduction to Undergraduate Research in Civil and Environmental Engineering

Credits: 2. Repeatable, maximum of 4 times.

Prereq: Instructor Permission for Course

Introduction to research, focusing on sub-disciplines of civil and environmental engineering. Research questions, hypotheses, literature reviews, experimental design, data collection, data analysis, and presentation. Topics chosen to introduce students to water resources, environmental engineering, transportation engineering, geotechnical/materials engineering, or structural engineering. Graduation Restriction: Repeatable but only two credits may count toward graduation in CE.

ENVE 2010: Environmental Engineering Measurements and Analysis

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: CE 1900

Introduction to environmental monitoring, environmental field and laboratory sampling, sample preservation and chain of custody, quality assurance and quality control, measurements of common chemical and biological components in different media, and analysis of environmental quality in natural and engineered systems. Concentrations and material balances concepts as applied to environmental engineering. Laboratory testing and experiments. (Typically Offered: Fall)

ENVE 3260: Principles of Environmental Engineering

(Cross-listed with CE 3260).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: [CHEM 1670 or (CHEM 1770 and CHEM 1780)] AND MATH 1660 AND (credit or concurrent enrollment in ABE 3780)

Introduction to environmental problems, water quality indicators and requirements, potable water quality and quantity objectives, water sources and treatment methods; water pollution control objectives and treatment methods; survey of solid and hazardous waste management and air pollution control. (Typically Offered: Fall, Spring)

ENVE 4260: Environmental Engineering Science

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: CE 3260 and CHEM 2310

Physical, chemical and biological principles related to environmental engineering and management. Topics include physical principles (mass transfer, mass balances, reactor systems), chemical principles (kinetics and equilibrium, acid-base, redox and precipitation), and biological principles (common environmental microbial processes, microbiology). Laboratory testing and experiments. ENVE 2010 recommended. (Typically Offered: Fall)

ENVE 4270: Environmental Engineering Systems

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 2650; MATH 2660; CE 3260; CE 3720

Integrated systems and modeling-based evaluation of natural and engineered environments including water, soil, and air. Exploration of public health outcomes and risk assessment in environmental engineering. Analysis of socio-environmental systems. (Typically Offered: Spring)

ENVE 4280: Water and Wastewater Treatment Plant Design

(Cross-listed with CE 4280).

Credits: 3. Contact Hours: Lecture 3.

Prereq: CE 3260

Physical, chemical and biological processes for the treatment of water and wastewater including coagulation and flocculation, sedimentation, filtration, adsorption, chemical oxidation/disinfection, fixed film and suspended growth biological processes and sludge management. Design project. (Typically Offered: Spring)

ENVE 4290: Air Pollution and Control

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 2650; CE 3260

Coverage of air pollution topics such as stationary and mobile sources, National Ambient Air Quality Standards, regional and global air pollution concerns (acid rain, ozone depletion, greenhouse gases), indoor air pollution, air pollution meteorology, air pollutant dispersion, and air pollution control equipment. (Typically Offered: Spring)

ENVE 4300: Solid and Hazardous Waste Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: CE 3260 AND (credit or concurrent enrollment in ENVE 4260)

Evaluation, characterization, assessment, planning and design of solid and hazardous waste management systems, regulatory requirements, material characterization and collection, minimization and recycling, energy and materials recovery, composting, off-gas treatment, incineration, stabilization, and landfill design. Design of treatment and disposal systems for solid and hazardous wastes, including physical, chemical, and biological treatment, solidification, incineration, secure landfill design, and final disposal site closure plus restoration. (Typically Offered: Fall)

ENVE 4900: Independent Study

Credits: 1-3. Repeatable.

Prereq: Department Permission for Course

Independent study in environmental or water resources engineering. Pre-enrollment contract required. Graduation Restriction: Maximum of 3 credits may be counted towards Engineering Topics Electives. (Typically Offered: Fall, Spring, Summer)

Environmental Science (ENSCI)

Courses primarily for undergraduates:**ENSCI 1100: Orientation to Environmental Science**

Credits: 1. Contact Hours: Lecture 1.

Overview of Environmental Science curriculum and discussion of professional opportunities. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

ENSCI 2010: Introduction to Environmental Issues

(Cross-listed with BIOL 2010/ ENVS 2010).

Credits: 2. Contact Hours: Lecture 2.

Discussion of current and emerging environmental issues such as human population growth, energy use, loss of biodiversity, water resources, and climate change. (Typically Offered: Fall)

ENSCI 2020: Exploration of Environmental and Sustainability Issues

Credits: 1. Contact Hours: Lecture 1.

Exploration of specific environmental and sustainability issues; designed to complement ENSCI 2010. (Typically Offered: Fall)

ENSCI 2030: Exploration of Environmental Science

Credits: 1. Contact Hours: Lecture 1.

Continued exploration of specific environmental science issues developed in ENSCI 2020. Topics may vary in different years. (Typically Offered: Spring)

ENSCI 2500: Environmental Geography

(Cross-listed with AGRON 2500/ ENVS 2500/ NREM 2500).

Credits: 3. Contact Hours: Lecture 3.

The distribution, origins and functions of the earth's physical systems and the spatial relationship between human activity and the natural world. (Typically Offered: Fall)

ENSCI 2510: Biological Processes in the Environment

(Cross-listed with BIOL 2510).

Credits: 3. Contact Hours: Lecture 3.

Principles of Biology from the level of macromolecules to the biosphere. Biological processes that affect environmental systems: including metabolism, energy pathways, biochemical reactions in cells, plant and microbial structure and function, element and water cycles. (Typically Offered: Spring)

ENSCI 2700: Geospatial Technologies

(Cross-listed with AGRON 2700).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Concepts and tools for acquiring, managing, analyzing, and displaying geographic information, including GIS, remote sensing, spatial analysis, and cartography. Focus on applications in biological, ecological, environmental, and agricultural sciences. (Typically Offered: Spring)

ENSCI 3010: Natural Resource Ecology and Soils

(Cross-listed with NREM 3010).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: BIOL 2110, BIOL 2110L; FOR 2010 or a second course in biology

Effects of environmental factors on ecosystem structure and function using forest, prairie and agricultural ecosystems as models. Special emphasis is given to soil-forming factors and the role of soil in nutrient and water cycling and ecosystem dynamics. Additional emphasis is given to human influences on natural ecosystems and the role of perennial plant communities in agricultural landscapes. (Typically Offered: Fall)

ENSCI 3120: Ecology

(Cross-listed with AECL 3120/ BIOL 3120).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: BIOL 2110; (BIOL 2120 or BIOL 2510)

Fundamental concepts and principles of ecology dealing with organisms, populations, communities, and ecosystems. Laboratory and field exercises examine ecological principles and methods as well as illustrate habitats. (Typically Offered: Fall, Summer)

ENSCI 3180: Introduction to Ecosystems

(Cross-listed with AGRON 3180/ BIOL 3180/ NREM 3180).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 12 credits in AECL, AGRON, BIOL, CHEM, FOR, GEOL, NREM

Biological and physical processes affecting material and energy flows in natural and managed ecosystems. Understanding and predicting climate and management impacts on ecosystem services and sustainability. (Typically Offered: Spring)

ENSCI 3190: Analysis of Environmental Systems

(Cross-listed with BIOL 3190/ ENVS 3190).

Credits: 3.

Prereq: ENSCI 3120; junior classification

Systems approach to the analysis and modeling of material and energy flows in natural and managed environmental systems and the primary environmental factors controlling these systems. Applications in hydrology, biogeochemistry, and population dynamics. (Typically Offered: Spring)

ENSCI 3240: Energy and the Environment

(Cross-listed with GEOL 3240/ ENVS 3240/ MTEOR 3240).

Credits: 3. Contact Hours: Lecture 3.

Exploration of Earth's energy resources and the environmental and climatic impacts of energy acquisition and consumption. Renewable and non-renewable energy resources within an Earth-system context. Various environmentally-relevant topics such as water quality and availability, habitat destruction, greenhouse-gas emissions, and health and safety hazards to wildlife and human communities. Designed for students with a college-level understanding of chemistry and physics. (Typically Offered: Spring)

ENSCI 3450: Natural Resource Photogrammetry and Geographic Information Systems

(Cross-listed with NREM 3450).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Junior classification

Measurement and interpretation of aerial photos in resource management. Introduction to Geographic Information Systems (GIS) using ArcGIS including digitizing, development and query of attribute tables, georeferencing, and use of multiple GIS layers in simple spatial analyses. (Typically Offered: Spring)

ENSCI 3600: Environmental Soil Science

(Cross-listed with AGRON 3600).

Credits: 3. Contact Hours: Lecture 3.

Application of soil science to contemporary environmental problems; comparison of the impacts that different management strategies have on short- and long-term environmental quality and land development. Emphasis on participatory learning activities. AGRON 1820 or ENSCI 2500 or GEOL 1010 recommended. (Typically Offered: Spring)

ENSCI 3700: GIS for Ecology and Environmental Science

(Cross-listed with BIOL 3700).

Credits: 1-6. Repeatable.

Prereq: 6 credits in BIOL or ENSCI

Introduction to geographic information systems (GIS) with emphasis on ecological and environmental applications. No prior GIS experience required. Guided, individualized study of topics based on student background and interest. For students with prior experience, topics and activities are selected to build upon any previous experience and minimize duplication to previous GIS coursework. Potential topics include: basic concepts of GIS, data structures, database management, spatial analysis, modeling and visualization of ecological and environmental data. Case studies in ecological and environmental applications using ArcGIS. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

ENSCI 3750: Marine Ecology and Ecosystems Dynamics

(Cross-listed with AECL 3750/ BIOL 3750).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2110

Overview of the ecological processes, ecosystems, and biodiversity in marine environments. Ever-changing dynamics caused by environmental disturbances, internal forces, or by human impacts on species and ecosystems. (Typically Offered: Spring)

ENSCI 3900: Internship in Environmental Science

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Supervised off-campus work experience in the field of environmental science. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

ENSCI 3910: Apprenticeship

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Practical experience in an approved setting such as a research laboratory, government office, or private office. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

ENSCI 4020: Watershed Hydrology

(Dual-listed with GEOL 5020/ ENSCI 5020/ MTEOR 5020/ NREM 5020).

(Cross-listed with GEOL 4020/ MTEOR 4020/ NREM 4020).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Examination of watersheds as systems, emphasizing the surface components of the hydrologic cycle. Combines qualitative understanding of hydrological processes and uncertainty with quantitative representation. Laboratory emphasizes field investigation and measurement of watershed processes. (Typically Offered: Fall)

ENSCI 4040: Global Change

(Dual-listed with MTEOR 5040/ AGRON 5040/ ENSCI 5040). (Cross-listed with AGRON 4040/ MTEOR 4040/ ENVS 4040/ CLSCI 4040).

Credits: 3. Contact Hours: Lecture 3.

Recent changes in global biogeochemical cycles and climate; models of future changes in the climate system; impacts of global change on agriculture, water resources and human health; ethical issues of global environmental change. (Typically Offered: Fall, Spring)

ENSCI 4050: Soil-Plant-Animal-Atmosphere Physics

(Dual-listed with AGRON 5050/ ENSCI 5050/ MTEOR 5050). (Cross-listed with AGRON 4050/ MTEOR 4050).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 1600 or MATH 1650

The movement of energy and mass among the soil, vegetation, and atmosphere. The heat and water budget of humans, other animals, plants, and plant communities. Relevance to weather and climate, the effect of climate change on organisms, and remote sensing. Some exposure to computer programming (any language) recommended. Offered odd-numbered years. (Typically Offered: Spring)

ENSCI 4060: World Climates

(Cross-listed with AGRON 4060/ MTEOR 4060).

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 2060 or MTEOR 2060

Distribution and causes of different climates around the world. Effects of climate and climate variations on human activities including society, economy and agriculture. Current issues such as climate change and international efforts to assess and mitigate the consequences of a changing climate. Semester project and in-class presentation required. Meets International Perspectives Requirement. (Typically Offered: Spring)

ENSCI 4070: Watershed Management

(Dual-listed with NREM 5070/ ENSCI 5070). (Cross-listed with NREM 4070/ ENVS 4070).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: 1 course in BIOL

Managing human impacts on the hydrologic cycle. Field and watershed level best management practices for modifying the impacts on water quality, quantity and timing are discussed. Field project includes developing a management plan using landscape buffers. (Typically Offered: Spring)

ENSCI 4090: Field Methods in Hydrogeology

(Dual-listed with GEOL 5090/ ENSCI 5090). (Cross-listed with GEOL 4090).

Credits: 3. Contact Hours: Laboratory 4.

Prereq: GEOL 4020/ENSCI 4020, GEOL 4110/ENSCI 4110 or CE 4730

Introduction to field methods used in groundwater investigations. In-field implementation of pumping tests, slug tests, monitoring well installation and drilling techniques, geochemical and water quality sampling, seepage meters, minipiezometers, stream gaging, and electronic instrumentation for data collection. Field trips to investigate water resource, water quality, and remediation projects. Offered even-numbered years. (Typically Offered: Summer)

ENSCI 4110: Hydrogeology

(Dual-listed with GEOL 5110/ ENSCI 5110). (Cross-listed with GEOL 4110).

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Physical principles of groundwater flow, nature and origin of aquifers and confining units, well hydraulics, groundwater modeling, and contaminant transport. Lab emphasizes applied field and laboratory methods for hydrogeological investigations. (Typically Offered: Spring)

ENSCI 4120: Micropaleontology

(Dual-listed with GEOL 5120). (Cross-listed with GEOL 4120).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: GEOL 1020 and GEOL 1020L

Evolution, identification and utility of major microfossil groups from the Mesozoic to present. Focus on Cenozoic applications including biostratigraphy, paleoclimate, and paleothermometry using assemblages, stable isotopes, Mg/Ca, and molecular fossils. Laboratory includes processing and analysis of specific microfossils. Major groups covered include foraminifera, calcareous nanofossils, sponge spicules, diatoms, radiolarians, and silicoflagellates. Offered even-numbered years.

(Typically Offered: Fall)

ENSCI 4130: Applied and Environmental Geophysics

(Dual-listed with GEOL 5130/ CE 5130/ ENSCI 5130). (Cross-listed with CE 4130/ GEOL 4130).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Seismic, gravity, magnetic, resistivity, electromagnetic, and ground-penetrating radar techniques for shallow subsurface investigations and imaging. Data interpretation methods. Lab emphasizes computer interpretation packages. Field work with seismic - and resistivity-imaging systems and radar. Introductory geology, algebra, and trigonometry recommended. Offered odd-numbered years. (Typically Offered: Spring)

ENSCI 4140: Applied Groundwater Flow Modeling

(Dual-listed with GEOL 5140/ ENSCI 5140). (Cross-listed with GEOL 4140).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: (GEOL 4110 or CE 4730); MATH 1650

Introduction to the principles of modeling groundwater flow systems. Finite-difference and analytic-element methods, spreadsheet models, boundary conditions, calibration, sensitivity analysis, parameter estimation, particle tracking, and post-audit analysis. Application of MODFLOW to regional flow-system analysis. Computer laboratory emphasizes assigned problems that illustrate topics discussed in the course. Offered even-numbered years. (Typically Offered: Spring)

ENSCI 4150: Paleoclimatology

(Dual-listed with GEOL 5150/ ENSCI 5150). (Cross-listed with GEOL 4150/ CLSCI 4150).

Credits: 3. Contact Hours: Lecture 3.

Introduction to mechanisms that drive climate, including the interplay between oceanic and atmospheric circulation and fluctuation in Earth's orbital parameters. Examination and analysis of past climate records ranging from historical documentation to ecological and geochemical proxies (e.g. tree ring analysis; O and C isotopes of skeletal carbonates and soils). Dating methods used to constrain and correlate climatic periods; utility of computer models to reconstruct past climates and predict future climate change. Emphasis placed on paleoclimatology and paleoecology of the late Quaternary (last ~1 million years). Offered even-numbered years. (Typically Offered: Fall)

ENSCI 4160: Hydrologic Modeling and Analysis

(Dual-listed with GEOL 5160/ ENSCI 5160/ MTEOR 5160). (Cross-listed with GEOL 4160/ MTEOR 4160).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Study of the basic principles of hydrologic modeling, including rainfall-runoff analysis, lumped and distributed modeling, conceptual and physical models, parameter estimation and sensitivity analysis, input and validation data, uncertainty analysis, and the use of models in surface water hydrology. A range of common models are applied to study hydrologic topics such as flood forecasting and land use change impacts. Previous experience with Matlab or other programming language is needed. Offered odd-numbered years. (Typically Offered: Spring)

ENSCI 4180: Stream Ecology

(Dual-listed with AECL 5180/ ENSCI 5180). (Cross-listed with AECL 4180).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: AECL 4860

Biological, chemical, physical, and geological processes that determine the structure and function of flowing water ecosystems. Current ecological theories as well as applications to stream management for water quality and fisheries. Offered odd-numbered years. (Typically Offered: Fall)

ENSCI 4190: Aqueous and Environmental Geochemistry

(Dual-listed with GEOL 5190/ ENSCI 5190). (Cross-listed with GEOL 4190).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: CHEM 1780 and CHEM 1780L

Geochemistry of natural waters and water-rock interactions. Acid-base equilibria, carbonate chemistry and buffer systems, mineral dissolution and precipitation, sorption, ion exchange, and redox reactions. Introduction to thermodynamics and kinetics. Laboratory emphasizes chemical analysis of waters and computer modeling. Offered even-numbered years. (Typically Offered: Spring)

ENSCI 4260: Stable Isotopes in the Environment

(Dual-listed with GEOL 5260/ ENSCI 5260). (Cross-listed with GEOL 4260).

Credits: 3. Contact Hours: Lecture 3.

Introduction to the theory, methods and applications of stable isotopes. Primary focus on the origin, natural abundance, and fractionation of carbon, hydrogen, oxygen, nitrogen isotopes. Applications of isotopic occurrence for elucidation of physical, chemical, biological, and environmental processes. Effects of plant physiology, photosynthesis, trophic structure, diffusion, evaporation, chemical precipitation, soil and atmospheric processes, and environmental factors on isotope abundance. Offered odd-numbered years. (Typically Offered: Fall)

ENSCI 4460: Integrating GPS and GIS for Natural Resource Management

(Dual-listed with NREM 5460/ ENSCI 5460). (Cross-listed with NREM 4460).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: 12 credits in student's major (AECL/FOR) at 3000 level or above

Emphasis on the use of GPS as a data collection tool for GIS. Basic theory of GPS. Use of Global Positioning System technology for spatial data collection and navigation. Post-processing and real-time correction of GPS data. GPS data transfer to GIS for mapping applications. Use of GIS to construct waypoints for use in GPS navigation. (Typically Offered: Fall)

ENSCI 4520: Intro GIS for Geoscientists

(Dual-listed with GEOL 5520/ AGRON 5520/ ENSCI 5520). (Cross-listed with AGRON 4520/ GEOL 4520).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Introduction to geographic information systems (GIS) using ArcGIS Pro with particular emphasis on geoscientific data. Teaches typical GIS operations and analyses in the geosciences to prepare students for practical GIS use in industry and academia. Includes a class project for GEOL 5520. Very suitable for Juniors. GEOL 4520 can be taken as a substitute for CPR 3510 for the GIS Minor. (Typically Offered: Fall, Spring)

ENSCI 4590: Soil and Water Chemistry

(Dual-listed with AGRON 5590/ ENSCI 5590). (Cross-listed with AGRON 4590).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: 6 credit of CHEM; (AGRON 1820 or AGRON 3600); MATH 1400 or higher

Applied chemistry in the context of soil and environmental sciences. Mobility, bioavailability, and retention of nutrients, metals, and organic compounds in water, soils, and sediments. Includes solution-phase chemistry, solid-phase chemistry, interface chemistry, and practical agricultural and environmental applications that involve integrated chemical reactions. AGRON 3540 and GEOL 1000 recommended. (Typically Offered: Fall)

ENSCI 4630: Soil Formation and Landscape Relationships

(Dual-listed with AGRON 5630/ ENSCI 5630). (Cross-listed with AGRON 4630).

Credits: 3. Contact Hours: Lecture 3.

Relationships between soil formation, geomorphology, and environment. Soil description, classification, geography, mapping, and interpretation for land use. Two weekend field trips. AGRON 1820 or ENSCI 2500 recommended. Graduation Restriction: Credit for one of AGRON 4630 or AGRON 4630L may be applied for graduation. (Typically Offered: Fall)

ENSCI 4640: Wetland Ecology

(Dual-listed with EEOB 5640/ ENSCI 5640). (Cross-listed with BIOL 4640).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 15 credits in BIOL

Ecology, classification, creation and restoration, and management of wetlands. Emphasis on North American temperate wetlands. (Typically Offered: Fall, Spring, Summer)

ENSCI 4660: Ecosystem Services

(Dual-listed with ENSCI 5660/ NREM 5660). (Cross-listed with NREM 4660).

Credits: 3. Contact Hours: Lecture 2, Discussion 1.

Prereq: 15 credits in AECL, AGRON, BIOL, CHEM, FOR, GEOL, NREM

Ecosystem services are the societal benefits provided by natural and managed ecosystems. Benefits such as provision of food, purification of air and water, and regulation of climate are essential to human survival and prosperity, but rely upon maintenance of healthy ecosystems. This course will cover the science, policy, and practice of ecosystem services assessment and management, with a special focus on biodiversity, water quality, food production, and climate. Offered odd-numbered years. (Typically Offered: Spring)

ENSCI 4680: Applied Geostatistics for Geoscientists

(Dual-listed with GEOL 5680/ ENSCI 5680/ MTEOR 5680). (Cross-listed with GEOL 4680/ MTEOR 4680).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: GEOL 4520; CRP 3510; CRP 4520; (NREM 3450 or NREM 4470)

Introduction to geospatial data collection, analysis, interpretation, and presentation. Geospatial techniques including geographic information systems (GIS), remote sensing (RS), and global positioning systems (GPS). Study of applied geostatistical analysis (e.g., interpolation and spatial regression). Offered even-numbered years. (Typically Offered: Fall)

ENSCI 4770: Soil Physics

(Dual-listed with AGRON 5770/ ENSCI 5770). (Cross-listed with AGRON 4770).

Credits: 3. Contact Hours: Lecture 3.

The physical soil system: the soil components and their physical interactions; transport processes involving water, air, and heat.

AGRON 1820 recommended. (Typically Offered: Spring)

ENSCI 4790: Surficial Processes

(Dual-listed with GEOL 5790/ ENSCI 5790). (Cross-listed with GEOL 4790).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

The study of physical processes that shape Earth's surface. Topics include weathering, sediment transport, and landform genesis with emphasis on fluvial, glacial, hillslope, eolian, and coastal processes. Applications to engineering and environmental problems. Laboratory includes topographic map interpretation and local field trips. An introductory course in geology is recommended as background. (Typically Offered: Fall)

ENSCI 4800: Engineering Analysis of Biological Systems

(Dual-listed with ABE 5800). (Cross-listed with ABE 4800/ GLOBE 4800).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: ABE 3800 or Permission of Department

Systems-level quantitative analysis of various biological systems, including applications in foods, feeds, biofuels, bioenergy, and other bio-based systems. Introduction to techno-economic analysis and life-cycle assessment of these systems at multiple production scales. Applying these tools to evaluate and improve cost and sustainability performance. Students enrolled in ABE 5800 will be required to conduct additional learning activities. (Typically Offered: Fall)

ENSCI 4830: Environmental Biogeochemistry

(Dual-listed with ENSCI 5830). (Cross-listed with BIOL 4830/ GEOL 4830).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Combined 12 credits in biology, chemistry, and physics

An exploration of biological, physical and geochemical impacts on the structure and function of ecosystems from local to global scales. Emphasis on the cycles of carbon, nitrogen, phosphorus, sulfur, and metals, and how these have been impacted by human activity. Topics may include biological feedbacks to climate change, microbial physiology and redox reactions, plant/soil feedbacks, terrestrial/aquatic linkages, early Earth processes and the origins of life. Offered odd-numbered years. (Typically Offered: Spring)

ENSCI 4840: Ecosystem Ecology

(Cross-listed with BIOL 4840).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Combined 12 credits in biology, chemistry, and physics

Introduction of the study of ecosystems and the biological and physical factors that influence their properties and dynamics. Conceptual foundations for ecosystem studies. Interactions among organisms, biological diversity, and ecosystem attributes. Quantitative analyses of accumulations, transformations, and fluxes of nutrients, water, and energy within and among ecosystems. Global change issues. Offered odd-numbered years. (Typically Offered: Spring)

ENSCI 4850: Soil and Environmental Microbiology

(Dual-listed with AGRON 5850/ ENSCI 5850/ MICRO 5850). (Cross-listed with AGRON 4850/ MICRO 4850).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: AGRON 1820

The living organisms in the soil and what they do. Emphasis on soil biota composition, the carbon cycle and bioremediation, soil-plant-microbial relationships, and environmental issues. MICRO 2010; MICRO 2010L recommended. (Typically Offered: Fall)

ENSCI 4860: Aquatic Ecology

(Dual-listed with AECL 5860/ EEOB 5860/ ENSCI 5860). (Cross-listed with AECL 4860/ BIOL 4860).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 3120 or ENSCI 3190 or ENSCI 4020 or NREM 3010

Structure and function of aquatic ecosystems with application to fishery and pollution problems. Emphasis on lacustrine, riverine, and wetland ecology. (Typically Offered: Fall)

ENSCI 4860L: Aquatic Ecology Laboratory

(Dual-listed with AECL 5860L/ EEOB 5860L/ ENSCI 5860L). (Cross-listed with AECL 4860L/ BIOL 4860L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Credit or concurrent enrollment in BIOL 4860

Field trips and laboratory exercises to accompany 4860. Hands-on experience with aquatic research and monitoring techniques and concepts. (Typically Offered: Fall)

ENSCI 4870: Microbial Ecology

(Dual-listed with EEOB 5870/ ENSCI 5870/ GEOL 5870/ MICRO 5870).

(Cross-listed with BIOL 4870/ GEOL 4870/ MICRO 4870).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 6 credits in Biology and 6 credits in Chemistry

Introduction to major functional groups of autotrophic and heterotrophic microorganisms and their roles in natural and environmental systems. Consequences of microbial activity on water chemistry, weathering, and precipitation/dissolution reactions will be emphasized. (Typically Offered: Fall)

ENSCI 4880: Raster GIS for Geoscientists

(Dual-listed with GEOL 5880/ AGRON 5880/ ENSCI 5880). (Cross-listed with AGRON 4880/ GEOL 4880).

Credits: 3.

GIS course with focus on the spatial analysis and modeling of raster and triangulated irregular network (TIN) data using ArcGIS Pro. Includes practical exercises during lectures, lab exercises, homework assignments, and (for GEOL 5880) a class project. Basic knowledge of ArcGIS Pro is a plus but not required. Course can be taken concurrently to any other Intro GIS course. Sophomore classification or above recommended. Offered odd-numbered years. (Typically Offered: Spring)

ENSCI 4890: Survey of Remote Sensing Technologies

(Dual-listed with MTEOR 5890/ EE 5890/ ENSCI 5890/ GEOL 5890/ NREM 5890). (Cross-listed with EE 4890/ MTEOR 4890/ GEOL 4890/ NREM 4890).

Credits: 3. Contact Hours: Lecture 3.

Electromagnetic-radiation principles, active and passive sensors, multispectral and hyperspectral sensors, imaging radar, SAR, thermal imaging, lidar. Examples of applications. Also offered online S. (Typically Offered: Fall)

ENSCI 4900: Independent Study

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

ENSCI 4900H: Independent Study

Credits: 1-30. Repeatable.

Prereq: Permission of Instructor; Membership in the University Honors Program

Permission of instructor and approval of Environmental Science coordinator. (Typically Offered: Fall, Spring, Summer)

ENSCI 4950: Current Topics and Case Studies in Environmental Science

Credits: 1-3. Contact Hours: Lecture 2, Laboratory 2.

Current topics and case studies related to the analysis and management of environmental systems. Individual and/or group projects.

ENSCI 4960A: Travel Course: International Tour

Credits: 1-30. Repeatable.

Extended field trips to study environmental topics in varied locations. Location and duration of trips will vary. Trip expenses paid by students. Check with department for current offerings.

ENSCI 4960B: Travel Course: Domestic Tour

Credits: 1-30. Repeatable.

Extended field trips to study environmental topics in varied locations. Location and duration of trips will vary. Trip expenses paid by students. Check with department for current offerings.

ENSCI 4980: Cooperative Education

Credits: Required. Repeatable.

Required of all cooperative education students. Students must register prior to commencing each work period. (Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

ENSCI 5020: Watershed Hydrology

(Dual-listed with GEOL 4020/ ENSCI 4020/ MTEOR 4020/ NREM 4020).

(Cross-listed with GEOL 5020/ MTEOR 5020/ NREM 5020).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Examination of watersheds as systems, emphasizing the surface components of the hydrologic cycle. Combines qualitative understanding of hydrological processes and uncertainty with quantitative representation. Laboratory emphasizes field investigation and measurement of watershed processes. (Typically Offered: Fall)

ENSCI 5040: Global Change

(Dual-listed with ENVS 4040/ MTEOR 4040/ AGRON 4040/ ENSCI 4040).

(Cross-listed with AGRON 5040/ MTEOR 5040).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Recent changes in global biogeochemical cycles and climate; models of future changes in the climate system; impacts of global change on agriculture, water resources and human health; ethical issues of global environmental change. (Typically Offered: Fall, Spring)

ENSCI 5050: Soil-Plant-Animal-Atmosphere Physics

(Dual-listed with AGRON 4050/ ENSCI 4050/ MTEOR 4050). (Cross-listed with AGRON 5050/ MTEOR 5050).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 1600 or MATH 1650 or Graduate Standing

The movement of energy and mass among the soil, vegetation, and atmosphere. The heat and water budget of humans, other animals, plants, and plant communities. Relevance to weather and climate, the effect of climate change on organisms, and remote sensing. Some exposure to computer programming (any language) recommended. Offered odd-numbered years. (Typically Offered: Spring)

ENSCI 5070: Watershed Management

(Dual-listed with ENVS 4070/ NREM 4070/ ENSCI 4070). (Cross-listed with NREM 5070).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Managing human impacts on the hydrologic cycle. Field and watershed level best management practices for modifying the impacts on water quality, quantity and timing are discussed. Field project includes developing a management plan using landscape buffers. (Typically Offered: Spring)

ENSCI 5090: Field Methods in Hydrogeology

(Dual-listed with GEOL 4090/ ENSCI 4090). (Cross-listed with GEOL 5090).

Credits: 3. Contact Hours: Laboratory 4.

Prereq: Graduate Standing or Permission of Instructor

Introduction to field methods used in groundwater investigations. In-field implementation of pumping tests, slug tests, monitoring well installation and drilling techniques, geochemical and water quality sampling, seepage meters, minipiezometers, stream gaging, and electronic instrumentation for data collection. Field trips to investigate water resource, water quality, and remediation projects. Offered even-numbered years. (Typically Offered: Summer)

ENSCI 5110: Hydrogeology

(Dual-listed with GEOL 4110/ ENSCI 4110). (Cross-listed with GEOL 5110).

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Physical principles of groundwater flow, nature and origin of aquifers and confining units, well hydraulics, groundwater modeling, and contaminant transport. Lab emphasizes applied field and laboratory methods for hydrogeological investigations. (Typically Offered: Fall)

ENSCI 5120: Micropaleontology

(Dual-listed with GEOL 4120). (Cross-listed with GEOL 5120).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Evolution, identification and utility of major microfossil groups from the Mesozoic to present. Focus on Cenozoic applications including biostratigraphy, paleoclimate, and paleothermometry using assemblages, stable isotopes, Mg/Ca, and molecular fossils. Laboratory includes processing and analysis of specific microfossils. Major groups covered include foraminifera, calcareous nannofossils, sponge spicules, diatoms, radiolarians, and silicoflagellates. Offered even-numbered years. (Typically Offered: Fall). (Typically Offered: Fall)

ENSCI 5130: Applied and Environmental Geophysics

(Dual-listed with GEOL 4130/ CE 4130/ ENSCI 4130). (Cross-listed with CE 5130/ GEOL 5130).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Seismic, gravity, magnetic, resistivity, electromagnetic, and ground-penetrating radar techniques for shallow subsurface investigations and imaging. Data interpretation methods. Lab emphasizes computer interpretation packages. Field work with seismic - and resistivity-imaging systems and radar. Introductory geology, algebra, and trigonometry recommended. Offered odd-numbered years. (Typically Offered: Spring)

ENSCI 5140: Applied Groundwater Flow Modeling

(Dual-listed with GEOL 4140/ ENSCI 4140). (Cross-listed with GEOL 5140).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Introduction to the principles of modeling groundwater flow systems. Finite-difference and analytic-element methods, spreadsheet models, boundary conditions, calibration, sensitivity analysis, parameter estimation, particle tracking, and post-audit analysis. Application of MODFLOW to regional flow-system analysis. Computer laboratory emphasizes assigned problems that illustrate topics discussed in the course. Offered even-numbered years. (Typically Offered: Spring)

ENSCI 5150: Paleoclimatology

(Dual-listed with GEOL 4150/ ENSCI 4150). (Cross-listed with GEOL 5150).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to mechanisms that drive climate, including the interplay between oceanic and atmospheric circulation and fluctuation in Earth's orbital parameters. Examination and analysis of past climate records ranging from historical documentation to ecological and geochemical proxies (e.g. tree ring analysis; O and C isotopes of skeletal carbonates and soils). Dating methods used to constrain and correlate climatic periods; utility of computer models to reconstruct past climates and predict future climate change. Emphasis placed on paleoclimatology and paleoecology of the late Quaternary (last ~1 million years). Offered even-numbered years. (Typically Offered: Fall)

ENSCI 5160: Hydrologic Modeling and Analysis

(Dual-listed with GEOL 4160/ ENSCI 4160/ MTEOR 4160). (Cross-listed with GEOL 5160/ MTEOR 5160).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Study of the basic principles of hydrologic modeling, including rainfall-runoff analysis, lumped and distributed modeling, conceptual and physical models, parameter estimation and sensitivity analysis, input and validation data, uncertainty analysis, and the use of models in surface water hydrology. A range of common models are applied to study hydrologic topics such as flood forecasting and land use change impacts. Previous experience with Matlab or other programming language is needed. Offered odd-numbered years. (Typically Offered: Spring)

ENSCI 5180: Stream Ecology

(Dual-listed with AECL 4180/ ENSCI 4180). (Cross-listed with AECL 5180).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: AECL 4860; or graduate standing

Biological, chemical, physical, and geological processes that determine the structure and function of flowing water ecosystems. Current ecological theories as well as applications to stream management for water quality and fisheries. Offered odd-numbered years. (Typically Offered: Fall)

ENSCI 5190: Aqueous and Environmental Geochemistry

(Dual-listed with GEOL 4190/ ENSCI 4190). (Cross-listed with GEOL 5190).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Geochemistry of natural waters and water-rock interactions. Acid-base equilibria, carbonate chemistry and buffer systems, mineral dissolution and precipitation, sorption, ion exchange, and redox reactions. Introduction to thermodynamics and kinetics. Laboratory emphasizes chemical analysis of waters and computer modeling. Offered even-numbered years. (Typically Offered: Spring)

ENSCI 5200: Environmental Engineering Chemistry

(Dual-listed with CE 4200/ ENSCI 4200). (Cross-listed with CE 5200).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: CE 3260, CHEM 1780 OR Graduate classification

Principles of chemical and physical phenomena applicable to the treatment of water and wastewater and natural waters; including chemical equilibria, reaction kinetics, acid-base equilibria, chemical precipitation, redox reactions, and mass transfer principles. Individual laboratory practicals and group projects required. (Typically Offered: Fall)

ENSCI 5210: Environmental Biotechnology

(Dual-listed with CE 4210/ ENSCI 4210). (Cross-listed with CE 5210).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: CE 3260 OR Graduate classification

Fundamentals of biochemical and microbial processes applied to environmental engineering processes, role of microorganisms in wastewater treatment and bioremediation, bioenergetics and kinetics, metabolism of xenobiotic compounds, waterborne pathogens and parasites, and disinfection. Term paper and oral presentation. (Typically Offered: Fall)

ENSCI 5220: Water Pollution Control Processes

(Cross-listed with CE 5220).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: (CE 4210 or CE 5210) or Graduate Classification

Fundamentals of biochemical processes, aerobic growth in a single CSTR, multiple events in complex systems, and techniques for evaluating kinetic parameters; unit processes of activated sludge system, attached growth systems, stabilization and aerated lagoon systems, biosolids digestion and disposal, nutrient removal, and anaerobic treatment systems.

ENSCI 5230: Physical-Chemical Treatment Process

(Cross-listed with CE 5230).

Credits: 3.

Prereq: ENVE 4260, or ABE 4510, or AGRON 4590, or CE 5200, or ENSCI 3820, or permission of instructor

Mass balances. Principles and design of physical-chemical unit processes including ideal and realistic reactors; heterogeneous process including gas transfer, sorption, precipitation, and dissolution; redox; flocculation/coagulation; gravity separations; filtration; and membrane processes, electrodialysis, fouling, and scaling. Emphasis on water and wastewater treatment for environmental, health, and aesthetic ends. Case studies in secondary industries.

ENSCI 5260: Stable Isotopes in the Environment

(Dual-listed with GEOL 4260/ ENSCI 4260). (Cross-listed with GEOL 5260).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to the theory, methods and applications of stable isotopes. Primary focus on the origin, natural abundance, and fractionation of carbon, hydrogen, oxygen, nitrogen isotopes. Applications of isotopic occurrence for elucidation of physical, chemical, biological, and environmental processes. Effects of plant physiology, photosynthesis, trophic structure, diffusion, evaporation, chemical precipitation, soil and atmospheric processes, and environmental factors on isotope abundance. Offered odd-numbered years. (Typically Offered: Fall)

ENSCI 5280: Solid and Hazardous Waste Management

(Cross-listed with CE 5280).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: CE 3260; junior or higher standing

Evaluation, characterization, assessment, planning and design of solid and hazardous waste management systems, regulatory requirements, material characterization and collection, minimization and recycling, energy and materials recovery, composting, off-gas treatment, incineration, stabilization, and landfill design. Design of treatment and disposal systems, including physical, chemical, and biological treatment, solidification, incineration, secure landfill design, and final disposal site closure plus restoration.

ENSCI 5310: Design and Evaluation of Soil and Water Conservation Systems

(Dual-listed with ABE 4310). (Cross-listed with ABE 5310).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Hydrology and hydraulics in agricultural and urbanizing watersheds. Design and evaluation of systems for the conservation and quality preservation of soil and water resources. Use and analysis of hydrologic data in engineering design; relationship of topography, soils, crops, climate, and cultural practices in conservation and quality preservation of soil and water for agriculture. Small watershed hydrology, water movement and utilization in the soil-plant-atmosphere system, agricultural water management, best management practices, and agricultural water quality. (Typically Offered: Fall)

ENSCI 5320: Nonpoint Source Pollution and Control

(Dual-listed with ABE 4320). (Cross-listed with ABE 5320).

Credits: 3.

Prereq: Graduate Standing or Permission of Instructor

Characteristics and mechanisms of non-point source (NPS) pollution in agricultural and urban watersheds, modeling of NPS pollution for terrestrial and aquatic systems, statistical tools to assess environmental datasets, strategies to control and manage NPS pollution of water bodies, and integrated watershed management. Graduate students are required to develop/deliver lecture models on assigned topics and/or complete additional assignments. Offered irregularly. (Typically Offered: Spring)

ENSCI 5330: Erosion and Sediment Transport

(Cross-listed with ABE 5330/ NREM 5330/ GEOL 5330).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Soil erosion processes, soil loss equations and their application to conservation planning, sediment properties, initiation of sediment motion and over land flow, flow in alluvial channels and theory of sediment transport, channel stability, reservoir sedimentation, wind erosion, BMPs for controlling erosion. Offered even-numbered years. (Typically Offered: Fall)

ENSCI 5350: Restoration Ecology

(Cross-listed with EEOB 5350/ NREM 5350).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Theory and practice of restoring animal and plant diversity, structure and function of disturbed ecosystems. Restored freshwater wetlands, forests, prairies and reintroduced species populations will be used as case studies. Offered even-numbered years. (Typically Offered: Fall)

ENSCI 5370: Watershed Modeling and Policy

(Dual-listed with ABE 4370). (Cross-listed with ABE 5370).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

A project-based course on watershed-scale models for improving water quality. Legislative and judicial basis of the Total Maximum Daily Load (TMDL) program; approaches to TMDL development; principles and techniques for implementation; stakeholder engagement strategies. Hands-on experiences with GIS-interfaced models, data sources, calibration/validation, statistical assessment of model results, and simulation using multiple tools. In addition to other assignments, graduate students will present case studies of TMDLs using different modeling tools. Offered irregularly. (Typically Offered: Fall)

ENSCI 5460: Integrating GPS and GIS for Natural Resource Management

(Dual-listed with NREM 4460/ ENSCI 4460). (Cross-listed with NREM 5460).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Emphasis on the use of GPS as a data collection tool for GIS. Basic theory of GPS. Use of Global Positioning System technology for spatial data collection and navigation. Post-processing and real-time correction of GPS data. GPS data transfer to GIS for mapping applications. Use of GIS to construct waypoints for use in GPS navigation. (Typically Offered: Fall)

ENSCI 5520: Intro GIS for Geoscientists

(Dual-listed with GEOL 4520/ AGRON 4520/ ENSCI 4520). (Cross-listed with AGRON 5520/ GEOL 5520).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Introduction to geographic information systems (GIS) using ArcGIS Pro with particular emphasis on geoscientific data. Teaches typical GIS operations and analyses in the geosciences to prepare students for practical GIS use in industry and academia. Includes a class project for GEOL 5520. Very suitable for Juniors. GEOL 4520 can be taken as a substitute for CPR 3510 for the GIS Minor. (Typically Offered: Fall, Spring)

ENSCI 5530: Soil-Plant Relationships

(Cross-listed with AGRON 5530).

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 3540 or graduate standing

Composition and properties of soils in relation to the nutrition and growth of plants. (Typically Offered: Spring)

ENSCI 5590: Soil and Water Chemistry

(Dual-listed with AGRON 4590/ ENSCI 4590). (Cross-listed with AGRON 5590).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: Graduate standing OR [6 credit of CHEM; (AGRON 1820 or AGRON 3600); MATH 1400 or higher]

Applied chemistry in the context of soil and environmental sciences. Mobility, bioavailability, and retention of nutrients, metals, and organic compounds in water, soils, and sediments. Includes solution-phase chemistry, solid-phase chemistry, interface chemistry, and practical agricultural and environmental applications that involve integrated chemical reactions. AGRON 3540 and GEOL 1000 recommended. (Typically Offered: Fall)

ENSCI 5630: Soil Formation and Landscape Relationships

(Dual-listed with AGRON 4630/ ENSCI 4630). (Cross-listed with AGRON 5630).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Relationships between soil formation, geomorphology, and environment. Soil description, classification, geography, mapping, and interpretation for land use. Two weekend field trips. AGRON 1820 or ENSCI 2500 recommended. Graduation Restriction: Credit for one of AGRON 4630 or AGRON 4630L may be applied for graduation. (Typically Offered: Fall)

ENSCI 5640: Wetland Ecology

(Dual-listed with BIOL 4640/ ENSCI 4640). (Cross-listed with EEOB 5640).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Ecology, classification, creation and restoration, and management of wetlands. Emphasis on North American temperate wetlands. (Typically Offered: Spring)

ENSCI 5660: Ecosystem Services

(Dual-listed with ENSCI 4660/ NREM 4660). (Cross-listed with NREM 5660).

Credits: 3. Contact Hours: Lecture 2, Discussion 1.

Prereq: Graduate Standing or Permission of Instructor

Ecosystem services are the societal benefits provided by natural and managed ecosystems. Benefits such as provision of food, purification of air and water, and regulation of climate are essential to human survival and prosperity, but rely upon maintenance of healthy ecosystems. This course will cover the science, policy, and practice of ecosystem services assessment and management, with a special focus on biodiversity, water quality, food production, and climate. Offered odd-numbered years. (Typically Offered: Spring)

ENSCI 5680: Applied Geostatistics for Geoscientists

(Dual-listed with GEOL 4680/ ENSCI 4680/ MTEOR 4680). (Cross-listed with GEOL 5680/ MTEOR 5680).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Introduction to geospatial data collection, analysis, interpretation, and presentation. Geospatial techniques including geographic information systems (GIS), remote sensing (RS), and global positioning systems (GPS). Study of applied geostatistical analysis (e.g., interpolation and spatial regression). Offered even-numbered years. (Typically Offered: Fall)

ENSCI 5710: Surface Water Hydrology

(Cross-listed with CE 5710).

Credits: 3. Contact Hours: Lecture 3.

Prereq: CE 3720 or Graduate Classification

Analysis of hydrologic data including precipitation, infiltration, evapotranspiration, direct runoff and streamflow; theory and use of frequency analysis; theory of streamflow and reservoir routing; use of deterministic and statistical hydrologic models. Fundamentals of surface water quality modeling, point and non-point sources of contamination. (Typically Offered: Spring)

ENSCI 5720: Analysis and Modeling Aquatic Environments

(Cross-listed with CE 5720).

Credits: 3. Contact Hours: Lecture 3.

Prereq: CE 3720 or Graduate Classification

Principles of surface water flows and mixing. Introduction to hydrologic transport and water quality simulation in natural water systems. Advection, diffusion and dispersion, chemical and biologic kinetics, and water quality dynamics. Applications to temperature, dissolved oxygen, primary productivity, and other water quality problems in rivers, lakes and reservoirs. Deterministic vs. stochastic models. Offered even-numbered years. (Typically Offered: Fall)

ENSCI 5730: Groundwater Hydrology

(Dual-listed with CE 4730). (Cross-listed with CE 5730).

Credits: 3. Contact Hours: Lecture 3.

Prereq: CE 3720 or Graduate Classification

Principles of groundwater flow, hydraulics of wells, super-position, slug and pumping tests, streamlines and flownets, and regional groundwater flow. Contaminant transport. Computer modeling. Individual and group projects. (Typically Offered: Fall)

ENSCI 5750: Soil Formation and Transformation

(Cross-listed with AGRON 5750).

Credits: 1. Contact Hours: Lecture 1.

Prereq: Graduate Standing or Permission of Instructor

A one-week intensive field class examining the pedology of Iowa under natural and transformed con. (Typically Offered: Fall)

ENSCI 5770: Soil Physics

(Dual-listed with AGRON 4770/ ENSCI 4770). (Cross-listed with AGRON 5770).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

The physical soil system: the soil components and their physical interactions; transport processes involving water, air, and heat. AGRON 1820 recommended. (Typically Offered: Spring)

ENSCI 5780: Laboratory Methods in Soil Physics

(Cross-listed with AGRON 5780).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: concurrent enrollment in AGRON 4770 or AGRON 5770

Methods of measuring soil physical properties such as texture, density, and water content, and transport of heat, water, and gases. (Typically Offered: Spring)

ENSCI 5790: Surficial Processes

(Dual-listed with GEOL 4790/ ENSCI 4790). (Cross-listed with GEOL 5790).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

The study of physical processes that shape Earth's surface. Topics include weathering, sediment transport, and landform genesis with emphasis on fluvial, glacial, hillslope, eolian, and coastal processes. Applications to engineering and environmental problems. Laboratory includes topographic map interpretation and local field trips. An introductory course in geology is recommended as background. (Typically Offered: Fall)

ENSCI 5810: Analysis of Environmental Systems

(Dual-listed with ENSCI 3810/ EEOB 3810). (Cross-listed with EEOB 5810).

Credits: 3.

Prereq: Graduate Standing or Permission of Instructor

Systems approach to the analysis and modeling of material and energy flows in natural and managed environmental systems and the primary environmental factors controlling these systems. Applications in hydrology, biogeochemistry, and population dynamics. (Typically Offered: Spring)

ENSCI 5830: Environmental Biogeochemistry

(Dual-listed with ENSCI 4830).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

An exploration of biological, physical and geochemical impacts on the structure and function of ecosystems from local to global scales. Emphasis on the cycles of carbon, nitrogen, phosphorus, sulfur, and metals, and how these have been impacted by human activity. Topics may include biological feedbacks to climate change, microbial physiology and redox reactions, plant/soil feedbacks, terrestrial/aquatic linkages, early Earth processes and the origins of life. Offered odd-numbered years. (Typically Offered: Spring)

ENSCI 5840: Ecosystem Science

(Cross-listed with EEOB 5840).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Advanced studies of ecosystems and the biological and physical factors that influence their properties and dynamics. Conceptual foundations and modern approaches to ecosystem studies. Interactions among organisms, biological diversity, and ecosystem attributes. Quantitative analyses of accumulations, transformations, and fluxes of nutrients, water, and energy within and among ecosystems. Global change issues. Offered even-numbered years. (Typically Offered: Spring)

ENSCI 5850: Soil and Environmental Microbiology

(Dual-listed with AGRON 4850/ ENSCI 4850/ MICRO 4850). (Cross-listed with AGRON 5850/ MICRO 5850).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: AGRON 1820 or graduate standing

The living organisms in the soil and what they do. Emphasis on soil biota composition, the carbon cycle and bioremediation, soil-plant-microbial relationships, and environmental issues. MICRO 2010; MICRO 2010L recommended. (Typically Offered: Fall)

ENSCI 5860: Aquatic Ecology

(Dual-listed with AECL 4860/ BIOL 4860/ ENSCI 4860). (Cross-listed with AECL 5860/ EEOB 5860).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 3120 or ENSCI 3810 or ENSCI 4020 or NREM 3010 or graduate classification

Structure and function of aquatic ecosystems with application to fishery and pollution problems. Emphasis on lacustrine, riverine, and wetland ecology. (Typically Offered: Fall)

ENSCI 5860L: Aquatic Ecology Laboratory

(Dual-listed with AECL 4860L/ BIOL 4860L/ ENSCI 4860L). (Cross-listed with AECL 5860L/ EEOB 5860L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Concurrent enrollment in BIOL 4860.

Field trips and laboratory exercises to accompany 4860. Hands-on experience with aquatic research and monitoring techniques and concepts. (Typically Offered: Fall)

ENSCI 5870: Microbial Ecology

(Dual-listed with BIOL 4870/ ENSCI 4870/ GEOL 4870/ MICRO 4870).

(Cross-listed with EEOB 5870/ GEOL 5870/ MICRO 5870).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to major functional groups of autotrophic and heterotrophic microorganisms and their roles in natural and environmental systems. Consequences of microbial activity on water chemistry, weathering, and precipitation/dissolution reactions will be emphasized. (Typically Offered: Fall)

ENSCI 5880: Raster GIS for Geoscientists

(Dual-listed with GEOL 4880/ AGRON 4880/ ENSCI 4880). (Cross-listed with AGRON 5880/ GEOL 5880).

Credits: 3.

Prereq: (GEOL 4520; CRP 4510; CRP 4520; NREM 3450; NREM 4460; AE 4080) or graduate standing

GIS course with focus on the spatial analysis and modeling of raster and triangulated irregular network (TIN) data using ArcGIS Pro. Includes practical exercises during lectures, lab exercises, homework assignments, and (for GEOL 5880) a class project. Basic knowledge of ArcGIS Pro is a plus but not required. Course can be taken concurrently to any other Intro GIS course. Sophomore classification or above recommended. Offered odd-numbered years. (Typically Offered: Spring)

ENSCI 5890: Survey of Remote Sensing Technologies

(Dual-listed with MTEOR 4890/ EE 4890/ ENSCI 4890/ GEOL 4890/ NREM 4890). (Cross-listed with EE 5890/ MTEOR 5890/ GEOL 5890/ NREM 5890).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Electromagnetic-radiation principles, active and passive sensors, multispectral and hyperspectral sensors, imaging radar, SAR, thermal imaging, lidar. Examples of applications. Also offered online S. (Typically Offered: Fall)

ENSCI 5900: Special Topics

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Literature reviews and conference in accordance with needs and interest of the student. (Typically Offered: Fall, Spring, Summer)

ENSCI 5990: Creative Component

Credits: 1-30. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Creative component for nonthesis master of science degree. (Typically

Offered: Fall, Spring, Summer)

Courses for graduate students:**ENSCI 6650: Spatial Soil Informatics**

(Cross-listed with AGRON 6650).

Credits: 3. Contact Hours: Lecture 3.

Application of geographic principles and geospatial technologies to study soil landscapes. Emphasis on detecting spatial patterns for research planning and answering research questions. Hands-on activities include designing sampling strategies, management of large spatial data sets, and spatial modelling. Prior GIS and soil science experience recommended. (Typically Offered: Spring)

ENSCI 6980: Seminar in Environmental Science

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Reports and discussion of recent research and literature. (Typically

Offered: Spring)

ENSCI 6990: Research

Credits: 1-30. Repeatable.

Prereq: Department Permission for Course

(Typically Offered: Fall, Spring, Summer)

Environmental Studies (ENVS)

Courses primarily for undergraduates:**ENVS 1010: Environmental Geology: Earth in Crisis**

(Cross-listed with GEOL 1010).

Credits: 3. Contact Hours: Lecture 3.

Exploration of the interactions between humans and the geologic environment, and the consequences of those interactions, on local to global scales. Discussion of water, soil, mineral, and energy resources, pollution, climate change, and natural hazards such as earthquakes, volcanism, mass wasting, and flooding. (Typically Offered: Fall, Spring, Summer)

ENVS 1080: Introduction to Oceanography

(Cross-listed with GEOL 1080).

Credits: 3. Contact Hours: Lecture 3.

Introduction to the study of oceans and the processes that helped shape them. A major focus is on how the oceans work, with special attention on geological, chemical, and biological processes. Ocean circulation and its influence on climate. Life of the oceans. Use and misuse of ocean resources. Anthropogenic impacts on the oceanic environment. (Typically Offered: Fall)

ENVS 1110: Geological Disasters

(Cross-listed with GEOL 1110).

Credits: 1. Contact Hours: Lecture 1.

Introduction to the catastrophic geologic processes with the potential to devastate human populations that continue to expand into regions at greatest risk from geologic hazards. Selected case studies and discussion of plate tectonics, climate, and earth processes explain the driving forces behind natural hazards such as earthquakes, tsunamis, volcanic eruptions, landslides, and floods. (Typically Offered: Fall, Spring, Summer)

ENVS 1200: Introduction to Renewable Resources

(Cross-listed with AGRON 1200/ NREM 1200).

Credits: 3. Contact Hours: Lecture 3.

Overview of soil, water, plants, and animals as renewable natural resources in an ecosystem context. History and organization of resource management. Concepts of integrated resource management. (Typically Offered: Fall, Spring)

ENVS 1300: Natural Resources and Agriculture

(Cross-listed with NREM 1300).

Credits: 3. Contact Hours: Lecture 3.

Survey of the ecology and management of fish, forest, and wildlife resources in areas of intensive agriculture, with emphasis on Iowa. Conservation and management practices for private agricultural lands. Designed for nonmajors. (Typically Offered: Spring)

ENVS 1400: Climate and Society

(Cross-listed with AGRON 1400/ MTEOR 1400/ GEOL 1400/ CLSCI 1400).

Credits: 3. Contact Hours: Lecture 3.

The climate system of our planet. How nature and our actions alter the existing energy balance leading to climate change. Past climates on our planet. The influence of climate on society and resource availability during the Holocene (~ 11,000 years ago to present) with focus on changes post industrial revolution. Significant climate events that have altered our way of life in the past. Projected changes in future climate and potential impacts on society, environment and resources. Adaption to and mitigation of climate change. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

ENVS 1600: Water Resources of the World

(Cross-listed with AGRON 1600/ MTEOR 1600/ GEOL 1600).

Credits: 3. Contact Hours: Lecture 3.

Study of the occurrence, history, development, and management of world water resources. Basic hydrologic principles including climate, surface water, groundwater, and water quality. Historical and current perspectives on water policy, use, and the role of water in society and the environment. Meets International Perspectives Requirement. (Typically Offered: Spring)

ENVS 1730: Environmental Biology

(Cross-listed with BIOL 1730).

Credits: 3. Contact Hours: Lecture 3.

An introduction to the structure and function of natural systems at scales from the individual to the biosphere and the complex interactions between humans and their environment. Discussions of human population growth, biodiversity, sustainability, resource use, and pollution. Does not satisfy biology major requirements. (Typically Offered: Fall, Spring)

ENVS 2010: Introduction to Environmental Issues

(Cross-listed with BIOL 2010/ ENSCI 2010).

Credits: 2. Contact Hours: Lecture 2.

Discussion of current and emerging environmental issues such as human population growth, energy use, loss of biodiversity, water resources, and climate change. (Typically Offered: Fall)

ENVS 2040: Biodiversity

(Cross-listed with BIOL 2040).

Credits: 2. Contact Hours: Lecture 4.

Survey of the major groups of organisms and biological systems. Definition, measurements, and patterns of distribution of organisms. Sources of information about biodiversity. Does not satisfy biology major requirements. Half semester course. See list of life science courses (<https://www.cals.iastate.edu/student-services/lifescience>) for additional information. (Typically Offered: Spring)

ENVS 2200: Globalization and Sustainability

(Cross-listed with ANTHR 2200/ SOC 2200/ GLOBE 2200/ ME 2200/ MATE 2200).

Credits: 3. Contact Hours: Lecture 3.

An introduction to understanding the key global issues in sustainability. Focuses on interconnected roles of energy, materials, human resources, economics, and technology in building and maintaining sustainable systems. Applications discussed will include challenges in both the developed and developing world and will examine the role of technology in a resource-constrained world. Graduation Restriction: Cannot be used for technical elective credit in any engineering department. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

ENVS 2500: Environmental Geography

(Cross-listed with AGRON 2500/ ENSCI 2500/ NREM 2500).

Credits: 3. Contact Hours: Lecture 3.

The distribution, origins and functions of the earth's physical systems and the spatial relationship between human activity and the natural world. (Typically Offered: Fall)

ENVS 2700: Foundations in Natural Resource Policy and History

(Cross-listed with NREM 2700/ LA 2700).

Credits: 3. Contact Hours: Lecture 3.

The development of natural resource conservation philosophy and policy from the Colonial Era to the present. North American wildlife, forestry, and environmental policy; national parks and other protected lands; federal and state agencies. Relationship to cultural contexts, including urban reform and American planning movement. Discussion of common pool resources, public and private lands. (Typically Offered: Fall)

ENVS 2830: Introduction to Environmental Politics and Policies

(Cross-listed with POLS 2830).

Credits: 3. Contact Hours: Lecture 3.

Introduction to major ideologies' relations to conservation and ecology. Processes, participants, and institutions involved in state, national, and global environmental policymaking. Case studies of environmental controversies and proposals for policy reform. (Typically Offered: Spring)

ENVS 2930: Environmental Planning

(Cross-listed with CRP 2930).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Comprehensive overview of the field of environmental relationships and the efforts being made to organize, control, and coordinate environmental, aesthetic, and cultural characteristics of land, air, and water. (Typically Offered: Fall, Spring)

ENVS 3190: Analysis of Environmental Systems

(Cross-listed with BIOL 3190/ ENSCI 3190).

Credits: 3.

Prereq: ENSCI 3120; junior classification

Systems approach to the analysis and modeling of material and energy flows in natural and managed environmental systems and the primary environmental factors controlling these systems. Applications in hydrology, biogeochemistry, and population dynamics. (Typically Offered: Spring)

ENVS 3200: Ecofeminism

(Cross-listed with WGS 3200).

Credits: 3. Contact Hours: Lecture 3.

Prereq: WGS 2010 or 3 credits in WGS at 3000 level or above

Women's relationships with the earth, non-human nature, and other humans. The course explores the connections between society's treatment of women and nature; origins of ecofeminism and how it relates to the science of ecology, conventional and sustainable agriculture as well as how ecofeminism relates to other branches of feminist philosophy. Evaluation and critique of modern science, technology, political systems and SOLUTIONS will be included.

ENVS 3240: Energy and the Environment

(Cross-listed with ENSCI 3240/ GEOL 3240/ MTEOR 3240).

Credits: 3. Contact Hours: Lecture 3.

Exploration of Earth's energy resources and the environmental and climatic impacts of energy acquisition and consumption. Renewable and non-renewable energy resources within an Earth-system context. Various environmentally-relevant topics such as water quality and availability, habitat destruction, greenhouse-gas emissions, and health and safety hazards to wildlife and human communities. Designed for students with a college-level understanding of chemistry and physics. (Typically Offered: Spring)

ENVS 3340: Environmental Ethics

(Cross-listed with PHIL 3340).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 3 credits in PHIL or Permission of Instructor

Thorough study of some of the central moral issues arising in connection with human impact on the environment, e.g., human overpopulation, species extinction, forest and wilderness management, pollution. Several world views of the proper relationship between human beings and nature will be explored. (Typically Offered: Fall)

ENVS 3360X: Climate Change Policy

(Cross-listed with POLS 3360X).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 3 credits in POLS OR ECON 1010 OR Sophomore Classification

Policy-centered approach to climate-change solutions. Investigation, analysis, and evaluation of policy responses to the prospect and occurrence of climate change. Politics of climate-related technological, regulatory, and societal changes. Interaction of social movements, institutions, and economic interests in shaping national and global responses to climate change. (Typically Offered: Spring)

ENVS 3420: World Food Issues: Past and Present

(Cross-listed with AGRON 3420/ FSHN 3420).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior classification

Issues associated with global agricultural and food systems including ethical, social, economic, environmental, and policy contexts.

Investigation of various causes and consequences of overnutrition/ undernutrition, global health, poverty, hunger, access, and distribution.

Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

ENVS 3450: Population and Society

(Cross-listed with SOC 3450).

Credits: 3. Contact Hours: Lecture 3.

History of present and future of human populations. How human population growth and structure impacts our world, influencing food and the environment, causes of death, fertility rates, and international migration. Compare the U.S. with other societies worldwide. Understand population policies and their impacts on climate, social and economic inequalities, and human well-being. Gain hands-on experience practicing demographic techniques and applying demographic data to real-world population problems. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

ENVS 3550: Literature and the Environment

(Cross-listed with ENGL 3550).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500

Focused study of texts that address a wide range of environmental issues, including the relationship between humans and natural/urban environments, views of other-than-human beings, food, climate change, extinction, and social and racial justice. Assignments for the course may include research, exams, writing, and/or individual/group projects.

ENVS 3620: Global Environmental History

(Cross-listed with HIST 3620).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Survey of the interactions of human communities with their environments from the beginnings of human history to the present.

Topics include the domestication of animals, the agricultural revolution, industrialization, urbanization, deforestation, hydraulic management, fossil fuel consumption, and climate change. (Typically Offered: Fall)

ENVS 3630: U. S. Environmental History

(Cross-listed with HIST 3630).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Survey of the interactions of human communities with the North American environment. Focus on the period from presettlement to the present, with a particular concentration on natural resources, disease, settlement patterns, land use, and conservation policies.

ENVS 3800: Energy, Environmental and Resource Economics

(Cross-listed with ECON 3800).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 1010

Natural resource availability, use, conservation, and government policy, with emphasis on energy issues. Environmental quality and pollution control policies.

ENVS 3820: Environmental Sociology

(Cross-listed with SOC 3820).

Credits: 3. Contact Hours: Lecture 3.

Environment-society relations; social construction of nature and the environment; social and environmental impacts of resource extraction, production, and consumption; environmental inequality; environmental mobilization and movements; U.S. and international examples. Meets International Perspectives Requirement. Meets International Perspectives Requirement. (Typically Offered: Spring)

ENVS 3900: Internship in Environmental Studies

Credits: 1-30. Repeatable.

Prereq: Program Coordinator Permission for Course

Practical experience with nature centers, government agencies, schools, private conservation groups, and other organizations. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

ENVS 4040: Global Change

(Dual-listed with MTEOR 5040/ AGRON 5040/ ENSCI 5040). (Cross-listed with AGRON 4040/ ENSCI 4040/ MTEOR 4040/ CLSCI 4040).

Credits: 3. Contact Hours: Lecture 3.

Recent changes in global biogeochemical cycles and climate; models of future changes in the climate system; impacts of global change on agriculture, water resources and human health; ethical issues of global environmental change. (Typically Offered: Fall, Spring)

ENVS 4070: Watershed Management

(Dual-listed with NREM 5070/ ENSCI 5070). (Cross-listed with ENSCI 4070/ NREM 4070).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: 1 course in BIOL

Managing human impacts on the hydrologic cycle. Field and watershed level best management practices for modifying the impacts on water quality, quantity and timing are discussed. Field project includes developing a management plan using landscape buffers. (Typically Offered: Spring)

ENVS 4240: Sustainable and Environmental Horticulture Systems

(Dual-listed with HORT 5240). (Cross-listed with HORT 4240).

Credits: 3. Contact Hours: Lecture 3.

Inquiry into ethical issues and environmental consequences of horticultural cropping systems, production practices and managed landscapes. Emphasis on systems that are resource efficient, environmentally sound, socially acceptable, and profitable. (Typically Offered: Spring)

ENVS 4500: Issues in Sustainable Agriculture

(Cross-listed with AGRON 4500).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior classification

Agricultural science as a human activity; contemporary agricultural issues from agroecological perspective. Comparative analysis of intended and actual consequences of agricultural practices from the perspective of ethics and sustainable agriculture. (Typically Offered: Spring)

ENVS 4600: Controversies in Natural Resource Management

(Cross-listed with NREM 4600).

Credits: 3. Contact Hours: Lecture 3.

Prereq: AECL 3120 or NREM 3010, NREM 1200, and Junior classification

Analysis of controversial natural resource issues using a case approach that considers uncertainty and adequacy of information and scientific understanding. Ecological, social, political, economic, and ethical implications of issues will be analyzed. (Typically Offered: Fall, Spring)

ENVS 4840: Sustainable Communities

(Dual-listed with CRP 5840). (Cross-listed with CRP 4840).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior classification

The history and theory of sustainable community planning. Procedural and substantive dimensions. Case studies of communities engaged in sustainability planning. Use and development of indicators. (Typically Offered: Spring)

ENVS 4900: Independent Study

Credits: 1-30. Repeatable.

Prereq: Program Coordinator Permission for Course

(Typically Offered: Fall, Spring, Summer)

ENVS 4900H: Independent Study: Honors

Credits: 1-30. Repeatable.

Prereq: Program Coordinator Permission; Membership in the University Honors Program

(Typically Offered: Fall, Spring, Summer)

ENVS 4910: Environmental Law and Planning

(Dual-listed with CRP 5910/ LA 5910). (Cross-listed with CRP 4910/ LA 4910).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 6 credits natural sciences or permission of instructor

Environmental law and policy as applied in planning at the local and state levels. Brownfields, environmental justice, water quality, air quality, wetland and floodplain management, and local government involvement in ecological protection through land use planning and other programs. (Typically Offered: Spring)

ENVS 4960A: International Tour

Credits: 1-30. Repeatable.

Prereq: Sophomore classification

Extended field trips to study environmental topics in varied locations. Location and duration of trips will vary. Trip expenses paid by students. Check with department for current offerings. (Typically Offered: Fall, Spring, Summer)

ENVS 4960B: Domestic Tour

Credits: 1-30. Repeatable.

Prereq: Sophomore classification

Extended field trips to study environmental topics in varied locations. Location and duration of trips will vary. Trip expenses paid by students. Check with department for current offerings. (Typically Offered: Fall, Spring, Summer)

Event Management (EVENT)

Courses primarily for undergraduates:

EVENT 1710: Introduction to Event Management

Credits: 3. Contact Hours: Lecture 3.

Overview of the event management industries. Techniques and procedures required for designing and implementing successful events. (Typically Offered: Fall, Spring, Summer)

EVENT 2030: Event Management Sophomore Mentorship

Credits: 2. Contact Hours: Lecture 1.

Prereq: Sophomore classification; AESHM 1110; EVENT 1710; by application only

Event Management sophomore students will be paired with a professional mentor in the event industry. Students will meet in the class and individually with their professional mentor throughout the spring semester. Students will be assessed on their experience through reflection, presentation, and mentor evaluation. (Typically Offered: Fall, Spring, Summer)

EVENT 2120: Digital Production in Event Management

Credits: 3.

Applications of skills in Adobe Suite and other software technologies. Introduction to design elements used within the event management industry with a focus on digital publishing of marketing and promotional materials, wayfinding, and other stationery items. Face-to-face lecture and laboratory work. (Typically Offered: Fall, Spring)

EVENT 2770: Digital Promotion in the Service Industry

Credits: 3. Contact Hours: Lecture 3.

Service industry management digital channels and platforms, including media planning, search advertising, social media, and mobile. Students will be introduced to the trending social media management platforms as well as digital marketing management topics of influencer marketing, digital media planning, and content marketing. (Typically Offered: Spring, Summer)

EVENT 2780: Sustainability Essentials for Service-Related Businesses

Credits: 3. Contact Hours: Lecture 3.

This course introduces with the knowledge and skills needed to navigate sustainability challenges in service business. Through engaging modules, students will explore global sustainability trends and effective business marketing strategies. By the end of the course, students will be empowered to identify and implement sustainable practices in a services business context. (Typically Offered: Spring, Spring)

EVENT 2900: Independent Study

Credits: 1-2. Repeatable, maximum of 4 credits.

Prereq: Freshman or Sophomore classification, permission of instructor

Independent study on topics of special interest to the student, facilitated by approved faculty member. Graduation Restriction: No more than 9 credits of EVENT 2900 and EVENT 4900 may be applied towards graduation requirements. (Typically Offered: Fall, Spring, Summer)

EVENT 3280: Incentive Meeting Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: EVENT 1710

Overview of the incentive meeting industry. Focus on incentive meeting planning, destination selection, program development, risk management, cultural aspects of destination, incentive meeting execution, and incentive meeting evaluation. (Typically Offered: Spring)

EVENT 3330: Entertainment Venue Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: EVENT 1710

Organization and management of various types of entertainment venues including clubs, theaters, auditoriums, and arenas. (Typically Offered: Fall)

EVENT 3430X: Virtual and Hybrid Events

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: EVENT 1710; Event Management major or minor

Application of event management leadership, communication, strategies, and production to analyze and execute virtual and hybrid events.

EVENT 3670: Event Sales

Credits: 3. Contact Hours: Lecture 3.

Prereq: EVENT 1710

This course provides an overview of sales marketing management in the event industry and highlights the role of the professional event sales manager in the marketing process. As an event professional, students will identify best sales practices to develop their personal selling style, to build on their strengths, and to create a referral business that delivers results. Principles covered include evaluation of characteristics and skills necessary for success in sales; strategic planning; sales leadership; analyzing customers and markets; designing and developing the sales force; recognize the importance of relationship building; process management; and measurement, analysis, and knowledge management. (Typically Offered: Fall, Spring)

EVENT 3710: Conference and Meeting Planning

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or concurrent enrollment in EVENT 1710; Sophomore classification

Application of event management principles to conference and meeting planning. Providing a comprehensive introduction to the key planning elements of the global conference, convention and meetings. (Typically Offered: Fall, Spring)

EVENT 3730: Wedding Planning and Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: EVENT 1710

Overview of wedding event industry. Focus on wedding planning processes and implementation, design, and business planning and development. (Typically Offered: Fall, Spring)

EVENT 3790: Nonprofit Fundraising Event Planning

Credits: 3. Contact Hours: Lecture 3.

Prereq: EVENT 1710

Provides a comprehensive understanding of the principles underlying event fundraising. Students will be provided with the necessary knowledge and skills to conceptualize and implement a fundraising plan, either for their own venture, or for a not-for-profit organization. Through practical exercise, students will have the opportunity to put their fundraising concepts and techniques into practice, gaining valuable insights into the challenges and opportunities of the funding process. (Typically Offered: Fall)

EVENT 3830: Sports Event Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: EVENT 1710

A comprehensive overview of sports and recreation competitions, events, and facilities. Best practices in sports event management, sports organizations, and franchises across the industry. In depth look at athlete and guest services, game day operations, marketing, sponsorship, and post-competition. (Typically Offered: Spring)

EVENT 3930: Event Management Workshop

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: EVENT Junior or Senior classification; Permission of Instructor

Topics vary each time offered. Graduation Restriction: Maximum of 6 EVENT 3930 credits can be applied to graduation. (Typically Offered: Fall, Spring, Summer)

EVENT 4230: International Sports and Entertainment Event Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: EVENT 1710

A comprehensive understanding of the strategies, procedures and nuances of planning and executing multinational and multicultural Sports and Entertainment Events that are held outside the U.S. or have large draw from an international audience. Meets International Perspectives Requirement. (Typically Offered: Spring)

EVENT 4710: Event Production

Credits: 1-3. Contact Hours: Lecture 3.

Prereq: EVENT 1710; credit or enrollment in EVENT 3710; Junior classification

Advanced application of event management-provides students with hands-on special event planning experience, an understanding of how events are managed, and confidence in the research, planning, coordinating, marketing, management, financial management, way-finding and evaluation of special events. Event management production, design elements, technical production, stakeholder management, logistics, operations, event marketing and promotion, merchandise, risk management, fundraising, sponsorship, and event assessment. (Typically Offered: Fall, Spring)

EVENT 4820: Sport Event Marketing

Credits: 3. Contact Hours: Lecture 3.

Prereq: EVENT 1710

Sports Marketing is a specialized marketing course that is designed to prepare students to develop skills necessary to address marketing issues specific to the sports industry. This course will analyze the field of sports in terms of the practices, applications, and strategies of mainstream marketing. The subject includes Sponsorship, Endorsements, Licensing, Segmentation of the Sports Market, Promotional Strategy for the Marketing of Sports Products, and Emerging Issues in Sports Marketing. In addition, this class touches on the unique opportunities and challenges associated with marketing in the entertainment industry as an aggregate. To provide students with practical experience addressing sports and entertainment marketing issues, the class is organized around four projects. This course will explore the strategies necessary for success in marketing sports events, products, and services. The course will build knowledge, skills, and a practical understanding of the nature, contexts, and dynamics of sports marketing and critically explore the product, price, promotion, and placement within the sports marketing context. This course emphasizes the exploration of the essentials of effective sports marketing. Topics include the application of marketing principles in the sports arena, licensing issues, sponsorships and endorsements, stadium and arena marketing, broadcasting and media considerations, public policy and sports, and the unique marketing challenges for sport-specific products (football, basketball, baseball, motorsports, etc.) Prerequisites: EVENT 1710. (Typically Offered: Fall)

EVENT 4850: Advanced Event Production: Special Event

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Advanced application event management. Provide leadership and direction for production of a special event including vendor sourcing, contracts, stakeholder relations, logistics, budget management, publicity, operations, choreography, staging, lighting, sponsorship, and food. (Typically Offered: Fall, Spring)

EVENT 4860: Advanced Event Production

Credits: 3. Repeatable, maximum of 6 credits.

Prereq: EVENT 3710; EVENT 4850; Event Management major

Advanced application event management. Provide leadership and direction for production of an event including vendor and stakeholder relations, budget management, publicity, advertising, choreography, staging, lighting, and food. Graduation Restriction: Maximum of 6 credits may be applied toward graduation. (Typically Offered: Fall)

EVENT 4900B: Independent Study: Conferences

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Independent study. (Typically Offered: Fall, Spring, Summer)

EVENT 4900C: Independent Study: Special Events

Credits: 1-30. Repeatable.

Prereq: Program approval

Independent study. (Typically Offered: Fall, Spring, Summer)

EVENT 4900D: Independent Study: Event Management

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Independent study. (Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

EVENT 5310: Event Business Research Essentials

(Dual-listed with EVENT 4310).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Instructor Permission for Course

The effective execution of an event necessitates the application of suitable tools and techniques to achieve the event's intended business objectives. This course equips students with the knowledge and skills to cater to the escalating requirement for a structured methodology for conducting event business research and integrating the findings into the strategic decision-making process. Students will be exposed to a comprehensive curriculum that covers research design, measurement, sampling, data collection, processing, analysis, and interpretation, thereby preparing them to navigate the multifaceted challenges of the event industry with poise and proficiency. (Typically Offered: Fall)

EVENT 5610: Advanced Topics in Event Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Advanced meeting and event planning topics including event strategy, event risk and security management, event financial management, event design, event project management, and event tourism strategy. Offered odd-numbered years. (Typically Offered: Spring)

EVENT 5770: Advanced Social Media Strategy

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Project-based course that includes analyzing relevant literature in social media and developing, implementing, and assessing an integrated social media marketing strategy in the service business marketing plan. Perspective on digital/social/mobile marketing to appreciate its true value to consumers, to managers, and to other corporate stakeholders. (Typically Offered: Fall)

EVENT 5780: Advanced Event Sustainability Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

This course emphasizes the significance of sustainability in service businesses, with a focus on integrating social, economic, and environmental factors. It examines the impact of sustainability on stakeholders, including consumers and employees, while ensuring business profitability." Offered even-numbered years. (Typically Offered: Fall)

EVENT 5900: Special Topics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Instructor Permission for Course

Topics in event management. (Typically Offered: Fall, Spring)

EVENT 5990: Creative Component

Credits: 3. Contact Hours: Lecture 3.

Prereq: Instructor Permission for Course

Creative component as arranged with instructor. (Typically Offered: Fall, Spring, Summer)

Courses for graduate students:**EVENT 6340: Theory and Research Seminar in Event Management**

Credits: 3. Contact Hours: Lecture 3.

Prereq: Permission of Instructor; Permission of Advisor

Analysis and application of theories and research methodologies in event management and is designed to strengthen students' analytical and critical perspectives to evaluate event management research. Multidisciplinary approach to the areas of sports events, festivals and fairs, conventions and trade shows, mega events, and event tourism. Offered even-numbered years. (Typically Offered: Spring)

Family and Consumer Sciences Education and Studies (FCEDS)

Courses primarily for undergraduates:

FCEDS 2060: Home Ec to Human Sciences: Legacy and Advocacy.

Credits: 2. Contact Hours: Lecture 2.

Explore the evolution of Home Economics into modern Human Sciences. Analyze how societal influences, gender dynamics, and interdisciplinary shifts have shaped the field. Gain insight into Family & Consumer Sciences and its role in addressing issues such as sustainable living and global health disparities. Required for FCEDS majors but useful to all Human Sciences majors. Includes 12 hours of field experience scheduled outside of class. . (Typically Offered: Spring)

FCEDS 3060: Teaching Human Sciences

Credits: 4. Contact Hours: Lecture 3, Laboratory 1.

Learn to design meaningful educational experiences for adolescents and adults within and beyond the traditional classroom. Integrate Human Sciences content with literacy and STEM-based education. Create engaging instruction for diverse audiences to promote critical thinking, self-awareness, and lifelong learning. Includes 12 hours of arranged practicum experience outside of the regular class schedule. . (Typically Offered: Fall)

FCEDS 3150X: Culinary Arts For FCS Professionals

Credits: 3. Contact Hours: Lecture 3.

This course provides Family and Consumer Sciences (FCS) teachers with essential knowledge and skills in nutrition and culinary arts. Participants explore the principles of nutrition, meal planning, food safety, and kitchen management. Through hands-on cooking labs and recipe development students learn culinary techniques, flavor profiles, and cultural influences on food choices. By course end, students are equipped to teach nutrition and culinary arts. This course fulfills the component for "Foods and Nutrition" content required for Iowa teaching endorsement 139: Family and Consumer Sciences. (Typically Offered: Summer)

FCEDS 3250: Housing & Interior Design for FCS Professionals

Credits: 3. Contact Hours: Lecture 3.

Prereq: 6 credits in FCEDS

Foundational knowledge in housing and interior design. Topics include architectural styles, space planning, sustainability, color theory, and furniture selection. Through theoretical exercises & hands-on activities, participants learn to create safe, functional, and culturally sensitive living environments. This course fulfills the component for "Housing" content required for Iowa teaching endorsement 139: Family and Consumer Sciences. (Typically Offered: Fall)

FCEDS 3350: Textiles & Apparel for FCS Professionals

Credits: 3. Contact Hours: Lecture 2, Laboratory 1.

Foundational understanding of fashion, textiles, apparel, and sewing. Participants explore fabric properties, garment construction techniques, fashion trends, and the role of textiles in culture and society. Emphasis is placed on promoting sustainable fashion practices and fostering creativity in design. This course fulfills the component for "Textiles or apparel design and merchandising" content required for Iowa teaching endorsement 139: Family and Consumer Sciences. (Typically Offered: Summer)

FCEDS 3800V: Pre-Student Teaching Experience in FCS Education

(Cross-listed with EDUC 3800V).

Credits: 1-2. Contact Hours: Laboratory 2.

Repeatable.

Prereq: Admission to Educator Preparation program AND Credit or concurrent enrollment in FCEDS 3060.

Clinical Experience Level II in culinary, fashion design, housing, and/or human development courses related to Family & Consumer Sciences at the secondary level. Includes 24 hours practicum: unsupervised. 1/2 day of time needed in schedule. Offered on a satisfactory-fail basis only. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

FCEDS 3980: Foundations of Career and Technical Education in Family and Consumer Sciences

Credits: 3. Contact Hours: Lecture 3.

Historical development and evolution of Career and Technical Education, including the impact of selected legislation. Planning and implementing Family and Consumer Sciences programs that include FCCLA. Techniques for school-to-work and work-based-learning education programs will also be explored. A minimum of two field experiences in high quality CTE programming; 2 days of professional leave are required. This course fulfills content required for Iowa teaching endorsement 139: Family and Consumer Sciences and 305: Multioccupations. (Typically Offered: Spring)

FCEDS 4060X: Educational Principles in Family & Consumer Sciences

Credits: 3. Contact Hours: Lecture 3.

This capstone course prepares future FCS educators by focusing on core concepts and values essential for promoting well-being in individuals, families, and communities engaging with perennial issues like food insecurity, sustainability, and economic disparity. The course encourages community engagement, advocacy, and reflective practice to develop effective integrative approaches. By course completion, students are equipped to design and deliver impactful, contemporary FCS curricula that empower individuals to lead healthy and fulfilling lives. Includes 12 hours of arranged practicum experience outside of the regular class schedule. . (Typically Offered: Fall)

FCEDS 4130: Curriculum, Lab Management and Assessment for Family and Consumer Sciences

Credits: 3. Contact Hours: Lecture 3.

Development of curriculum and assessment tools for secondary Family and Consumer Sciences programs. Application of Laboratory and Classroom management strategies. Focus on accommodating exceptional learners and aligning teaching standards for classroom assessment. Includes 12 hours of Career and Technical Student Organization Competitive Event Assessment at the state/national level. (Typically Offered: Spring)

FCEDS 4170A: Supervised Teaching in Family and Consumer Sciences: Vocational family and consumer sciences.

Credits: 3-8. Repeatable.

Prereq: Admitted to Educator Preparation Program or permission of instructor

Supervised teaching experience in secondary schools. (Typically Offered: Fall, Spring)

FCEDS 4170B: FCEDS 4170B: Supervised Teaching in Family and Consumer Sciences

Credits: 3-8. Repeatable.

Prereq: Admitted to Educator Preparation Program or permission of instructor

Supervised teaching experience in secondary schools. (Typically Offered: Fall, Spring)

FCEDS 4800V: Pre-Student Teaching Experience in FCS Education

(Cross-listed with EDUC 4800V).

Credits: 2. Contact Hours: Laboratory 4.

Repeatable.

Prereq: FCEDS 3060; FCEDS 3800V; admission to Educator Preparation program

Clinical Experience Level III in culinary, fashion design, housing, and/or human development courses related to Family & Consumer Sciences at the secondary level. Includes 48 hours practicum and supervised individual teaching. 1/2 day of time needed in schedule. Offered on a satisfactory-fail basis only. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

FCEDS 4900C: Independent Study: Curriculum

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

FCEDS 4900G: Independent Study: General

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

FCEDS 4900H: Independent Study: Honors

Credits: 1-30. Repeatable.

Prereq: Permission of Instructor; Membership in the University Honors Program

(Typically Offered: Fall, Spring, Summer)

FCEDS 4910A: Supervised Experiences in a Professional Setting: Communications

Credits: 3-8. Repeatable, maximum of 8 credits.

Prereq: FCEDS 2060; FCEDS 3060; minimum 24 credits in FCEDS

Supervised professional experience in an approved setting such as Cooperative Extension, business, community, human service, or government agency. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

FCEDS 4910B: Supervised Experiences in a Professional Setting: Professional Studies

Credits: 3-8. Repeatable, maximum of 8 credits.

Prereq: FCEDS 2060; FCEDS 3060; minimum 24 credits in FCEDS

Supervised professional experience in an approved setting such as Cooperative Extension, business, community, human service, or government agency. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

FCEDS 5000F: Short Course: Career and Technical Education

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

(Typically Offered: Fall, Spring, Summer)

FCEDS 5000G: Short Course: General

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

(Typically Offered: Fall, Spring, Summer)

FCEDS 5000K: Short Course: Textile Selection and Apparel Construction Methods

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

(Typically Offered: Fall, Spring, Summer)

Family Financial Planning (FFP)

Courses primarily for graduate students, open to qualified undergraduates:

FFP 5200: Financial Theory and Research I

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Theories of family functioning, macroeconomic theory related to family resource allocation decisions, the family as an economic unit, and the interaction of the economy and families. (Typically Offered: Fall, Spring, Summer)

FFP 5250: Financial Theory and Research II

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Microeconomic theory as it relates to family resource allocation decisions, theories of household behavior, the lifecycle hypothesis, behavioral economics, behavioral finance, theories of behavioral change, and psychological theories of family well-being. Focus on empirical research investigating household financial decision-making. (Typically Offered: Fall, Spring, Summer)

FFP 5300: Fundamentals of Family Financial Planning

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to the financial planning process and establishing client-planner relationships. Applied work in cash flow, credit and debt, income tax, insurance, investment, retirement and estate planning. Review of services provided to families, documentation required, ethics in financial planning, and Certified Financial Planner licensee responsibilities. (Typically Offered: Fall, Spring, Summer)

FFP 5350: Financial Counseling

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Theory and research regarding the interactive process between the client and the practitioner, including communication techniques, motivation and esteem building, the counseling environment, ethics, and methods of data intake, verification, and analysis. Other topics include legal issues, compensation, uses of technology to identify resources, information management, and current or emerging issues. (Typically Offered: Fall, Spring, Summer)

FFP 5400: Estate Planning for Families

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Fundamentals of the estate planning process, including estate settlement, estate and gift taxes, property ownership and transfer, and powers of appointment. Tools and techniques used in implementing an effective estate plan, ethical considerations used in providing estate planning services, and new and emerging issues in the field. Case studies provide experience in developing estate plans suitable for varied family forms. (Typically Offered: Fall, Spring, Summer)

FFP 5410: Housing and Real Estate in Family Financial Planning

(Cross-listed with HDFS 5410).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

The role of housing and real estate in the family financial planning process, including taxation, mortgages, financial calculations, legal concerns, and ethical issues related to home ownership and real estate investments. Emphasis on emerging issues in the context of housing and real estate. Offered even-numbered years. (Typically Offered: Summer)

FFP 5450: Retirement Planning, Employee Benefits, and the Family

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Study of micro and macro considerations for retirement planning. Survey of various types of retirement plans, ethical considerations in providing retirement planning services, assessing and forecasting financial needs in retirement, and integration of retirement plans with government benefits. (Typically Offered: Fall, Spring, Summer)

FFP 5500: Military Personal Financial Readiness

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Overview of the topics relevant to the financial planning process that address the unique needs of military service members and their families. (Typically Offered: Fall, Summer)

FFP 5550: Insurance Planning for Families

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

In-depth study of risk management concepts, tools, and strategies for individuals and families, including life insurance; property and casualty insurance; liability insurance; accident, disability, health, and long-term care insurance; and government-subsidized programs. Current and emerging issues and ethical considerations relative to risk management. Case studies provide experience in selecting insurance products suitable for individuals and family, study of investment options for clients including common stocks, fixed income securities, convertible securities, and related choices. Relationships between investment options and employee/employer benefit plan choices. Current and emerging issues and ethics are included. (Typically Offered: Fall, Spring, Summer)

FFP 5650: Personal Income Taxation

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

In-depth information on income tax practices and procedures including tax regulations, tax return preparation, the tax audit processes, the appeals process, preparation for an administrative or judicial forum, and ethical considerations of taxation. New and emerging issues related to taxation. Family/individual case studies provide practice in applying and analyzing tax information and recommending appropriate tax strategies. (Typically Offered: Fall, Spring, Summer)

FFP 5700: Professional Practices in Financial Planning

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Challenges of managing financial planning practices including, but not limited to: business valuation, personnel, marketing, client services, ethics and technological applications. Relying both on a theoretical as well as an applied approach, students analyze case studies that provide relevant, practical exposure to practice management issues, with a strong emphasis on current research findings. (Typically Offered: Fall, Spring, Summer)

FFP 5830: Investing for the Family's Future

(Cross-listed with HDFS 5830).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Evaluation of investment markets for the household. Analysis of how families choose where to put their savings. Emphasis is on using the family's overall financial and economic goals to help inform investment choices. (Typically Offered: Fall)

FFP 5900: Family Financial Planning Seminar

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 3 credits.

Prereq: Graduate Standing or Permission of Instructor

Through a seminar format comprised of readings, guest lectures, collaborative case studies, peer interaction, and practical application, students will explore the rapidly growing and changing opportunities of sustainable, responsible, and impact investments. (Typically Offered: Spring, Summer)

FFP 5910: Practicum

Credits: 3-6. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Supervised experience in family financial planning. (Typically Offered: Fall, Spring, Summer)

FFP 5950: Financial Planning - Case Studies

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Professional issues in financial planning, including ethical considerations, regulation and certification requirements, communication skills, and professional responsibility. Students are expected to utilize skills obtained in other courses and work experiences in the completion of personal finance case studies, the development of a targeted investment policy, and other related financial planning assignments. (Typically Offered: Fall, Spring, Summer)

Finance (FIN)

Courses primarily for undergraduates:**FIN 3010: Principles of Finance**

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 1010 and ACCT 2840

Introduction to financial management with emphasis on corporate financing and investment decision making, time value of money, asset valuation, capital budgeting decision methods, cash budgeting, and financial markets. (Typically Offered: Fall, Spring, Summer)

FIN 3100: Corporate Finance

Credits: 3. Contact Hours: Lecture 3.

Prereq: (FIN 3010 or MATH 2400) and STAT 2260 and (credit or enrollment in MATH 1510 or MATH 1600 or MATH 1650)

Theory used in a firm's investment and financing decisions. Analysis of environment in which financial decisions are made; applications of analytical techniques to financial management problems. (Typically Offered: Fall, Spring, Summer)

FIN 3200: Investments

Credits: 3. Contact Hours: Lecture 3.

Prereq: (FIN 3010 or MATH 2400) and STAT 2260 and (credit or enrollment in MATH 1510 or MATH 1600 or MATH 1650)

Introduction to securities and markets from the viewpoint of the individual investor. Emphasis on mechanics of trading, measurement of return and risk, behavior of security prices, valuation of stocks and bonds, mutual funds, portfolio selection techniques, and performance evaluation. (Typically Offered: Fall, Spring)

FIN 3300: Financial Markets and Institutions

Credits: 3. Contact Hours: Lecture 3.

Prereq: FIN 3010

Introduction to the structure and operations of the United States financial system and its markets and institutions. Emphasis on developing an integrated understanding of markets and financial service providers including global linkages. (Typically Offered: Fall, Spring)

FIN 3340: Introduction to Financial Technologies and Cryptocurrencies

Credits: 3. Contact Hours: Lecture 3.

Prereq: FIN 3010

Introduction to the emerging role of financial technologies and cryptocurrencies in the financial services industry and the impact these technologies are having in areas such as payment systems, financial regulation, crowdfunding, robotic investments, and cyber security. Explore the history and origins of crypto coins, markets for trading cryptocurrencies, and role of digital money as a medium of exchange and financial asset, including valuation, risk, and correlation with other investments. (Typically Offered: Fall, Spring)

FIN 3610: Personal Risk Management and Insurance

Credits: 3. Contact Hours: Lecture 3.

Prereq: FIN 3010 or MATH 2400

Risk concepts and the use of insurance by individuals and families. Emphasis on the insurance mechanism and methods of dealing with income, property, and liability risks. (Typically Offered: Fall, Spring)

FIN 3710: Real Estate Principles

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 1010.

Legal, economic, social and financial aspects of real estate, including property rights, contracts, mortgage instruments, tax factors, brokerage, valuation, risk and return analysis, financing techniques, and investments. (Typically Offered: Summer)

FIN 4100: Corporate Financial Planning and Analysis

Credits: 3. Contact Hours: Lecture 3.

Prereq: FIN 3100

Advanced study of corporate financial planning and cash flow management. Major topics include strategic planning and budgeting, analysis of business performance, forecasting and modeling, and financial reporting. (Typically Offered: Spring)

FIN 4150: Business Financing Decisions

Credits: 3. Contact Hours: Lecture 3.

Prereq: FIN 3100

In depth study of the firm's external financing decision. Emphasis on the development of cash flow statements, projected financing needs and the selection of the appropriate financing instrument. Focus on case studies and application of developed techniques on actual field project. (Typically Offered: Fall, Spring, Summer)

FIN 4240: Financial Futures and Options

Credits: 3. Contact Hours: Lecture 3.

Prereq: FIN 3200 and (STAT 3260 or STAT 3410)

Advanced study of pricing and using derivatives - instruments deriving value from fundamental items such as commodities, currency exchange rates, market indices, equities and bonds. Addresses basic building blocks of derivatives (i.e., forwards, futures, options and swaps) and relevant current topics and issues. (Typically Offered: Fall, Spring)

FIN 4250: Security Analysis and Portfolio Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: FIN 3200 and (STAT 3260 or STAT 3410)

Advanced study of security analysis, security selection techniques and portfolio management. Emphasis on the applications of methods learned via the selection and evaluation of a portfolio of actual securities purchased in securities markets in the U.S. or abroad. Tracking and periodic reporting of the portfolio's performance relative to standard benchmarks is also required. (Typically Offered: Fall, Spring)

FIN 4260: Quantitative Investment Analysis

Credits: 3. Contact Hours: Lecture 3.

Prereq: FIN 3200 and (STAT 3260 or STAT 3410)

Introduction to the use of advanced statistical and machine learning techniques in the practice of portfolio construction. Topics include regularization and tree-based investment techniques, characteristic-based and trend-following investing, and multivariate GARCH analysis. Provides essential analytics training needed for investment management. (Typically Offered: Spring)

FIN 4270: Fixed Income Securities

Credits: 3. Contact Hours: Lecture 3.

Prereq: FIN 3200

Valuation of fixed income securities, including pricing conventions, term structure of interest rates, default, duration, and hedging of interest rate risk with derivatives. Analysis of bond market sectors, including treasury, agency, corporate, sovereign, municipal, and residential mortgage bonds.

FIN 4280: Advanced Fixed Income Analysis and Portfolio Management
(Dual-listed with FIN 5280).

Credits: 3. Contact Hours: Lecture 3.

Prereq: FIN 4270

Advanced analysis of fixed income markets and securities, including valuation and trading of treasury securities, corporate bonds, mortgage backed securities. Analysis of structured financial securities, including CDO, CMBS, and ABS. Analysis of active and passive investment strategies for managing fixed income portfolios. Students are required to manage a fixed income portfolio for an institutional investor. A top-down approach to portfolio management is assumed, with active bets taken on market direction, duration, yield curve, and credit spreads.

FIN 4310: New Venture Financing

(Cross-listed with ENTSP 4310).

Credits: 3. Contact Hours: Lecture 3.

Prereq: FIN 3100 or [(ENSTP 3130 or MGMT 3130) and FIN 3010]

Exploration of the foundations of financing entrepreneurial companies. Emphasis on the roles of the entrepreneurs, venture capitalists, and limited partners in the full financing cycle of early-stage ventures, including pitching and raising capital, deal sourcing and due diligence, deal structuring, and post-investment management. Extensive use of case studies and interactive presentations to a mock investor-based board of directors to illustrate the key concepts and processes involved in start-up financing. (Typically Offered: Spring)

FIN 4350: Venture Capital, Private Equity, and Mergers and Acquisitions

Credits: 3. Contact Hours: Lecture 3.

Prereq: FIN 3100 and FIN 3200 and (STAT 3260 or STAT 3410)

An advanced investments class that focuses on alternative investments. Topics include techniques for valuing public and private firms, venture capital finance, investment banking, private equity finance, leveraged buyouts, hedge funds, the structure and financing of mergers and acquisitions, and divestitures. (Typically Offered: Spring)

FIN 4430X: Introduction to Mathematical Finance

(Cross-listed with MATH 4430X).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 2650 and (MATH 2070 or MATH 3170)

Mathematics of financial engineering. Topics covered will include arbitrage principles, Capital Asset Pricing Model (CAPM) model and portfolio theory, futures and options contracts, and binomial asset pricing model. Introduction to some continuous time models, stochastic processes, and the Black-Scholes partial differential equation (PDE). Some background in differential equations (MATH 2660 or MATH 2670) is recommended. (Typically Offered: Spring)

FIN 4450: Bank Management Decisions

Credits: 3. Contact Hours: Lecture 3.

Prereq: FIN 3100 or FIN 3200 or FIN 3300 or ECON 3530

Analysis of operations of depository financial institutions from management viewpoint. Emphasis on evaluating performance, policy formation, asset and liability management, the role of capital, and the operating environment. (Typically Offered: Fall, Spring)

FIN 4500: Analytical Methods in Finance

Credits: 3. Contact Hours: Lecture 3.

Prereq: (STAT 3260 or STAT 3410) and (FIN 3010 or ECON 3010)

Applied empirical methods commonly employed in the analysis of firm and market data. Specific applications to financial and agricultural markets. Experiential learning experience using lectures with frequent in-class computer work sessions. Experience with financial and agricultural data sources. Application and interpretation of empirical techniques. (Typically Offered: Fall, Spring)

FIN 4550: Risk Modeling

Credits: 3. Contact Hours: Lecture 3.

Prereq: (FIN 3010 or MATH 2400); (STAT 3260 or STAT 3410)

Introduction to predictive modeling and business analytics in the finance and insurance industry. Basic statistical/computing skills, analytical thinking, and business acumen. Develop practical data analytic skills based on building real analytic applications on real data. (Typically Offered: Fall, Spring)

FIN 4560: Financial Modeling

Credits: 3. Contact Hours: Lecture 3.

Prereq: ACCT 2850 and FIN 3010 and (STAT 3260 or STAT 3410)

Applying computers to business applications especially using Excel in finance related work.

FIN 4620: Corporate Risk Management and Insurance

Credits: 3. Contact Hours: Lecture 3.

Prereq: FIN 3100

Analysis of an organization's approaches to the management of price, credit, and pure risk. Emphasis on the consideration and selection of risk control and financing treatments and the decision making framework underlying the alternatives selected. Covers commercial insurance, self-insurance, and alternative financing arrangements. (Typically Offered: Fall)

FIN 4720: Real Estate Finance

Credits: 3. Contact Hours: Lecture 3.

Prereq: FIN 3010 and (STAT 3260 or STAT 3410)

Introduction to the techniques of assessing the value of real estate and real estate financing instruments.

FIN 4740: Real Estate Investment

Credits: 3. Contact Hours: Lecture 3.

Prereq: (FIN 3710 or FIN 4270 or FIN 4720) and (STAT 3260 or STAT 3410)

Introduction to theories and methods of investment analysis applied to real estate. Studies cash flow analysis, alternative measures of investment performance, the impact of the financing decision on real estate investment risks and return, and various real estate financing techniques. Covers cases involving more complex financing and capital markets tools used in real estate. (Typically Offered: Fall, Spring)

FIN 4800: International Finance

Credits: 3. Contact Hours: Lecture 3.

Prereq: FIN 3100, FIN 3200 or FIN 3300

Advanced study of currency market equilibrium, use and analysis of currency derivatives, hedging currency risk, and additional topics, which could include multinational capital budgeting, taxation, raising capital internationally, international portfolio diversification, international capital market equilibrium, political and country risk, financing international trade, multinational corporate treasury management, and current issues. (Typically Offered: Fall, Spring)

FIN 4900: Independent Study

Credits: 1-3. Repeatable.

*Prereq: Instructor Permission for Course***FIN 4910: International Study Course in Global Capital Markets**

Credits: 3.

European capital markets and multinational corporate finance with focus on banking, capital markets, and corporate finance in a particular European country. Exposure to European capital markets, the European Monetary Union and the banking system. Current and historical banking practices within the EU and how they changed since the EMU implementation. Understand financial decisions faced by firms located in the EU. Study banks, institutions, and companies in Europe to gain specific knowledge of their practices. Learn about the culture and general economy of Europe during the in country visit. (Typically Offered: Spring)

FIN 4920: Case Studies in Strategic Financial Decision-Making

Credits: 1. Contact Hours: Lecture 1.

Prereq: FIN 3100 and FIN 3200

Case based study of situations where companies need to strategically use equity financing. Focus on equity financing decisions at the different phases of a company's lifecycle, from raising private equity, to going public, to making significant acquisitions. Will also consider issues such as investor activism, governance, regulatory and valuation impact. Multiple guest speakers who are actively engaged in private equity and investment banking. (Typically Offered: Fall)

Courses primarily for graduate students, open to qualified undergraduates:

FIN 5010: Financial Valuation and Corporate Financial Decisions

Credits: 3. Contact Hours: Lecture 3.

Prereq: Ivy College of Business graduate student or Engineering Management student or instructor permission

Shareholder wealth maximization as the goal of the firm within a social responsibility context, financial Math, valuation of securities, the global financial market place as the test of value, estimation of cost of capital, global capital investment decisions, capital structure policy, working capital management.

FIN 5100: Advanced Corporate Finance

Credits: 3. Contact Hours: Lecture 3.

Prereq: FIN 5010 or Permission of Instructor

Examines corporate financial decisions, including theory and associated empirical evidence. Topics include agency conflicts, corporate governance, executive compensation, becoming publicly traded, raising capital through public and private offerings, capital structure, financial distress and bankruptcy, leasing, dividend policy, corporate control, restructuring, and risk management.

FIN 5150: Case Studies in Financial Decision Making

Credits: 3. Contact Hours: Lecture 3.

Prereq: FIN 5010 or Permission of Instructor

This course focuses on case studies to develop an integrated set of financial decisions. Topic areas include fixed asset, working capital, capital structure, dividend and merger/acquisition decisions. The objective of the course is to examine different firm settings and establish a framework within which to apply financial tools.

FIN 5200: Investments

Credits: 3. Contact Hours: Lecture 3.

Prereq: FIN 5010 or Permission of Instructor

Analysis of risk and return for individual securities and portfolios of securities. Topics include the market environment, mechanics of trading, measurement of return and risk, valuation of stocks and bonds, mutual funds, optimal asset allocation, market efficiency, portfolio performance evaluation, and risk management.

FIN 5260: Advanced Quantitative Investment Analysis

Credits: 3. Contact Hours: Lecture 3.

Prereq: FIN 5200 or Permission of Instructor

Study of the use of advanced statistical and machine learning techniques in the practice of portfolio construction. Topics include regularization and tree-based investment techniques, characteristic-based and trend-following investing, and multivariate GARCH analysis. Provides essential analytics training needed for quantitative investment management.

FIN 5280: Advanced Fixed Income Analysis and Portfolio Management
(Dual-listed with FIN 4280).

Credits: 3. Contact Hours: Lecture 3.

Prereq: FIN 4270

Advanced analysis of fixed income markets and securities, including valuation and trading of treasury securities, corporate bonds, mortgage backed securities. Analysis of structured financial securities, including CDO, CMBS, and ABS. Analysis of active and passive investment strategies for managing fixed income portfolios. Students are required to manage a fixed income portfolio for an institutional investor. A top-down approach to portfolio management is assumed, with active bets taken on market direction, duration, yield curve, and credit spreads.

FIN 5300: Financial Analysis and Valuation

Credits: 3. Contact Hours: Lecture 3.

Prereq: FIN 5010 or Permission of Instructor

Valuation of public and private firms through analysis of financial statements and other information. Study of drivers of value creation, industry analysis, patterns of growth, models for forecasting and analyzing firm cash flows, estimating and adjusting cost of capital, alternative methods of cash flow valuation, the calculation and use of valuation multiples, and valuing mergers and acquisitions.

FIN 5320: Financial Markets and the Economy

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Exploration of the structure and integration of financial and product markets in the United States. Focus on the operation and function of U.S. debt and equity markets, and the linkages between financial markets and the real economy. Topics include inflation, interest rates, the banking system, the conduct and impact of monetary policy, the development and function of stock markets, and the impact of changes in the cost and availability of external finance on corporate decision-making. Graduation Restriction: Students cannot use both ECON 5320 and FIN 5320 toward their degrees.

FIN 5340: Financial Derivatives

Credits: 3. Contact Hours: Lecture 3.

Prereq: FIN 5010 or graduate classification

An applied course in derivative markets. Topics covered include futures and options markets, option pricing, swaps, use and rating of insurance products, and alternative forms of reinsurance. Emphasis will be placed on agricultural commodity markets, but energy, interest, currency and stock index contracts will also be covered. (Typically Offered: Fall)

FIN 5350: Venture Capital, Private Equity, and Mergers and Acquisitions

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: FIN 5010 or Permission of Instructor

Advanced investments class focusing on alternative investments. Topics include the nature and scope of investment banking, techniques for valuing public and private firms, venture capital finance, private equity finance, leveraged buyouts, hedge funds, the structure and financing of mergers and acquisitions, and divestitures.

FIN 5410: Analytics in Finance

(Cross-listed with MIS 5410).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BUSAD 5020

Introduction to Business Analytics (BA) in finance and the insurance industry. The concepts and tools discussed in this course, to be followed and complemented by more advanced courses in the area. Basic analytical thinking and business acumen focusing on applications from finance and insurance. Practical data analytic skills based on building real analytic applications on real data. (Typically Offered: Spring)

FIN 5500: Financial Econometrics

Credits: 3. Contact Hours: Lecture 3.

Prereq: FIN 5010

Analysis, modeling, and forecasting of time series data, volatility modeling and forecasting, maximum likelihood estimation, robust standard error computation, specification testing, estimation under alternative distributional assumptions, and Monte Carlo simulation. Applications include tests of asset pricing models, analysis of asset volatility, corporate event studies, and value at risk analysis.

FIN 5560: Advanced Financial Modeling

Credits: 3. Contact Hours: Lecture 3.

Prereq: FIN 5010

Applying computers to business applications, especially using Excel to solve advanced finance related problems. (Typically Offered: Spring)

FIN 5640: Advanced Derivatives and Risk Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: FIN 5010; FIN 5340

Risk management tools and how they are applied within financial institutions and the corporate enterprise. Focus on measuring exposure to stock market risk, interest rate risk, currency risk, and credit risk and how these exposures may be managed. Topics include bank risk management regulations, volatility modeling, value at risk analysis, extreme value theory, credit default swaps, and portfolio simulation.

FIN 5720: Real Estate Finance

Credits: 3. Contact Hours: Lecture 3.

Prereq: Ivy College of Business Graduate Student or instructor permission

Survey of techniques for assessing the value of real estate assets. Introduction to real estate financing instruments, their use and appropriateness.

FIN 5740: Real Estate Investment

Credits: 3. Contact Hours: Lecture 3.

Prereq: FIN 5010; Ivy College of Business graduate student or instructor permission

Introduction to theories and methods of investment analysis applied to real estate. Designed as second course in the sequence of real estate finance and investments. Basics of income-producing properties, the valuations of those properties using pro-forma, risk management and various other issues about the finance and investment of income-producing properties. Study of analysis of sustainable real estate development from capital budgeting perspective. Discussion of the financing practices in real estate and land development.

FIN 5750: Real Estate Securitization and Portfolio Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: FIN 5010; Ivy College of Business graduate student or instructor permission

Mechanics, incentives and importance of securitization in firms' efforts to raise capital with application to residential and commercial real estate. Design and implementation of portfolio management strategies of private-market real estate investments. Additional topics include devising alpha strategies, approaches to diversification, creating investment plans to achieve different risk profiles and performance measurement and analysis.

FIN 5760: Real Estate Market Analysis

Credits: 3. Contact Hours: Lecture 3.

Prereq: Ivy College of Business Graduate Student or instructor permission

Introduction to the structure of real estate markets. Topics include determinants of supply and demand in space and capital markets, house price dynamics and causes and consequences of market cycles. Discussion of likely behavior of U.S. real estate markets and comparisons with markets in other countries.

FIN 5780: MRED Capstone Project

(Cross-listed with CRP 5780).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Enrollment in Master of Real Estate Development

Refinement of students' problem-solving, communication and negotiation skills. Students work on an actual case. Teams will apply knowledge acquired in the classroom to some aspect of a current development on-the-ground and in-process project.

FIN 5900: Special Topics

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

For students wishing to do individual research in a particular area of finance. (Typically Offered: Fall)

Courses for graduate students:

FIN 6050: Advanced Regression Analysis for Business PhD Students

Credits: 3. Contact Hours: Lecture 3.

Prereq: Ivy College of Business PhD student or instructor permission

Understand how to apply regression analysis, with applications in business research. Focus on applying the theory to analyze data that suffer from problems which make classical Ordinary Least Squares (OLS) regression inappropriate. Emphasis on analyzing market and firm level data to test hypotheses in business research. Required analysis of business data that are characterized by violations of the ideal conditions behind OLS, including data with autocorrelated or heteroskedastic errors, multicollinearity, endogeneity, qualitative (dummy) variables, seemingly unrelated regressions, and panel data. (Typically Offered: Fall)

FIN 6100: Corporate Finance

Credits: 3. Contact Hours: Lecture 3.

Prereq: Ivy College of Business PhD student or instructor permission

Empirical aspects of corporate finance research as well as the underlying theory. Topics include agency theory, corporate governance, raising capital, capital structure theory and evidence, dividend theory and signaling models, financial distress, and corporate control. (Typically Offered: Fall)

FIN 6150: Empirical Corporate Finance Research

Credits: 3. Contact Hours: Lecture 3.

Prereq: Ivy College of Business PhD student or instructor permission

Focus on understanding major paradigms in the corporate finance literature, and applying the methodologies used in empirical corporate finance research. Students will be exposed to the most impactful papers in empirical corporate finance, with a focus on recent publications in the top finance journals. Students will also master the various econometric techniques that are used to analyze corporate finance data. Topics include capital structure decisions, investment policy, liquidity management, corporate governance, mergers and acquisitions, and innovation.

FIN 6250: Empirical Asset Pricing Research

Credits: 3. Contact Hours: Lecture 3.

Prereq: Ivy College of Business PhD student or instructor permission

Focus on understanding the major paradigms in the asset pricing literature, and applying the methodologies used in empirical asset pricing research. Students will be exposed to the most impactful papers published over the years, as well as more recent work. Students will also master various currently used econometric techniques for analyzing financial data. Topics include tests of market efficiency and return predictability that reveal the numerous asset pricing anomalies, behavioral finance, how information is diffused into asset prices, limits of arbitrage, and market microstructure issues. (Typically Offered: Fall)

FIN 6500: Seminar in Empirical Finance

Credits: 3. Contact Hours: Lecture 3.

Prereq: Ivy College of Business PhD student or instructor permission

Issues in empirical financial economics including Identification of causal effects, evolution of research streams, development of new research questions, critical usage of archival data and replication of published results. (Typically Offered: Spring)

FIN 6600: Research Practicum I

Credits: 1.

Prereq: Ivy College of Business PhD student or instructor permission

Preparation of a research manuscript to be submitted to a peer-reviewed academic journal. Students will work with a faculty mentor on a research project. Offered on a satisfactory-fail basis only. (Typically Offered: Summer)

FIN 6610: Research Practicum II

Credits: 1.

Prereq: Ivy College of Business PhD student or instructor permission

Preparation of a second research manuscript to be submitted to a peer-reviewed academic journal. Although students work under the supervision of a faculty mentor, the students will take independent responsibility for the research project. Offered on a satisfactory-fail basis only. (Typically Offered: Summer)

Food Science and Human Nutrition (FSHN)

Courses primarily for undergraduates:

FSHN 1010: Food and the Consumer

Credits: 3. Contact Hours: Lecture 3.

The food system from point of harvest to the consumption of the food by the consumer. Properties of food constituents. Protection of food against deterioration and microbial contamination. Introduction of foods into the marketplace. Processes for making various foods. Government regulations. Use of food additives. Current and controversial topics. High school biology and chemistry or 3 credits of college level biology and chemistry recommended. (Typically Offered: Fall, Spring, Summer)

FSHN 1020: Nutrition for Sport Performance

Credits: 1. Contact Hours: Lecture 1.

A scientific evaluation of dietary needs, dietary supplementation, and pop-culture claims relative to physical/sport performance. Discussion of safe and effective practices to enhance physical/sport performance. (Typically Offered: Fall, Spring)

FSHN 1040: Introduction to Professional Skills in Culinary Science

Credits: 2.

Prereq: Major in CUFSA or CUFSH or Culinary Science minor

Introduction to culinary science. Students will develop fundamental culinary skills by arranged on-campus work experience (100 hours). Sessions with instructor arranged. (Typically Offered: Spring)

FSHN 1100: Professional and Educational Preparation

Credits: 1. Contact Hours: Lecture 1.

Introduction to professional and educational development within the food science and human nutrition disciplines. Focus is on university and career acclimation as well as enhancement of communication skills. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

FSHN 1150: Food Preparation Laboratory

Credits: 1. Contact Hours: Laboratory 3.

Prereq: (Credit or enrollment in FSHN 1010 OR FSHN 1110 OR FSHN 2140) AND Major in DIET, FCEDS, HSPM, NS, PDEX

Practice standard methods of food preparation with emphasis on quality, nutrient retention, and safety. (Typically Offered: Fall, Spring)

FSHN 1200: The Biochemistry of Beer

(Cross-listed with BBMB 1200).

Credits: 2. Contact Hours: Lecture 2.

An introduction to the major classes of biomolecules, basic biochemical concepts, enzymology, metabolism and genetic engineering as they apply to the production and flavor of beer. All aspects of the biochemistry of beer will be covered, including the malting of barley, starch conversion, yeast fermentation and the chemical changes that occur during the aging of beer. Intended for non-majors. (Typically Offered: Fall)

FSHN 1200L: Biochemistry of Beer Laboratory

(Cross-listed with BBMB 1200L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Credit or enrollment in BBMB 1200

An introduction to biochemical methods related to the production of beer. Laboratory exercises related to water chemistry, mash enzymology, hop compound extraction and analysis, and yeast biology will be performed. Closely follows the material being taught in BBMB 1200. Graduation Restriction: Natural science majors are limited to elective credit only. (Typically Offered: Fall)

FSHN 1670: Introductory Human Nutrition and Health

Credits: 3. Contact Hours: Lecture 3.

Understanding and implementing present day knowledge of nutrition. The role of nutrition in the health and well being of the individual and family. High school biology or 3 credits of biology recommended. (Typically Offered: Fall, Spring, Summer)

FSHN 2020X: Food Literacy through Film

Credits: 1. Contact Hours: Lecture 1.

An introduction to food literacy using systems thinking. Exploration of movies and documentaries to identify how one's food choices can support personal health, community, and the environment. Development of skills to assess potential bias of multi-media messages. (Typically Offered: Fall)

FSHN 2030: Contemporary Issues in Food Science and Human Nutrition

Credits: 1. Contact Hours: Lecture 1.

Introduction to presentation of published research and discussion of current issues in food science and human nutrition. Emphasis on sources of credible information, ethics, and communication. (Typically Offered: Fall, Spring)

FSHN 2070: Processing of Foods: Basic Principles and Applications

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: FSHN 1010

Lecture and lab-based instruction on principles of food processing and packaging. Food product-based discussion and activities will highlight raw food materials; unit operations; food quality and safety; processing plant sanitation; food forming and extrusion; fermentation; properties and selection of packaging materials. (Typically Offered: Spring)

FSHN 2140: Scientific Study of Food

Credits: 3. Contact Hours: Lecture 3.

Prereq: FSHN 1670 or FSHN 2650; CHEM 2310 or CHEM 3310; plus concurrent enrollment in FSHN 1150 or 2150

Composition and structure of foods. Principles of preparation of standard quality food products. Behavior and interactions of food constituents. (Typically Offered: Fall, Spring)

FSHN 2150: Advanced Food Preparation Laboratory

Credits: 2. Contact Hours: Laboratory 6.

Prereq: Credit or enrollment in FSHN 2140

Practice standard methods of food preparation with emphasis on quality, nutrient retention, and safety. Development of culinary skills and advanced food preparation. (Typically Offered: Fall, Spring)

FSHN 2200: American Food and Culture

Credits: 3. Contact Hours: Lecture 3.

American cuisine reflects the history of the U.S. It is the unique blend of diverse groups of people from around the world, including indigenous Native American Indians, Africans, Asians, Europeans, Pacific Islanders, and South Americans. Explore factors that impact the American Cuisine of today including diverse ethnic and cultural group influences, historical events related to food diversity in the U.S., and agriculture and industrial impacts on food production. Practical knowledge and basic food preparation techniques related to the U.S. food system and trends. Class sessions will include lectures, class discussions and Tasting Immersion activities. (Typically Offered: Fall, Spring)

FSHN 2410: Introduction to Manufacturing Processes for Plastics

(Cross-listed with TSM 2410).

Credits: 2. Contact Hours: Lecture 1, Laboratory 2.

Prereq: MATH 1450 or higher.

A study of selected materials and related processes used in plastics manufacturing. Lecture and laboratory activities focus on materials, properties, and processes. (Typically Offered: Fall, Spring)

FSHN 2420: The US Food System

Credits: 3. Contact Hours: Lecture 3.

Exploration of the components of our food system including production, processing, and access. A systems approach is used to evaluate the social, environmental, and nutrition/health implications of the US food system. Controversial topics related to how food is produced, processed, marketed and consumed will be discussed. (Typically Offered: Spring)

FSHN 2650: Metabolism, Nutrition and Health

Credits: 3. Contact Hours: Lecture 3.

Prereq: FSHN 1670 AND (credit or enrollment in BBMB 2210, BBMB 3010, or BBMB 3160)

Fundamentals of nutrient metabolism and nutrient requirements. Role of macronutrient metabolism in physical performance and disease prevention. Effect of manipulation of macronutrient metabolism on physical performance and disease prevention. Applications of nutrient metabolism principles to dietary recommendations and planning. Current enrollment in 3000-level BBMB recommended. (Typically Offered: Spring, Summer)

FSHN 2670: Clinical Perspectives on Nutrition

Credits: 1. Contact Hours: Lecture 1.

Through case scenarios presented by practicing physicians and other health care professionals of various specializations, students will gain appreciation for the actual clinical impact of nutrition on health and disease. Through interactions with clinicians, students will learn about the current and future status of health care.

FSHN 2760: Grape and Wine Science

(Cross-listed with HORT 2760).

Credits: 3. Contact Hours: Lecture 4.

An introduction to viticulture (grape growing) and enology (wine making) to increase understanding of the science, including grape biology, chemistry, sensory of grape production and winemaking. Knowledge and the practical applications of grape growing and winemaking will be emphasized. No wine tasting. High school biology and chemistry or 3 credits of college biology and chemistry recommended.

FSHN 3010: Nutrigenomics: From Basic Science to Translational Impact

Credits: 1. Contact Hours: Lecture 2.

Introduction to the concepts of nutrigenomics and nutrigenetics and how it affects consumers of food, as well as the implications for human diseases. The potential impact of personalized nutrition and full genome sequencing on health maintenance, chronic disease prevention, and the ethical implications of this knowledge will be explored. (Typically Offered: Fall)

FSHN 3050: Food Quality Management and Control

Credits: 2. Contact Hours: Lecture 2.

Prereq: 3 credits in statistics

Fundamentals of statistical decision-making processes and quality control procedures used in food quality assurance programs. (Typically Offered: Spring)

FSHN 3110: Food Chemistry

Credits: 3. Contact Hours: Lecture 3.

Prereq: (CHEM 2310 or CHEM 3310); ENGL 2500

The structure, properties, and chemistry of food constituents and animal and plant commodities. Credit or enrollment in BBMB course 3000 or higher recommended. (Typically Offered: Fall)

FSHN 3110L: Food Chemistry Laboratory

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Credit or concurrent enrollment in FSHN 3110

The laboratory practices of structure, properties, and chemistry of food constituents. (Typically Offered: Fall)

FSHN 3140: Professional Development for Culinary Food Science and Food Science Majors

Credits: 1. Contact Hours: Lecture 1.

Prereq: Major or minor in Culinary Food Science or Food Science; Junior or senior classification.

Introduction to the roles culinary scientists and food scientists hold within industry. Discussions focused on professional and educational development and emerging issues and trends in the food industry. (Typically Offered: Fall)

FSHN 3150: Professional Skills for Culinary Food Science and Food Science Majors

Credits: 1. Contact Hours: Lecture 1.

Prereq: Major or minor in FSHN

Focus on the importance of professional skills and application of those skills to potential job situations. Professional skills include communication, team building, leadership vs. management styles, business ethics, and continual learning. Junior classification recommended. (Typically Offered: Fall)

FSHN 3200X: Taste of the Middle East and North Africa

(Cross-listed with ARABC 3200X).

Credits: 3. Contact Hours: Lecture 3.

Exploration of Middle Eastern and North African food cultures through historical, religious, and social lenses. Students will engage in discussions, presentations, and cooking demonstrations and tastings. Taught in English. (Typically Offered: Fall, Spring)

FSHN 3400: Foundations of Dietetic Practice

Credits: 2. Contact Hours: Lecture 2.

Prereq: Major in Dietetics (A or H) or Pre-Diet and Exercise; Junior classification

Introduction to the profession of dietetics and responsibilities associated with dietetic professional practice. Emphasis on exploring career options in dietetics and preparation for supervised practice and graduate school. Leadership and professional career development for the dietitian is addressed through self reflection and creation of materials for post-baccalaureate programs. Professional issues related to dietetic practice include Code of Ethics, legal credentialing and standards of professional practice, leadership and future trends in the profession. (Typically Offered: Fall)

FSHN 3420: World Food Issues: Past and Present

(Cross-listed with ENVS 3420/ AGRON 3420).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior classification

Issues associated with global agricultural and food systems including ethical, social, economic, environmental, and policy contexts. Investigation of various causes and consequences of overnutrition/ undernutrition, global health, poverty, hunger, access, and distribution. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

FSHN 3510: Introduction to Food Engineering Concepts

Credits: 3. Contact Hours: Lecture 3.

Prereq: (FSHN 2070; [MATH 1600 or MATH 1650]; [PHYS 1310 or PHYS 2310]) or Permission of Instructor

Methodology for solving problems in food processing and introduction to food engineering concepts including food properties, material and energy balances, sources of energy, thermodynamics, fluid flow, heat transfer, and mass transfer. (Typically Offered: Spring)

FSHN 3600: Advanced Nutrition and the Regulation of Metabolism in Health and Disease

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500; FSHN 2650

Physiological and biochemical basis for nutrient needs; assessment of nutrient deficiency and toxicity; examination of nutrient functions and the regulation of metabolism; nutrient-gene interactions; mechanistic role of nutrients in health and disease. 3 credits or concurrent enrollment in 3000-level or above Biochemistry recommended. 3 credits in physiology recommended. (Typically Offered: Fall)

FSHN 3610: Nutrition and Health Assessment

Credits: 2. Contact Hours: Lecture 2, Laboratory 2.

Prereq: FSHN 2650

The assessment of nutritional status in healthy individuals. Laboratory experiences in food composition and assessment of dietary intake, body composition, and biochemical indices of nutritional status. (Typically Offered: Spring)

FSHN 3620: Nutrition and Health Throughout the Lifecycle

Credits: 3. Contact Hours: Lecture 3.

Prereq: FSHN 3600; credit or enrollment in BIOL 2560 or 3350

Molecular, biochemical and physiological basis to understand the nutritional aspects of human development and aging. Nutrient needs and various disease states at each stage of human life cycle. (Typically Offered: Spring)

FSHN 3640: Nutrition and Prevention of Chronic Disease

Credits: 3. Contact Hours: Lecture 3.

Prereq: (BIOL 2560 or BIOL 3350) or enrolled in NRS major

Overview of nutrients, their functions, metabolism, food sources and optimal choices for the promotion of health and wellness. Nutrition strategies for the prevention of chronic disease, including cancer, diabetes and obesity, as they apply to individuals or the wider population will be discussed. (Typically Offered: Fall)

FSHN 3650: Obesity and Health

Credits: 3. Contact Hours: Lecture 3.

Multifactorial aspects of obesity, maintenance of healthy weight, and the relationship of weight status and chronic disease prevention. Traditional and novel nutrition and exercise theories as well as current popular diet and exercise trends will be discussed. (Typically Offered: Spring)

FSHN 3670: Medical Terminology for Health Professionals

Credits: 1. Contact Hours: Lecture 1.

An independent course focused on medical terminology, abbreviations, and simple clinical mathematical calculations. (Typically Offered: Fall, Spring, Summer)

FSHN 3730: Science and Practice of Brewing

(Cross-listed with ME 3730).

Credits: 3. Contact Hours: Lecture 1.5, Laboratory 4.5.

Introduction to brewing science and technology. Understanding the role of malts, hops, water, and yeast in production of ale and lager beers. Unit operations in brewing. Health, safety, and environmental sustainability in alcohol production and consumption. Weekly laboratory in practical aspects of beer production. (Typically Offered: Fall, Spring)

FSHN 3760X: Science and Practice of Cheesemaking

Credits: 2. Contact Hours: Lecture 2.

Science and Practice of Cheesemaking is designed to provide students with applied knowledge about milk chemistry and microbiology, sanitation, and cheesemaking. Small teams will engage in various aspects of research and development, including brainstorming, basic market research, food processing, sensory evaluation, and marketing pitches for a new cheese with beer or wine. The course culminates with an invitational culinary event, designed and executed by the students. (Typically Offered: Fall)

FSHN 3920: Food and Nutrition Services Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: HSPM 3800; HSPM 3800L

Functions and responsibilities related to the management of foodservice systems and nutrition services, including planning, marketing, human resource management, and cost accounting. Accounting recommended. Graduation Restriction: Only one of HSPM 3920 or FSHN 3920 may count toward graduation. (Typically Offered: Spring)

FSHN 4030: Food Laws and Regulations

Credits: 2. Contact Hours: Lecture 2.

Prereq: 3 credits in FSHN at 2000-level or above

History of food law in the US and the world. Relationship between policy, legislation and regulation. Introduction to primary US regulatory agencies and enforcement principles. Discussion of key laws related to food safety and nutrition. Overview of federal and independent research tools and sources of food law. (Typically Offered: Spring)

FSHN 4060: Sensory Evaluation of Food

(Dual-listed with FSHN 5060).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: FSHN 3050 and credit or enrollment in FSHN 4110; 3 credits in statistics

Sensory evaluation techniques used to evaluate the appearance, aroma, flavor, texture and acceptability of foods. Relationships between sensory and instrumental measurements of color and texture. Work independently and cooperatively (in a team) to identify sensory evaluation objectives, write hypotheses, design and conduct experiments, and analyze and interpret data. (Typically Offered: Fall)

FSHN 4070: Microbiological Safety of Foods of Animal Origins

(Dual-listed with FSHN 5070/ MICRO 5070). (Cross-listed with MICRO 4070).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MICRO 2010 or MICRO 3020

Examination of the various factors in the production of foods, from production through processing, distribution and final consumption which contribute to the overall microbiological safety of the food. Upon successful completion of this class, the student will receive both the Preventive Controls for Human Foods certificate (FDA program) and the International HACCP Alliance certificate (USDA-FSIS program). Recommended: FSHN 4200 or MICRO 4200 and one semester of Microbiology Laboratory. (Typically Offered: Fall, Spring)

FSHN 4080: Dairy Products Evaluation

Credits: 1. Contact Hours: Laboratory 3.

Gain experience in identifying quality defects in dairy products including milk, cottage cheese, cheddar cheese, strawberry yogurt, butter, and vanilla ice cream. Intensive training for the National Collegiate Dairy Products Evaluation competition and for dairy product evaluation in the food industry. (Typically Offered: Spring)

FSHN 4100: Food Analysis

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: FSHN 3110 or CHEM 2110

An introduction to the theory and application of chemical and instrumental methods for determining the constituents of food. Use of standard procedures for food analysis and food composition data bases. (Typically Offered: Fall)

FSHN 4110: Food Ingredient Interactions and Formulations

Credits: 2. Contact Hours: Lecture 1, Laboratory 3.

Prereq: FSHN 2140 or FSHN 3110

Application of food science principles to ingredient substitutions in food products. Laboratory procedures for standard formulations and instrumental evaluation, with emphasis on problem-solving and critical thinking. (Typically Offered: Fall, Spring)

FSHN 4120: Food Product Development

(Dual-listed with FSHN 5120).

Credits: 3. Contact Hours: Lecture 1, Laboratory 6.

Prereq: FSHN 4110; senior classification

Principles of developing consumer packaged food products. Application of skills gained in food chemistry, formulation, quality, sensory and processing. Emphasis on teamwork and effective communication. (Typically Offered: Spring)

FSHN 4190: Foodborne Hazards

(Cross-listed with MICRO 4190/ TOX 4190).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MICRO 2010 or MICRO 3020; 3 credits in BBMB

Pathogenesis of human microbiological foodborne infections and intoxications, principles of toxicology, major classes of toxicants in the food supply, governmental regulation of foodborne hazards. Assessed service-learning component. Offered even-numbered years. Graduation Restriction: Only one of FSHN 4190 and FSHN 5190 may count toward graduation. (Typically Offered: Spring)

FSHN 4200: Food Microbiology

(Cross-listed with MICRO 4200/ TOX 4200).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MICRO 2010 or MICRO 3020

Effects of microbial growth in foods. Methods to control, detect, and enumerate microorganisms in food and water. Foodborne infections and intoxications. (Typically Offered: Fall)

FSHN 4210: Food Microbiology Laboratory

(Cross-listed with MICRO 4210).

Credits: 3. Contact Hours: Lecture 1, Laboratory 5.

Prereq: MICRO 2010 or MICRO 3020; MICRO 2010L or MICRO 3020L. Credit or enrollment in FSHN/MICRO 4200

Standard techniques used for the microbiological examination of foods. Independent and group projects on student-generated questions in food microbiology. Emphasis on oral and written communication and group interaction. (Typically Offered: Spring)

FSHN 4300: U.S. Health Systems and Policy

(Dual-listed with FSHN 5300).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Junior, Senior, or Graduate Standing

Introduction to public policy for health care professionals. Emphasis on understanding the role of the practitioner for participating in the policy process, interpreting government policies and programs such as Medicare and Medicaid, determining reimbursement rates for eligible services, and understanding licensure and accreditation issues. Discussion and exploration of federal, state and professional policy-relevant resources. (Typically Offered: Fall, Spring)

FSHN 4350: Analysis of Food Markets

(Cross-listed with ECON 4350).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 3010 and STAT 2260

Food market analysis from an economics perspective; food markets and consumption; methods of economic analysis; food industry structure and organization; food and agriculture regulations; labeling; consumer concerns; agricultural commodity promotion. Final project required. (Typically Offered: Spring)

FSHN 4420: Food, Culture, and Sustainability

Credits: 3. Contact Hours: Lecture 2.

Prereq: Sophomore classification

Sustainable food, social, and health systems depend on positive interactions between culture, biology, and the environment. Historical and current cultural characteristics, such as common foods, meal patterns, food taboos, therapeutic uses of food, religion, immigration, and food acquisition patterns will be studied. Cultural acceptability, socio-economic equity, inclusion of diversity beyond culture, and ways to leverage healthy behaviors will be discussed. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall)

FSHN 4450: Strategies for Personal Food Waste Reduction

Credits: 1. Contact Hours: Lecture 1.

Prereq: Junior standing

In-depth analysis and discussion of economic, environmental, social, and ethical implications of food waste. Overview of personal food waste reduction strategies, food recycling/recovery, and responsible waste disposal methods. Discussion and application of advocacy tactics for the promotion of food waste reduction in local communities. (Typically Offered: Spring)

FSHN 4600: Global Nutrition, Health and Sustainability

(Dual-listed with FSHN 5600).

Credits: 3. Contact Hours: Lecture 3.

Nutrition, health, and agriculture related issues in low- and middle-income countries are discussed using the framework of the Sustainable Development Goals. Topics include malnutrition, climate change, food insecurity/famine, micronutrient deficiencies, food production, the nutrition transition, water and sanitation challenges, and chronic diseases to enhance awareness of diverse worldviews and cultural humility. Systems thinking and the interaction of culture, biology, and the environment are emphasized. Meets International Perspectives requirement. Meets International Perspectives Requirement. (Typically Offered: Spring)

FSHN 4610: Medical Nutrition and Disease I

(Dual-listed with NUTRS 5610).

Credits: 4. Contact Hours: Lecture 4.

Prereq: BIOL 2560 or BIOL 3350; FSHN 3600; FSHN 3610; FSHN 3670

Pathophysiology of selected chronic disease states and their associated medical problems. Specific attention will be directed to medical nutrition needs of patients in the treatment of each disease state to optimize nutritional status and improve health. (Typically Offered: Fall)

FSHN 4630: Community Nutrition and Health

(Dual-listed with NUTRS 5630).

Credits: 3. Contact Hours: Lecture 3.

Prereq: FSHN 3610

Dual listed with FSHN 4630. Survey of current public health nutrition problems among nutritionally vulnerable individuals and groups. Discussion of the multidimensional nature of those problems and of community programs addressing them. Grant writing as a means for funding community nutrition program development. Significant emphasis on written and oral communication at the lay and professional level. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall, Spring)

FSHN 4640: Medical Nutrition and Disease II

(Dual-listed with NUTRS 5640).

Credits: 4. Contact Hours: Lecture 4.

Prereq: FSHN 4610 or NUTRS 5610

Dual listed with FSHN 4640. Pathophysiology of selected acute and chronic disease states and their associated medical problems. Specific attention will be directed to medical nutrition needs of patients in the treatment of each disease state to optimize nutritional status and promote health. (Typically Offered: Fall, Spring, Summer)

FSHN 4660: Nutrition Counseling and Education Methods

(Dual-listed with FSHN 5660).

Credits: 3.

Prereq: FSHN 3610 and FSHN 3620

Application of counseling and learning theories with individuals and groups in community and clinical settings. Includes discussion and experience in building rapport, assessment, diagnosis, intervention, monitoring, evaluation, and documentation. Literature review of specific counseling and learning theories. (Typically Offered: Fall, Spring)

FSHN 4670: Molecular Basis of Nutrition in Disease Etiology and Health Promotion

Credits: 3. Contact Hours: Lecture 3.

Prereq: BBMB course 2000 or higher OR instructor permission

Understanding the molecular basis for the role of nutrients, nutrient-derivatives, and bioactive compounds in the development, prevention, and treatment of common diseases including diabetes, cancer, vascular disease, obesity, neurological disease, aberrant mineral metabolism, and autoimmune disease. Translating this understanding into practical approaches for improving the health of individuals and populations. Credit for FSHN 3600 suggested. (Typically Offered: Spring)

FSHN 4710: Food Processing

Credits: 3. Contact Hours: Lecture 3.

Prereq: (AE 4510 or CHE 3570 or FSHN 3510)

Principles and application of food processing using both thermal (ex., blanching, pasteurization, canning, drying, freezing, evaporation, aseptic processing, extrusion) and non-thermal (ex., high pressure, irradiation, pulsed electric field, fermentation) unit operations. Emphasis on microbial inactivation, process heat and mass balance, and numerical problem solving. (Typically Offered: Fall)

FSHN 4720: Food Processing Laboratory

Credits: 2. Contact Hours: Lecture 1, Laboratory 3.

Prereq: FSHN 4710

Hands-on and demonstration laboratory activities related to food processing principles and applications using lab and pilot-scale equipment. Laboratory experiences include important food processing operations, e.g., blanching/pasteurization, canning, freezing, drying, corn wet milling, fermentation, baking etc. Emphasis on mass balance, interpreting data, writing reports, and presentations. Occasional field trips. (Typically Offered: Spring)

FSHN 4900A: Independent Study: Dietetics

Credits: 1-6. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

Independent work in food science, nutrition, or dietetics. Graduation Restriction: A maximum of 6 credits of FSHN 4900 may be used toward graduation. (Typically Offered: Fall, Spring, Summer)

FSHN 4900B: Independent Study: Food Science

Credits: 1-6. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

Independent work in food science, nutrition, or dietetics. Graduation Restriction: A maximum of 6 credits of FSHN 4900 may be used toward graduation. (Typically Offered: Fall, Spring, Summer)

FSHN 4900C: Independent Study: Nutrition

Credits: 1-6. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

Independent work in food science, nutrition, or dietetics. Graduation Restriction: A maximum of 6 credits of FSHN 4900 may be used toward graduation. (Typically Offered: Fall, Spring, Summer)

FSHN 4900D: Independent Study: International Experience

Credits: 1-6. Repeatable, maximum of 6 credits.

Independent work in food science, nutrition, or dietetics. Graduation Restriction: A maximum of 6 credits of FSHN 4900 may be used toward graduation. (Typically Offered: Fall, Spring, Summer)

FSHN 4900E: Independent Study: Entrepreneurship

Credits: 1-6. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

Independent work in food science, nutrition, or dietetics. Graduation Restriction: A maximum of 6 credits of FSHN 4900 may be used toward graduation. (Typically Offered: Fall, Spring, Summer)

FSHN 4900H: Independent Study: Honors

Credits: 1-6. Repeatable, maximum of 6 credits.

Prereq: Permission of Instructor; Membership in the University Honors Program

Independent work in food science, nutrition, or dietetics. Graduation Restriction: A maximum of 6 credits of FSHN 4900 may be used toward graduation. (Typically Offered: Fall, Spring, Summer)

FSHN 4910A: Supervised Work Experience: Dietetics

Credits: 1-4. Repeatable, maximum of 4 credits.

Prereq: Permission of Instructor; Permission of Advisor

Supervised off-campus work experience relevant to the academic major. Graduation Restriction: No More Than 4 Credits Of FSHN 4910A,B,C May Be Applied Toward Graduation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

FSHN 4910B: Supervised Work Experience: Food Science

Credits: 1-4. Repeatable, maximum of 4 credits.

Prereq: Permission of Instructor; Permission of Advisor

Supervised off-campus work experience relevant to the academic major. Graduation Restriction: A maximum of 4 credits of FSHN 4910 may be used toward graduation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

FSHN 4910C: Supervised Work Experience: Nutrition

Credits: 1-4. Repeatable, maximum of 4 credits.

Prereq: Permission of Instructor; Permission of Advisor

Supervised off-campus work experience relevant to the academic major. Graduation Restriction: A maximum of 4 credits of FSHN 4910 may be used toward graduation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

FSHN 4910D: Supervised Work Experience: Culinary Science

Credits: 1-4. Repeatable, maximum of 4 credits.

Prereq: Permission of Instructor; Permission of Advisor

Supervised off-campus work experience relevant to the academic major. Graduation Restriction: No More Than 4 Credits Of FSHN 4910A,B,C May Be Applied Toward Graduation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

FSHN 4920: Research Concepts in Human Nutrition

Credits: 2.

Prereq: Junior standing or Permission of Instructor

Students will develop and implement research projects with faculty supervision, based on knowledge gained from nutrition, biology and chemistry courses and write a formal science paper to share the results of their research. Students will gain appreciation for independent research and experience creative and innovative aspects of nutrition research. (Typically Offered: Fall)

FSHN 4930: Food Preparation Workshop

Credits: 1-3. Repeatable, maximum of 3 credits.

Selected topics in food preparation including scientific principles, culture and culinary techniques. Variable format may include laboratory, recitation, and lecture. Offered on a satisfactory-fail basis only.

FSHN 4960A: Food Science and Human Nutrition Travel Course: International travel

(Dual-listed with FSHN 5960A).

Credits: 1-4. Repeatable.

(One credit per week traveled.) Limited enrollment. Tour and study of food industry, dietetic and nutritional agencies in different regions of the world. Pre-travel session arranged. Travel expenses paid by students. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

FSHN 4960B: Food Science and Human Nutrition Travel Course: Domestic travel

(Dual-listed with FSHN 5960B).

Credits: 1-4. Repeatable.

(One credit per week traveled.) Limited enrollment. Tour and study of food industry, dietetic and nutritional agencies in different regions of the world. Pre-travel session arranged. Travel expenses paid by students. (Typically Offered: Fall, Spring, Summer)

FSHN 4980: Cooperative Education

Credits: Required. Repeatable, maximum of 0 credits.

Prereq: Department Chair Permission for Course

Required for students completing professional work periods in a cooperative education program. Students must register prior to commencing each work period. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

FSHN 4990: Undergraduate Research

Credits: 1-6. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

Research under staff guidance. Graduation Restriction: A maximum of 6 credits of FSHN 4990 may be used toward graduation. (Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

FSHN 5060: Sensory Evaluation of Food

(Dual-listed with FSHN 4060).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: FSHN 3050 and credit or enrollment in FSHN 4110; 3 credits in statistics

Sensory evaluation techniques used to evaluate the appearance, aroma, flavor, texture and acceptability of foods. Relationships between sensory and instrumental measurements of color and texture. Work independently and cooperatively (in a team) to identify sensory evaluation objectives, write hypotheses, design and conduct experiments, and analyze and interpret data. (Typically Offered: Fall)

FSHN 5070: Microbiological Safety of Foods of Animal Origins

(Dual-listed with FSHN 4070/ MICRO 4070). (Cross-listed with MICRO 5070).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MICRO 4200 or Graduate Classification

Examination of the various factors in the production of foods, from production through processing, distribution and final consumption which contribute to the overall microbiological safety of the food. Upon successful completion of this class, the student will receive both the Preventive Controls for Human Foods certificate (FDA program) and the International HACCP Alliance certificate (USDA-FSIS program). Recommended: FSHN 4200 or MICRO 4200 and one semester of Microbiology Laboratory. (Typically Offered: Fall, Spring)

FSHN 5080: Consumer Perceptions and Nutrition Communication

Credits: 2. Contact Hours: Lecture 2.

Prereq: Acceptance in the Master of Professional Practice in Dietetics program

Examination of current consumer food and nutrition trends. Critical analysis of consumer perceptions relative to current research base. Use of various media, such as infographic, print/publication, and YouTube video) to create effective nutrition messages for consumers. Activities designed to meet accreditation standards. (Typically Offered: Fall, Spring, Summer)

FSHN 5090: Sensory Evaluation of Wines

Credits: 2. Contact Hours: Lecture 1, Laboratory 2.

Prereq: Must be at least 21 years of age; senior or graduate classification

Principles of sensory evaluation and their application to wine evaluation. Sensory testing methods such as discrimination tests, ranking, descriptive analysis and scoring of wines will be covered. Students will have the opportunity to evaluate and learn about major types and styles of wines of the world. Lab fee. (Typically Offered: Spring)

FSHN 5110: Integrated Food Science

Credits: 3. Contact Hours: Lecture 3.

Prereq: 3 credits in organic chemistry, physics, mathematics, and microbiology

Critical review of the key principles of food science and applications in the chemistry, microbiology, and processing of food. Understanding of the impact of processing on the quality of foods with respect to composition, quality and safety. (Typically Offered: Fall)

FSHN 5120: Food Product Development

(Dual-listed with FSHN 4120).

Credits: 3. Contact Hours: Lecture 1, Laboratory 6.

Prereq: FSHN 4110; senior classification

Principles of developing consumer packaged food products. Application of skills gained in food chemistry, formulation, quality, sensory and processing. Emphasis on teamwork and effective communication. (Typically Offered: Spring)

FSHN 5160: Advanced Nutrition I

Credits: 2. Contact Hours: Lecture 2.

Prereq: Acceptance in the Master of Professional Practice in Dietetics program

Examination of current literature relative to molecular, cellular, and physiologic aspects of macronutrient and micronutrient metabolism. Integration of current evidence-based information, including peer-reviewed literature, to inform nutrition practice. Activities designed to meet accreditation standards. (Typically Offered: Fall)

FSHN 5170: Gut Microbiome: Implications for Health and Diseases

(Cross-listed with ANS 5170/ MICRO 5170/ VMPM 5170).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 2-3 credits in microbiology and/or immunology.

Explore current research on gut microbiome including modern tools used to study the gut microbiome. Examine the linkages between gut microbiome and health status, diseases, and manipulation of gut microbiome to improve health. (Typically Offered: Fall)

FSHN 5180: Advanced Nutrition II

Credits: 3. Contact Hours: Lecture 3.

Prereq: Acceptance in the Master of Professional Practice in Dietetics program

Principles of research design/methods and interpreting results/statistics in the current peer-reviewed scientific literature. Critical evaluation of the evidence-base to inform nutrition practice. Activities designed to meet accreditation standards. (Typically Offered: Spring)

FSHN 5210: Microbiology of Food

Credits: 2. Contact Hours: Lecture 2.

Prereq: A course in microbiology with laboratory; enrollment IDEA Food Safety and Defense Graduate Certificate or permission of instructor

Identification, enumeration, and characterization of bacteria, yeasts, and mold associated with foods and food processing. Effects of physical and chemical agents on micro-organisms will be studied. Microbiological problems in food spoilage, food preservation, food fermentation, and food-borne disease will be discussed. (Typically Offered: Spring, Summer)

FSHN 5220: Advanced Food Microbiology and Biotechnology

Credits: 2. Contact Hours: Lecture 2.

Prereq: Enrollment in IDEA Food Safety and Defense Graduate Certificate or permission of instructor

Basic principles in biotechnology and applied food microbiology, including current topics of interest in food biotechnology. Introduction to recombinant DNA techniques and how they are applied to genetically modify microorganisms, the use of nucleic acids as tools of rapid detection of microorganisms in foods, basic enzyme immobilization and down-stream processing techniques, and regulatory aspects of food biotechnology. Offered odd-numbered years. (Typically Offered: Spring).

FSHN 5230: A Multidisciplinary Overview of Food Safety and Security

Credits: 2. Contact Hours: Lecture 2.

Prereq: A course in biology or chemistry; enrollment in IDEA Food Safety and Defense Graduate Certificate or permission of instructor

Multidisciplinary food safety and security perspectives provided by numerous subject matter experts. Topics include food safety policy, ag bioterrorism, border security, animal ID, food defense and site security, risk analysis, crisis communication, epidemiology, HACCP, and more. (Typically Offered: Fall, Summer)

FSHN 5240: Food Microbiology

Credits: 3. Contact Hours: Lecture 3.

Prereq: A course in microbiology with laboratory; enrollment IDEA Food Safety and Defense Graduate Certificate or permission of instructor

Food Microbiology looks at the nature, physiology, and interactions of microorganisms in foods. The course is an introduction to food-borne diseases, the effect of food processing systems on the microflora of foods, principles of food preservation, food spoilage, and foods produced by microorganisms. Additionally, the course looks at food plant sanitation and criteria for establishing microbial standards for food products. (Typically Offered: Fall)

FSHN 5250: Principles of HACCP

Credits: 2. Contact Hours: Lecture 2.

Prereq: Enrollment in IDEA Food Safety and Defense Graduate Certificate or permission of instructor

A comprehensive study of the Hazard Analysis and Critical Control Point System and its application in the food industry. (Typically Offered: Fall)

FSHN 5260: Ethnic Foods: Food Safety, Food Protection and Defense

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate standing; enrollment in IDEA Food Safety and Defense Graduate Certificate or permission of instructor

Understanding of the various factors that impact safety of ethnic and imported ethnic foods; knowledge about the handling, preparation, processing and storage of ethnic and imported foods and food products; science-based characterization of representative ethnic foods. (Typically Offered: Summer)

FSHN 5270: Microbiology of Fermented Foods

Credits: 2. Contact Hours: Lecture 2.

Prereq: Enrollment in IDEA Food Safety and Defense Graduate Certificate or permission of instructor

Microbiology of fermented foods covers the physiology, biochemistry, and genetics of microorganisms important in food fermentations. The course looks at how microorganisms are used in fermentations and the effects of processing and manufacturing conditions on production of fermented foods. (Typically Offered: Summer)

FSHN 5280: Food Protection and Defense-Essential Concepts

Credits: 2. Contact Hours: Lecture 2.

Prereq: Enrollment in IDEA Food Safety and Defense Graduate Certificate or permission of instructor

This course will provide students with an understanding of the principles required in a food defense program for a food manufacturing, warehousing or distribution center. The topics covered include: defining threats and aggressors; the Bioterrorism Act; food defense teams; vulnerability assessments; security programs; recall and traceability basics; security inspections; crisis management; emergency preparedness; and workplace violence. (Typically Offered: Spring)

FSHN 5290: Foodborne Toxicants

(Cross-listed with TOX 5290).

Credits: 2. Contact Hours: Lecture 2.

Mechanisms of action, metabolism, sources, remediation/detoxification, risk assessment of major foodborne toxicants of current interest, design of HACCP plans for use in food industries targeting foodborne toxicants, discussion of toxicants from a food defense perspective. Offered online only. (Typically Offered: Fall, Spring, Summer)

FSHN 5300: U.S. Health Systems and Policy

(Dual-listed with FSHN 4300).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Junior, Senior, or Graduate Standing

Introduction to public policy for health care professionals. Emphasis on understanding the role of the practitioner for participating in the policy process, interpreting government policies and programs such as Medicare and Medicaid, determining reimbursement rates for eligible services, and understanding licensure and accreditation issues. Discussion and exploration of federal, state and professional policy-relevant resources. (Typically Offered: Fall, Spring)

FSHN 5330: Diet and Integrative Therapies for Prevention and Treatment of Diseases

Credits: 2. Contact Hours: Lecture 2.

Prereq: Acceptance in the Master of Professional Practice in Dietetics program

Explore the role of specific nutrients, dietary bioactive compounds and integrative therapies on disease prevention and treatment. Activities designed to meet accreditation standards. (Typically Offered: Fall)

FSHN 5370: Leadership and Management in Dietetics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Acceptance in the Master of Professional Practice in Dietetics program

Application of leadership and management theories and approaches relevant to dietetics practice. Use of self-reflection and self-assessment to assist in recognition and development of leadership behaviors. Activities designed to meet accreditation standards. (Typically Offered: Summer)

FSHN 5380: Advanced Medical Nutrition Therapy

Credits: 3. Contact Hours: Lecture 3.

Prereq: Acceptance in the Master of Professional Practice in Dietetics program

Medical Nutrition Therapy for complex medical problems utilizing the scope and standards of dietetics practice, Nutrition Care Process, and practice-specific resources such as the Standards of Professional Performance. Evidence-based practice will be integrated into each topic. Capstone project. Activities designed to meet accreditation standards. (Typically Offered: Spring)

FSHN 5420A: Introduction to Molecular Biology Techniques: DNA Techniques

(Cross-listed with BMS 5420A/ EEOB 5420A/ BBMB 5420A/ GDCB 5420A/ HORT 5420A/ NREM 5420A/ NUTRS 5420A/ VDPAM 5420A/ VMPM 5420A).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes genetic engineering procedures, sequencing, PCR, and genotyping. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

FSHN 5420B: Introduction to Molecular Biology Techniques: Protein

(Cross-listed with BMS 5420B/ EEOB 5420B/ BBMB 5420B/ GDCB 5420B/ HORT 5420B/ NREM 5420B/ NUTRS 5420B/ VDPAM 5420B).

Credits: 1. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. Offered on a satisfactory-fail basis only. (Typically Offered: Spring, Summer)

FSHN 5420C: Introduction to Molecular Biology Techniques: Cell Techniques

(Cross-listed with BMS 5420C/ EEOB 5420C/ BBMB 5420C/ GDCB 5420C/ HORT 5420C/ NREM 5420C/ NUTRS 5420C/ VMPM 5420C/ VDPAM 5420C).

Credits: 1. Contact Hours: Laboratory 2.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. Includes biology techniques and related procedures. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

FSHN 5420D: Introduction to Molecular Biology Techniques: Plant Transformation

(Cross-listed with BMS 5420D/ EEOB 5420D/ BBMB 5420D/ GDCB 5420D/ HORT 5420D/ NREM 5420D/ NUTRS 5420D/ VMPM 5420D/ VDPAM 5420D).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: Agrobacterium and particle gun-mediated transformation of tobacco, Arabidopsis, and maize, and analysis of transformants. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

FSHN 5420E: Introduction to Molecular Biology Techniques: Proteomics

(Cross-listed with BMS 5420E/ EEOB 5420E/ BBMB 5420E/ GDCB 5420E/ HORT 5420E/ NREM 5420E/ NUTRS 5420E/ VMPM 5420E/ VDPAM 5420E).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: two-dimensional electrophoresis, laser scanning, mass spectrometry, and database searching. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

FSHN 5420F: Introduction to Molecular Biology Techniques:**Metabolomics**

(Cross-listed with BMS 5420F/ EEOB 5420F/ BBMB 5420F/ GDCB 5420F/ HORT 5420F/ NREM 5420F/ NUTRS 5420F/ VMPM 5420F/ VDPAM 5420F).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: metabolomics and the techniques involved in metabolite profiling. For non-chemistry majoring students who are seeking analytical aspects into their biological research projects. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

FSHN 5420G: Introduction to Molecular Biology Techniques: Genomic

(Cross-listed with BMS 5420G/ EEOB 5420G/ BBMB 5420G/ GDCB 5420G/ HORT 5420G/ NREM 5420G/ NUTRS 5420G/ VMPM 5420G/ VDPAM 5420G).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

FSHN 5540: Supervised Experience in Food Systems Management

Credits: 3.

Prereq: Acceptance in the Master of Professional Practice in Dietetics program

Combined supervised practice experiential and didactic learning course. Students demonstrate their competence of food service and management principles to ensure safe and efficient delivery of food and water to various populations; implement change management principles and demonstrate leadership in a variety of organizational settings. Experiences and course-related activities designed to meet accreditation standards. Capstone project. (Typically Offered: Summer)

FSHN 5550: Supervised Experience in Community Nutrition

Credits: 3.

Prereq: Acceptance in the Master of Professional Practice in Dietetics program

Combined supervised practice experiential and didactic learning course. Application of systems thinking and principles of sustainable, resilient, and healthy food and water systems to identify and assess nutrition problems in the community, design, implement and evaluate effectiveness of programs, and demonstrate competence in the relationship between policy, food, nutrition, health, and the environment. Experiences and course-related activities designed to meet accreditation standards. (Typically Offered: Fall)

FSHN 5560: Supervised Experience in Medical Nutrition Therapy

Credits: 5.

Prereq: Acceptance in the Master of Professional Practice in Dietetics program

Combined supervised practice experiential and didactic learning course. The Nutrition Care Process will be implemented in various populations, conditions and settings. Two weeks of staff relief at the end of the rotation. Experiences and course-related activities are designed to meet accreditation standards. (Typically Offered: Spring)

FSHN 5600: Global Nutrition, Health and Sustainability

(Dual-listed with FSHN 4600).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Nutrition, health, and agriculture related issues in low- and middle-income countries are discussed using the framework of the Sustainable Development Goals. Topics include malnutrition, climate change, food insecurity/famine, micronutrient deficiencies, food production, the nutrition transition, water and sanitation challenges, and chronic diseases to enhance awareness of diverse worldviews and cultural humility. Systems thinking and the interaction of culture, biology, and the environment are emphasized. Meets International Perspectives requirement. (Typically Offered: Spring)

FSHN 5620: Advanced Nutrition Assessment

Credits: 4. Contact Hours: Lecture 4.

Prereq: Acceptance in the Master of Professional Practice in Dietetics program

Overview and practical applications of methods for assessing nutritional status, including: theoretical framework of nutritional health and disease, dietary intake, biochemical indices, nutrition focused physical exam and body composition across the lifecycle. Activities designed to meet accreditation standards. (Typically Offered: Fall)

FSHN 5660: Nutrition Counseling and Education Methods

(Dual-listed with FSHN 4660).

Credits: 3.

Prereq: FSHN 3610 and FSHN 3620

Application of counseling and learning theories with individuals and groups in community and clinical settings. Includes discussion and experience in building rapport, assessment, diagnosis, intervention, monitoring, evaluation, and documentation. Literature review of specific counseling and learning theories. (Typically Offered: Fall)

FSHN 5680X: Foundations of Sustainable, Resilient, and Healthy Food Systems

Credits: 3. Contact Hours: Lecture 3.

Prereq: FSHN 1670 or FSHN 2420

Critically analyze current and future nutrition, health, and policy issues in the US food system using a systems-based approach. Controversial topics influencing multiple sectors of the US food system will be discussed. Identify pathways forward for local and regional food system transformation and propose community-based solutions. . (Typically Offered: Fall)

FSHN 5690X: Food Disconnected - What We Eat Matters

Credits: 3. Contact Hours: Lecture 3.

Prereq: FSHN 1670; Credit or concurrent enrollment in FSHN 5680X

Our food systems are at a crossroad and sustainability is a pressing need. In this course, students will apply a systems-based approach to critically evaluate food production and processing challenges in the US food system using domestic and global case studies. We will consider how food production can be done in environmentally friendly way and reflect on whether consumers can play a role through their food choices. Finally, students will enhance their knowledge regarding food literacy and the ability to apply skills to engage in enterprises that can transform current food systems. (Typically Offered: Fall)

FSHN 5700: Sustainable and Healthy Eating Patterns

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate classification

Utilize a systems-based approach to consider health implications, economic considerations, environmental impacts, and sociocultural wellbeing to comprehensively explore sustainable diets. Evaluate benefits and challenges of transitioning to sustainable diets in the context of current and future food systems. Address the role of food environments, connect dietary guidelines to sustainability issues, and identify how sustainable diets fit in the context of global environmental goals. Food systems frameworks and models will be applied to evaluate the sustainability of select foods and eating patterns at the local and global level. (Typically Offered: Spring)

FSHN 5750: Processed Foods

Credits: 3. Contact Hours: Lecture 3.

Prereq: FSHN 2140 or FSHN 3110; A course in nutrition

This course will examine effect of industrial and domestic food processing on the nutrient content of food and risk of developing chronic disease. Offered odd-numbered years. (Typically Offered: Spring).

FSHN 5890: Systems Neuroscience: Brain, Behavior, and Nutrition-Related Integrative Physiology

(Cross-listed with NUTRS 5890/ GERON 5890/ NEURO 5890/ PSYCH 5890).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Qualified Undergraduate with Permission of Instructor

Structural, functional, and biochemical aspects of brain and non-motor behavior across the human lifespan. Types of neuroimaging used to assess the brain. Current research is leveraged to gauge how nutrition, diseases related to nutrition, and associated physiological processes influence the brain, particularly for common developmental, psychological, and neurological disorders. (Typically Offered: Spring)

FSHN 5900A: Special Topics: Nutrition

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

FSHN 5900B: Special Topics: Food Science

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

FSHN 5900C: Special Topics: Teaching

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

FSHN 5960A: Food Science and Human Nutrition Travel Course: International Travel

(Dual-listed with FSHN 4960A).

Credits: 1-4. Repeatable.

(One credit per week traveled.) Limited enrollment. Tour and study of food industry, dietetic and nutritional agencies in different regions of the world. Pre-travel session arranged. Travel expenses paid by students. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

FSHN 5960B: Food Science and Human Nutrition Travel Course:

Domestic travel

(Dual-listed with FSHN 4960B).

Credits: 1-4. Repeatable.

Prereq: Instructor Permission for Course

(One credit per week traveled.) Limited enrollment. Tour and study of food industry, dietetic and nutritional agencies in different regions of the world. Pre-travel session arranged. Travel expenses paid by students.

(Typically Offered: Fall, Spring, Summer)

FSHN 5990: Creative Component

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Nonthesis option only. (Typically Offered: Fall, Spring, Summer)

Courses for graduate students:

FSHN 6060: Advanced Food Analysis and Instrumentation

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: FSHN 3110 or FSHN 4100 or FSHN 5110 or equivalent

Instrumental methods for measuring chemical and physical properties of foods, food quality and functionality. Techniques for methods development, sample preparation, optimization of operating conditions, and data analysis needed to obtain accurate, reproducible results by means of instrumentation. Offered even-numbered years. (Typically Offered: Fall). .

FSHN 6110: Advanced Food Processing

Credits: 3. Contact Hours: Lecture 3.

Recent advances in the science and technology of food processing and preservation; examples include both thermal and non-thermal processes, including cold plasma, nanotechnology, and extrusion. Advances in extraction and separation technologies, by-product utilization, and sustainability in food processing industry will also be discussed. Students to research on select topics and present. Offered odd-numbered years. (Typically Offered: Fall).

FSHN 6120: Advanced Food Chemistry

Credits: 3. Contact Hours: Lecture 3.

Prereq: FSHN 3110 or FSHN 4110 or FSHN 5110 or BBMB 4040 or equivalent

Structure, chemical and physical properties of lipids, proteins and carbohydrates, and their food and industrial applications. Changes in functionalities during processing and storage. Offered even-numbered years. (Typically Offered: Spring).

FSHN 6260: Advanced Food Microbiology

(Cross-listed with MICRO 6260/ TOX 6260).

Credits: 3. Contact Hours: Lecture 3.

Prereq: FSHN 4200 or FSHN 4210 or FSHN 5040

Topics of current interest in food microbiology, including new foodborne pathogens, rapid identification methods, effect of food properties and new preservation techniques on microbial growth, and mode of action of antimicrobials. Offered odd-numbered years. (Typically Offered: Spring)

FSHN 6530: Food and Agricultural Traceability

Credits: 3. Contact Hours: Lecture 3.

Prereq: Enrollment in the Ivy Executive MBA program within the Ivy College of Business

Current issues and concepts of food and agricultural product traceability in the U.S., from production to consumption. Food types, microbial agents of concern, adulterants, disease investigations, risk analysis, risk mitigation, prevention and regulatory policy and advocacy. Travel to Washington, D.C. (Typically Offered: Fall)

FSHN 6810: Seminar

Credits: 1. Contact Hours: Lecture 1.

Repeatable, maximum of 2 credits.

Presentation of thesis or dissertation research. Must be taken once for each graduate program; once for the M.S. program and once for the Ph.D. program. Offered on a satisfactory-fail basis only. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

FSHN 6820: Research Presentation and Discussion

Credits: 0. Contact Hours: Lecture 1.

Repeatable.

Development of presentation skills and critical thinking skills through the presentation and discussion of research within student's discipline. Required each semester for all FSHN graduate students. . Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

FSHN 6900: Special Problems

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

FSHN 6950: Grant Proposal Writing

(Cross-listed with NUTRS 6950).

Credits: 1. Contact Hours: Lecture 1.

Prereq: 3 credits of graduate course work in food science or nutritional sciences

Grant proposal preparation experiences including writing and critiquing of proposals and budget planning. Understanding the grant funding process from federal, foundation, and commodity agencies. Includes preparing a grant for possible submission and participation in the review of proposals. Discussion of the role of successful grant writing in career development. (Typically Offered: Fall, Spring)

FSHN 6990: Research in Food Science and Technology

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

Forestry (FOR)

Courses primarily for undergraduates:

FOR 2010: Forest Biology

Credits: 2. Contact Hours: Lecture 2.

Prereq: Concurrent enrollment in FOR 2020, FOR 2030, FOR 2040, FOR 2050, and FOR 2060

Discussion of ecological concepts, individual tree structure and growth, variation and diversity in tree populations. Physical environment of trees and forests, ecological processes in forest communities, and introduction to different regional forest communities. (Typically Offered: Fall)

FOR 2020: Sustainable Materials: Wood Utilization

Credits: 2. Contact Hours: Lecture 2.

Prereq: Concurrent enrollment in FOR 2010, FOR 2030, FOR 2040, FOR 2050, and FOR 2060.

Basis for use of wood as an industrial raw material for lumber, composites, pulp and paper, energy and chemicals. Implications of use of alternative renewable and non-renewable materials for societal infrastructure and consumer goods. (Typically Offered: Fall)

FOR 2030: Resource Measurements/Evaluation

Credits: 2. Contact Hours: Lecture 2.

Prereq: Concurrent enrollment in FOR 2010, FOR 2020, FOR 2040, FOR 2050, and FOR 2060; MATH 1400

Survey techniques involved in quantification, valuation, and evaluation of tree and stand growth and other variables in the forest environment (e.g., recreational use, wildlife habitat value, biomass, and solid wood). (Typically Offered: Fall)

FOR 2040: Forest Ecosystem Decision-Making

Credits: 2. Contact Hours: Lecture 2.

Prereq: Concurrent enrollment in FOR 2010, FOR 2020, FOR 2030, FOR 2050, and FOR 2060

Methods of decision-making related to forest ecosystems including communications, teams and conflict resolution. Current issues relating to public, private, and urban forests; quantification of processes, services, and goods produced by the forest and expected by the public such as wildlife, water, range, recreation, wilderness, biodiversity, as well as wood and fiber products. (Typically Offered: Fall)

FOR 2050: Integrated Forestry Laboratory

Credits: 3. Contact Hours: Laboratory 8.

Prereq: Credit or concurrent enrollment in FOR 2010, FOR 2020, FOR 2030, FOR 2040, and FOR 2060

Field and laboratory exercises integrating the evaluation and management of forest goods, services, and the processing of wood products. (Typically Offered: Fall)

FOR 2060: Fall Forestry Camp

Credits: 4.

Prereq: Credit or concurrent enrollment in FOR 2010, FOR 2020, FOR 2030, FOR 2040, and FOR 2050

Three-week field camp to address topics and issues covered in 2010, 2020, 2030, 2040, and 2050. (Typically Offered: Fall)

FOR 2800: Wood Properties and Identification

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Properties of wood and how they relate to its successful use. Comparative anatomical characteristics, scientific nomenclature, and hand lens identification of commercially important North American woods. (Typically Offered: Spring)

FOR 2830: Pesticide Application Certification

(Cross-listed with AGRON 2830/ ENT 2830/ HORT 2830).

Credits: 2. Contact Hours: Lecture 2.

Core background and specialty topics in agricultural, and horticultural pesticide applicator certification. Students can select certification categories and have the opportunity to obtain pesticide applicator certification at the completion of the course. Commercial pesticide applicator certification is emphasized. (Typically Offered: Spring)

FOR 2900A: Special Problems: Leadership in Forestry Teams (LIFT) Learning Community

Credits: 1-4. Repeatable.

Prereq: Freshman or Sophomore classification, permission of instructor
Offered on a satisfactory-fail basis only.

FOR 2900B: Special Problems: Forest Ecosystem Management

Credits: 1-4. Repeatable.

Prereq: Freshman or Sophomore classification, permission of instructor

Offered on a satisfactory-fail basis only.

FOR 2900C: Special Problems: Natural Resource Conservation

Credits: 1-4. Repeatable.

Prereq: Freshman or Sophomore classification, permission of instructor

Offered on a satisfactory-fail basis only.

FOR 2900D: Special Problems: Urban and Community Forestry

Credits: 1-4. Repeatable.

Prereq: Freshman or Sophomore classification, permission of instructor

Offered on a satisfactory-fail basis only.

FOR 2900E: Special Problems: Wood Science and Technology

Credits: 1-4. Repeatable.

Prereq: Freshman or Sophomore classification, permission of instructor

Offered on a satisfactory-fail basis only.

FOR 3020: Silviculture

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: FOR 2010 or NREM 3010 or AECL 3120

Manipulation of forest vegetation based on ecological principles for the production of goods and services. (Typically Offered: Spring)

FOR 3560: Dendrology

(Cross-listed with BIOL 3560).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: BIOL 2110

Identification and ecology of North American woody plant species. Importance of woody plants in timber production and wildlife habitat. Historical conditions of North American forest regions will also be addressed. (Typically Offered: Fall)

FOR 3580: Forest Herbaceous Layer: Ecology and Identification.

Credits: 1.

Survey of the major plant families, general, and representative species of the forest herbaceous layer. Functional ecology and restoration. (Typically Offered: Spring)

FOR 4160: Forest Insects and Diseases

(Cross-listed with PLP 4160).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Nature of insects and pathogens of forest and shade trees; their role in the dynamics of natural and managed forest ecosystems; and the management of indigenous and exotic pests. Laboratory experience working with insect and fungal pests of trees. (Typically Offered: Fall)

FOR 4420: Dynamics of Forest Stands

(Dual-listed with FOR 5420).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: FOR 3020; NREM 3010; (STAT 1010 or STAT 1040)

Change in forest species composition and structure at the stand and landscape scales resulting from site quality, tree growth, competition, succession, and disturbance. Methods for assessing tree growth and reconstructing past stand development. Applications to forest and savanna management. Offered even-numbered years. (Typically Offered: Fall)

FOR 4510: Forest Resource Economics and Quantitative Methods

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: FOR 2030

Application of economic principles to forest resource management considering both market and non-market goods and services. Methods of identifying and specifying problems in the management and use of forest resources. Application of mathematical and statistical models to the solution of managerial problems. (Typically Offered: Spring)

FOR 4520: Ecosystem Management: Integrating Ecology, Society, and Policy

(Dual-listed with FOR 5520/ NREM 5520). (Cross-listed with NREM 4520).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Junior or Senior classification; (NREM 1200 or BIOL 1730)

Principles of planning, regulating, and decision-making associated with public and private lands, with consideration of forest, grassland, wetland, and freshwater aquatic ecosystems. Integrated natural resources management within ecological, social, economic and policy constraints. (Typically Offered: Spring)

FOR 4540: Forestry Practicum

Credits: 3. Contact Hours: Lecture 1, Laboratory 4.

Prereq: Senior classification

Integrated decision-making related to the conservation, management, and preservation of private and public forests, wildlands, urban/ community forests, and/or the production and utilization of wood products. Student teams work with a client and develop management plans that incorporate ecological, social, economic, ethical, and institutional/political factors. Effective teamwork, written/oral/visual communication, and problem-solving stressed. Multiple trips to project site and client. (Typically Offered: Spring)

FOR 4750: Urban Forestry

(Cross-listed with HORT 4750).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Junior or senior classification, 3 credits in BIOL

Discussion of establishment and management of woody perennials in community-owned urban greenspaces, consideration of urban site and soil characteristics, plant physiology, plant culture, urban forest valuation, inventory methods, species selection, and urban forest maintenance (health care and pest management). (Typically Offered: Fall)

Courses primarily for graduate students, open to qualified undergraduates:

FOR 5420: Dynamics of Forest Stands

(Dual-listed with FOR 4420).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Change in forest species composition and structure at the stand and landscape scales resulting from site quality, tree growth, competition, succession, and disturbance. Methods for assessing tree growth and reconstructing past stand development. Applications to forest and savanna management. Offered even-numbered years. (Typically Offered: Fall)

FOR 5520: Ecosystem Management: Integrating Ecology, Society, and Policy

(Dual-listed with FOR 4520/ NREM 4520). (Cross-listed with NREM 5520).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Principles of planning, regulating, and decision-making associated with public and private lands, with consideration of forest, grassland, wetland, and freshwater aquatic ecosystems. Integrated natural resources management within ecological, social, economic and policy constraints. (Typically Offered: Spring)

FOR 5990A: Creative Component: Forest Biology

Credits: 1-12. Repeatable, maximum of 12 credits.

Prereq: Instructor Permission for Course

Offered on a satisfactory-fail basis only.

FOR 5990B: Creative Component: Forest Biometry

Credits: 1-12. Repeatable, maximum of 12 credits.

Prereq: Instructor Permission for Course

Offered on a satisfactory-fail basis only.

FOR 5990C: Creative Component: Forest and Recreation Economics

Credits: 1-12. Repeatable, maximum of 12 credits.

Prereq: Instructor Permission for Course

Offered on a satisfactory-fail basis only.

FOR 5990D: Creative Component: Forest Management and Administration

Credits: 1-12. Repeatable, maximum of 12 credits.

Prereq: Instructor Permission for Course

Offered on a satisfactory-fail basis only.

FOR 5990E: Creative Component: Wood Science

Credits: 1-12. Repeatable, maximum of 12 credits.

Prereq: Graduate Standing or Permission of Instructor

Offered on a satisfactory-fail basis only.

Courses for graduate students:

FOR 6960: Research Seminar

(Cross-listed with AGRON 6960/ BBMB 6960/ PLBIO 6960/ GDCB 6960/ HORT 6960).

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Research seminars by faculty and graduate students. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

FOR 6990A: Research: Forest Biology - Wood Science

Credits: 1-12. Repeatable, maximum of 12 credits.

Prereq: Instructor Permission for Course

Offered on a satisfactory-fail basis only.

FOR 6990B: Research: Forest Biometry

Credits: 1-12. Repeatable, maximum of 12 credits.

Prereq: Instructor Permission for Course

Offered on a satisfactory-fail basis only.

FOR 6990C: Research: Forest Economics

Credits: 1-12. Repeatable, maximum of 12 credits.

Prereq: Instructor Permission for Course

Offered on a satisfactory-fail basis only.

FOR 6990D: Research: Forest Management and Administration

Credits: 1-12. Repeatable, maximum of 12 credits.

Prereq: Instructor Permission for Course

Offered on a satisfactory-fail basis only.

FOR 6990E: Research: Wood Science

Credits: 1-12. Repeatable, maximum of 12 credits.

Offered on a satisfactory-fail basis only.

FOR 6990F: Research: Plant Physiology

Credits: 1-12. Repeatable, maximum of 12 credits.

Prereq: Instructor Permission for Course

Offered on a satisfactory-fail basis only.

French (FRNCH)

Courses primarily for undergraduates:

FRNCH 1010: Elementary French I

Credits: 4. Contact Hours: Lecture 4.

Beginning level development of reading, writing, listening comprehension, and speaking in French, within the context of French culture. (Typically Offered: Fall, Summer)

FRNCH 1020: Elementary French II

Credits: 4. Contact Hours: Lecture 4.

Prereq: FRNCH 1010

Beginning level development of reading, writing, listening comprehension, and speaking in French, within the context of French culture. Graduation Restriction: A student may apply either FRNCH 1010 and 1020 or FRNCH 1070 to graduation. Meets International Perspectives Requirement. (Typically Offered: Spring, Summer)

FRNCH 1070: Intensive Beginning French

Credits: 4. Contact Hours: Lecture 4.

An accelerated introduction to reading, writing, listening comprehension, and speaking in French, within the context of Francophone cultures around the world. This course is the equivalent of FRNCH 1010 and 1020. Graduation Restrictions: A Student may apply either FRNCH 1010 and 1020 or FRNCH 1070 to graduation. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

FRNCH 2010: Intermediate French I

Credits: 4. Contact Hours: Lecture 4.

Prereq: FRNCH 1020

Intermediate level development of reading, writing, listening comprehension, and speaking in French within the context of French culture. Meets International Perspectives Requirement. (Typically Offered: Fall)

FRNCH 2020: Intermediate French II

Credits: 4. Contact Hours: Lecture 4.

Prereq: FRNCH 2010

Intermediate level development of reading, writing, listening comprehension, and speaking in French within the context of French culture. Meets International Perspectives Requirement. (Typically Offered: Spring)

FRNCH 2030: Intermediate French Grammar and Conversation

Credits: 4. Contact Hours: Lecture 4.

Prereq: FRNCH 2010

Practice in oral communication within the context of French language and cultures for professions. Best-suited for students with a solid foundation in basic French grammar. Graduation Restriction: Only one of FRNCH 2020 or 2030 may count toward graduation.

FRNCH 2370X: French and Francophone Animation

(Cross-listed with ARTH 2370X/ WFS 2370X).

Credits: 3. Contact Hours: Lecture 3.

Survey of French and Francophone cinematic animation and introduction to the principles of motion and French and Francophone decorative arts. Emphasis on interdisciplinary practices. (Typically Offered: Fall, Spring)

FRNCH 3001X: French Culture Through Cuisine

Credits: 3. Contact Hours: Lecture 3.

Introduction to French and Francophone cultures through cuisine. Emphasis on cross-cultural competence via inter-disciplinary approaches and topics. Taught in English, but basic French language pertinent to dining à la française will be taught. (Typically Offered: Fall, Spring)

FRNCH 3010: Language, Culture, Contexts

Credits: 3. Contact Hours: Lecture 3.

Prereq: FRNCH 2020

Emphasis on developing language proficiency and skills in reading and writing. Selective review of grammar within the context of cultural and literary prose. Meets International Perspectives Requirement. (Typically Offered: Fall)

FRNCH 3020: Text and Media Analysis

Credits: 3. Contact Hours: Lecture 3.

Prereq: FRNCH 3010

Readings in French prose, theater and poetry. Introduction to close reading and analysis. Development of reading and writing skills for upper-level courses. Meets International Perspectives Requirement.

FRNCH 3040: French for Global Professionals

Credits: 3. Contact Hours: Lecture 3.

Prereq: FRNCH 2020

Communication in business and professional contexts in French-speaking countries. Development of effective communication strategies and project management in the workplace. Cultural contexts of business and professional practice. Emphasis on working across French-American cultures. Preparation for internships. Meets International Perspectives Requirement.

FRNCH 3050: French Conversation

Credits: 3. Contact Hours: Lecture 3.

Prereq: Concurrent enrollment in FRNCH 3010

Intensive conversational and listening practice emphasizing contemporary France and the Francophone world. Native or near-native speakers are not eligible to enroll. Meets International Perspectives Requirement.

FRNCH 3100: French Pronunciation

Credits: 1. Contact Hours: Lecture 1.

Prereq: Concurrent enrollment in FRNCH 2020

Practice and theory of correct pronunciation of sounds in French. Correlation between sound and spelling in French. Relationship between pronunciation and grammar.

FRNCH 3200: France Today

Credits: 3. Contact Hours: Lecture 3.

Prereq: FRNCH 2020

Selected topics dealing with contemporary French society and culture. Meets International Perspectives Requirement.

FRNCH 3260: French and Francophone Film

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: FRNCH 3010

In-depth study of a selected filmmaker, genre, or movement. Emphasis on analytical interpretation and relationship between film and French or Francophone culture, history, and society. Counts toward World Film Studies Minor. Meets International Perspectives Requirement.

FRNCH 3400: Cultural Expressions in the French-Speaking World

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Credit or concurrent enrollment in FRNCH 3020

Cultural approaches to selected topics, genres, movements, or voices in French language, literatures, and media. Emphasis on close reading and discussion. Meets International Perspectives Requirement.

FRNCH 3700: French Studies in English

Credits: 3-4. Repeatable.

Author, genre, or period study in French or Francophone history, literature, or culture. Three credits: readings, discussions and papers in English; open to all students. Four credits: required for French concentration credit, supplementary readings and written course work in French. For enrollment in fourth credit, 6 credits in FRNCH at 3000-level. Meets International Perspectives Requirement.

FRNCH 3700F: Studies in English Translation: French Topics on Women and Gender Studies

(Cross-listed with WGS 3700F).

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Topics vary according to faculty interest. Readings, discussions, and papers in English. Meets International Perspectives Requirement.

FRNCH 3750: Francophone Studies in English

Credits: 3-4. Contact Hours: Lecture 4.

Repeatable.

Author, genre, period study, or contemporary topics in Francophone history, literature, politics, or culture. Readings, discussions, and papers in English. Required for French concentration credit (4th credit), supplementary readings and written course work in French. For enrollment in fourth credit, 6 credits in FRNCH at 3000-level. Meets International Perspectives Requirement.

FRNCH 3780: French Cinema

Credits: 3-4. Repeatable.

Analysis and interpretation of film in French society. Topics vary according to faculty interest. Film directors, genres, movements (e.g. The New Wave), historical survey, aesthetics, and cinematography. Three credits: readings, discussions and papers in English; open to all students. Four credits: required for French concentration credit, supplementary readings and written course work in French. Counts toward World Film Studies Minor. For enrollment in fourth credit, 6 credits in FRNCH at 3000-level. Meets International Perspectives Requirement.

FRNCH 3950: Study Abroad

Credits: 1-10. Repeatable.

Prereq: 12 credits in FRNCH

Formal class instruction at level appropriate to the student's training, augmented by practical living experience. Meets International Perspectives Requirement. (Typically Offered: Summer)

FRNCH 4400: Seminar in French and/or Francophone Studies

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: FRNCH 3400

Seminar in French and/or Francophone literatures, civilizations, or cultural studies. Topics vary according to faculty interest. Meets International Perspectives Requirement.

FRNCH 4760: French Culture and Society in English

Credits: 3-4. Contact Hours: Lecture 3.

Repeatable.

Key moments and themes in French society and culture up to the modern era. Subjects vary according to faculty interest. Readings, discussions, and papers in English. Meets International Perspectives Requirement.

FRNCH 4900: Independent Study

Credits: 1-6. Repeatable, maximum of 9 credits.

Prereq: Department Chair Permission for Course

Designed to meet the needs of students who wish to focus on areas other than those in which courses are offered. Graduation Restriction: No more than 9 credits in FRNCH 4900 may be counted toward graduation.

FRNCH 4990: Internship in French

Credits: 1-3. Repeatable, maximum of 3 credits.

Prereq: 9 credits of French at the 3000 level; permission of advisor and WLC Internship Coordinator

Work experience using French language skills in the public or private sector, combined with academic work under faculty supervision.

Graduation Restriction: No more than 3 credits of FRNCH 4990 may be applied to the major. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

FRNCH 5900A: Special Topics in French: Literature or Literary Criticism

Credits: 2-4. Repeatable.

Prereq: Permission of instructor; 6 credits of 4000 level French

FRNCH 5900B: Special Topics in French: Linguistics

Credits: 2-4. Repeatable.

Prereq: Permission of instructor; 6 credits of 4000 level French

FRNCH 5900C: Special Topics in French: Language Pedagogy

Credits: 2-4. Repeatable.

Prereq: Permission of instructor; 6 credits of 4000 level French

FRNCH 5900D: Special Topics in French: Civilization

Credits: 2-4. Repeatable.

Prereq: Permission of instructor; 6 credits of 4000 level French

Genetics (GEN)

Courses primarily for undergraduates:

GEN 1100: Genetics Orientation

Credits: 1. Contact Hours: Lecture 1.

This course is intended for first year students and others new to the genetics major. Discussion of university policies and resources, requirements of the major, career opportunities, and other topics related to the first-year experience. Graduation Restriction: Only one of GEN 1100 or 1120 may count toward graduation. (Typically Offered: Fall)

GEN 1120: Genetics Orientation for Transfer Students

Credits: 0.5. Contact Hours: Lecture 0.5.

Eight-week course for external transfer students and internal change of major students. Discussion of university policies and resources, requirements of the major, and career opportunities. Graduation Restriction: Only one of GEN 1100 or 1120 may count toward graduation. (Typically Offered: Spring)

GEN 1130X: Exploring Possibilities in Life Sciences

(Cross-listed with BIOL 1130X).

Credits: 1. Contact Hours: Lecture 1.

Seminar focusing on introducing students to life science fields and careers. Explores interdisciplinary career paths and guidance on strategies for success in achieving career goals. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

GEN 1140X: Experiential Learning and Explorations in Life Sciences

(Cross-listed with BIOL 1140X).

Credits: 1.

A second year experiential learning course focused on careers in life science fields. Sections offer themed learning allowing students to choose an immersive experience in an area of interest. Sections utilize hands-on engagement, field trips to on- and off-campus locations, and small group discussions with speakers working in different life science careers. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

GEN 2980: Cooperative Education

Credits: Required.

Prereq: Permission of the department cooperative education coordinator; sophomore classification

Required of all cooperative education students. Students must register for this course prior to commencing each work period. (Typically Offered: Fall, Spring, Summer)

GEN 2990X: Introduction to Undergraduate Research

(Cross-listed with BIOL 2990X).

Credits: 1-2.

Prereq: Instructor Permission for Course

Identify a research opportunity on campus and conduct guided research under the supervision. (Typically Offered: Fall, Spring, Summer)

GEN 3130: Principles of Genetics

(Cross-listed with BIOL 3130).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2110 and BIOL 2120

Introduction to the principles of transmission and molecular genetics of plants, animals, and bacteria. Recombination, structure and replication of DNA, gene expression, cloning, quantitative genetics, and population genetics. Graduation Restriction: Students may receive graduation credit for no more than one of the following: GEN 2600, GEN 3130 and 3130L, GEN 3200, BIOL 3130 and 3130L, and AGRON 3200. (Typically Offered: Fall, Spring, Summer)

GEN 3130L: Genetics Laboratory

(Cross-listed with BIOL 3130L).

Credits: 1. Contact Hours: Laboratory 4.

Prereq: Credit or enrollment in BIOL 3130

Laboratory to accompany 3130. Graduation Restriction: Students may receive graduation credit for no more than one of the following: BIOL 3130 and 3130L, GEN 2600, GEN 3130, GEN 3200, and AGRON 3200. (Typically Offered: Fall, Spring)

GEN 3200: Genetics, Agriculture and Biotechnology

(Cross-listed with AGRON 3200).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2110 or BIOL 2120 or BIOL 2510

Transmission and molecular genetics with an emphasis on applications in agriculture, the structure and expression of the gene, how genes behave in populations and how recombinant DNA technology can be used to improve agriculture. Graduation Restriction: Credit for graduation will not be allowed for more than one of the following: GEN 2600, 3130, 3200 and BIOL 3130 and 3130L. (Typically Offered: Fall, Spring)

GEN 3220: Introduction to Bioinformatics and Computational Biology

(Cross-listed with BIOL 3220/ BC BIO 3220).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2120

Genome sequencing, assembly, structural and functional annotation, and comparative genomics. Investigating these topics will develop skills in programming and scripting (Perl and/or Python), the use of biological databases, sequence alignment, similarity search, identification of sequence patterns, construction of phylogenetic trees, and comparative genomics. (Typically Offered: Fall)

GEN 3400: Human Genetics

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 3130 or GEN 3130

Fundamental concepts and current issues of human genetics. Human chromosome analysis, pedigree analysis, gene mapping, the human genome project, sex determination, genetics of the immune system, genetics of cancer, gene therapy, the genetic basis of human diversity, eugenics. (Typically Offered: Fall, Spring)

GEN 3490: The Genome Perspective in Biology

(Cross-listed with BIOL 3490).

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: GEN 3130 or GEN 3200

Analysis of genome, RNA, and protein data using computer technology to answer biological questions on topics ranging from microbial diversity to human health. An introduction for students in the life sciences to the fields of genomics, bioinformatics and systems. (Typically Offered: Spring)

GEN 3510: Principles of Domestic Animal Genetics

(Cross-listed with ANS 3510).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2120; STAT 1010 or STAT 1040

Foundation of genetics, genomics, and statistical concepts in domestic animal populations. Graduation Restriction: Only one of ANS 3510, BIOL/GEN 3130, and GEN 3200 may count toward graduation. (Typically Offered: Fall)

GEN 3980: Cooperative Education

Credits: Required.

Prereq: Permission of Department Cooperative Education Coordinator; Junior classification

Required of all cooperative education students. Students must register for this course prior to commencing each work period. (Typically Offered: Fall, Spring, Summer)

GEN 4010: Bioinformatics of Sequences

(Cross-listed with BIOL 4010/ COMS 4010/ BC BIO 4010).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BC BIO 3220; (COMS 1270 OR COMS 2270); (MATH 1600 or MATH 1650); (MATH 1660 or STAT 3010); (STAT 1010 or STAT 1040 or STAT 3300) or Permission of Instructor

Application of computer science and statistics to molecular biology with a significant problem-solving component, including hands-on programming using Python to solve a variety of biological problems. String algorithms, sequence alignments, homology search, pattern discovery, genotyping, genome assembly, genome annotation, comparative genomics, protein structure. Offered odd-numbered years. (Typically Offered: Fall)

GEN 4020: Microbial Genetics and Genomics

(Dual-listed with MICRO 5020/ VMPM 5020). (Cross-listed with MICRO 4020).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 3130; MICRO 3020

The fundamental concepts of bacterial and bacteriophage genetics including mutagenesis, mechanisms of vertical and horizontal genetic information transfer and gene regulation are covered, along with genetic and genomic-based approaches to study these and other cellular processes of microorganisms. Review and discussion of research literature to examine experimental design, methodology, and interpretation of both historical and contemporary relevance to microbial genetics and genomics. Offered even-numbered years. (Typically Offered: Fall)

GEN 4060: Bioinformatics of OMICS

(Cross-listed with BIOL 4060/ COMS 4060/ BCBIO 4060).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2120

Introduction to cutting edge OMICS analyses including transcriptome, proteome, metabolome, DNA-protein interactome, protein-protein interactome and methylome. Genomic analysis including transcriptome analysis, cancer genomics, comparative genomics, and regulatory network analysis. (Typically Offered: Spring)

GEN 4090: Molecular Genetics

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 3130 or GEN 3130

Principles of molecular genetics and analysis of gene expression, including elements of the Central Dogma (DNA replication, transcription, and translation) and gene regulation. Utilizing examples from the primary literature to illustrate experimental design, data analysis, and interpretation. (Typically Offered: Fall)

GEN 4100: Analytical Genetics

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 3130 or GEN 3130

The principles and practice of genetic analysis. Mendelian genetic analysis, mutational, transgenic, and genomic analysis of gene function, linkage and gene mapping, chromosomal aberrations, aneuploidy and polyploidy, extrachromosomal inheritance, analysis of genetic pathways. (Typically Offered: Spring)

GEN 4620: Evolutionary Genetics

(Cross-listed with BIOL 4620).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 3150

The population and quantitative genetic basis of evolutionary processes.

The role of genetic variation in natural selection and the influences of random processes on evolutionary change. The determinants of phenotype. (Typically Offered: Fall)

GEN 4900: Independent Study

Credits: 1-5. Repeatable, maximum of 9 credits.

Prereq: GEN 3130; Junior or Senior classification; Instructor Permission

Independent study in any area of genetics. Graduation Restriction: Students may use no more than 9 credits of university-wide 4900 credits (including GEN 4900) toward the total of 120 credits required for graduation.

GEN 4910: Undergraduate Seminar, Professional Practice in Genetics Disciplines

Credits: 1. Contact Hours: Lecture 1.

Prereq: Junior classification

Intended to develop career objectives and obtain positions appropriate to the goals of students, in particular juniors, in preparation for position searches in the senior year. Discussion of various career paths in genetics disciplines; identification of experiences to enhance entry to specific careers; exposure to professional practices not covered elsewhere including literature database management, scientific figure preparation for publication, the peer-review journal system, the federal competitive grants system, laboratory budgets and management, authorship and collaborations, etc.; preparation of effective curricula vitae and application letters; and verbal scientific discourse appropriate to interview interactions and other professional settings. (Typically Offered: Fall, Spring)

GEN 4920: Undergraduate Teaching Experience

Credits: 1-2. Repeatable, maximum of 9 credits.

Prereq: BIOL 2120; Junior or Senior classification; Instructor Permission

For students registering to be undergraduate laboratory or classroom assistants. Graduation Restriction: No more than 2 credits of GEN 4920 may be applied toward the Genetics advanced course requirement. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

GEN 4950: Special Topics in Genetics

Credits: 1-3. Repeatable, maximum of 3 credits.

Prereq: GEN 3130; Instructor Permission

Content varies from year to year. Graduation Restriction: Genetics students may use no more than 9 credits of university-wide 4900 - 4990 credits toward the total of 120 credits required for graduation. (Typically Offered: Fall, Spring)

GEN 4960: Attendance and Critique of Genetics Seminars

Credits: 1-3. Repeatable, maximum of 3 credits.

Prereq: GEN 3130; Junior or Senior classification; Instructor Permission

Attendance and critique of departmental seminars in BBMB, GDCB, or EEGB. Graduation Restriction: Genetics students may use no more than 9 credits of university-wide 4900 - 4990 credits toward the total of 120 credits required for graduation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

GEN 4980: Cooperative Education

Credits: Required.

Prereq: Senior classification; Department Permission

Required of all cooperative education students. Students must register for this course prior to commencing each work period. (Typically Offered: Fall, Spring, Summer)

GEN 4990: Genetics Research

Credits: 1-5. Repeatable, maximum of 9 credits.

Prereq: GEN 3130; Junior or Senior classification; Instructor Permission

Independent research in any area of genetics. Graduation Restriction: Genetics students may use no more than 9 credits of university-wide 4900 - 4990 credits toward the total of 120 credits required for graduation. (Typically Offered: Fall, Spring, Summer)

GEN 4990H: Genetics Research for Honors

Credits: 1-5. Repeatable, maximum of 9 credits.

Prereq: GEN 3130; Junior or Senior classification; Instructor Permission; Membership in the University Honors Program

Independent research in any area of genetics; for Honors students only. Graduation Restriction: Genetics students may use no more than 9 credits of university-wide 4900 - 4990 credits toward the total of 120 credits required for graduation. (Typically Offered: Fall, Spring, Summer)

Genetics (GENET)

Courses primarily for graduate students, open to qualified undergraduates:

GENET 5390: Ethics and Biological Sciences

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Introduction to Bioethics through case studies, discussion of contemporary work on central bioethics topics, and discussion of important emerging ethical issues associated with recent research or technological development. Issues covered will vary somewhat from year to year, but will include at least some of the following: ethics and responsible research practice, animal ethics and the use of animals in teaching and research, cloning, human reproductive and stem cell research, regulation of genetically modified crops and foods, plant biotechnology, gene patents. Students will be divided into groups to develop their own case study, to be presented in class at the end of the term. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

GENET 5900: Special Topics

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Contact individual faculty for special projects or topics. Graded. (Typically Offered: Fall, Spring, Summer)

GENET 5910: Workshop in Genetics

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Prereq: Instructor Permission for Course

Current topics in genetics research. Lectures by off-campus experts. Students read background literature, attend preparatory seminars, attend all lectures, meet with lecturers. (Typically Offered: Fall)

Courses for graduate students:**GENET 6900: Graduate Student Seminar in Genetics**

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Research presentations by students to improve their ability to: orally present scientific work in a clear and meaningful way, critically evaluate oral presentations, and give and receive constructive criticism. Students may enroll in one seminar per school year. (Typically Offered: Fall, Spring)

GENET 6910: Faculty Seminar in Genetics

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Faculty research seminars that introduce students to the variety of genetics research projects on campus and provide an opportunity for students to become engaged in the scientific presentation to the point where they can think critically and ask meaningful questions. (Typically Offered: Fall)

GENET 6920: Conceptual Foundations of Genetics

Credits: 1. Contact Hours: Lecture 1.

Landmark papers in the development of genetics concepts. Papers are presented and discussions led by students, guided and mentored by the instructors. Instructors provide a broad overview and history of the development of fundamental concepts in genetics. (Typically Offered: Fall)

GENET 6930: Entrepreneurship for Graduate Students in Science and Engineering

(Cross-listed with AGRON 6930/ BCB 6930/ ENGR 6930/ EE 6930/ ME 6930).

Credits: 1. Contact Hours: Lecture 3.

Repeatable, maximum of 2 credits.

Understanding key topics of starting a technology based company, from development of technology-led idea to early-stage entrepreneurial business. Concepts discussed include: entrepreneurship basics, starting a business, funding your business, protecting your technology/ business IP. Subject matter experts and successful, technology-based entrepreneurs will provide real world examples from their experience with entrepreneurship. Learn about the world class entrepreneurship ecosystem at ISU and Central Iowa. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

GENET 6970: Graduate Research Rotation

Credits: 1-30. Repeatable.

Graduate research projects performed under the supervision of selected faculty members in the graduate Genetics major. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

GENET 6990: Research

Credits: 1-30. Repeatable.

Prereq: Department Permission for Course

Research. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

Genetics, Development and Cell Biology (GDCB)

Courses primarily for graduate students, open to qualified undergraduates:

GDCB 5100: Transmission Genetics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

In-depth investigations of modern research practices of transmission genetics. Designed for students interested in genetic research. Topics include: Mendelian genetic analysis, analysis of genetic pathways, mutational analysis of gene function, chromosomal mechanics, genetic mapping, epigenetic inheritance, human genetic analysis. (Typically Offered: Fall)

GDCB 5110: Advanced Molecular Genetics

(Cross-listed with MCDB 5110).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Mechanisms of molecular genetic processes in eukaryotes and prokaryotes, including DNA replication and repair, transcription, translation and regulation of gene expression. Critical evaluation and discussion of current primary literature, methodologies and experimental data. (Typically Offered: Spring)

GDCB 5130: Plant Metabolism

(Cross-listed with PLBIO 5130).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Photosynthesis, respiration, and other aspects of plant metabolism. Offered even-numbered years. (Typically Offered: Fall)

GDCB 5280: Advances in Molecular Cell Biology

(Cross-listed with MCDB 5280).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Cell biological processes including cell signaling, cell division, intracellular trafficking, biogenesis of organelles, cell adhesion and motility. Offered even-numbered years. (Typically Offered: Fall)

GDCB 5330: Advances in Developmental Biology

(Cross-listed with MCDB 5330).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Fundamental principles in multicellular development. Emphasis on cellular and molecular regulation of developmental processes, and experimental approaches as illustrated in the current literature. Offered odd-numbered years. (Typically Offered: Fall)

GDCB 5360: Statistical Genetics

(Cross-listed with STAT 5360).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Statistical models and methods for genetics covering models of population processes: selection, mutation, migration, population structure, and linkage disequilibrium, and inference techniques: genetic mapping, linkage analysis, and quantitative trait analysis. Applications include genetic map construction, gene mapping, genome-wide association studies (GWAS), inference about population structure, phylogenetic tree construction, and forensic and paternity identification.

GDCB 5420A: Introduction to Molecular Biology Techniques: DNA Techniques

(Cross-listed with BMS 5420A/ EEOB 5420A/ FSHN 5420A/ BBMB 5420A/ HORT 5420A/ NREM 5420A/ NUTRS 5420A/ VDPAM 5420A/ VMPM 5420A).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes genetic engineering procedures, sequencing, PCR, and genotyping. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

GDCB 5420B: Introduction to Molecular Biology Techniques: Protein

(Cross-listed with BMS 5420B/ EEOB 5420B/ FSHN 5420B/ BBMB 5420B/ HORT 5420B/ NREM 5420B/ NUTRS 5420B/ VDPAM 5420B).

Credits: 1. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. Offered on a satisfactory-fail basis only. (Typically Offered: Spring, Summer)

GDCB 5420C: Introduction to Molecular Biology Techniques: Cell Techniques

(Cross-listed with BMS 5420C/ EEOB 5420C/ FSHN 5420C/ BBMB 5420C/ HORT 5420C/ NREM 5420C/ NUTRS 5420C/ VMPPM 5420C/ VDPAM 5420C).

Credits: 1. Contact Hours: Laboratory 2.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. ular biology techniques and related procedures. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

GDCB 5420D: Introduction to Molecular Biology Techniques: Plant Transformation

(Cross-listed with BMS 5420D/ EEOB 5420D/ FSHN 5420D/ BBMB 5420D/ HORT 5420D/ NREM 5420D/ NUTRS 5420D/ VMPPM 5420D/ VDPAM 5420D).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: Agrobacterium and particle gun-mediated transformation of tobacco, Arabidopsis, and maize, and analysis of tranformants. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

GDCB 5420E: Introduction to Molecular Biology Techniques: Proteomics

(Cross-listed with BMS 5420E/ EEOB 5420E/ FSHN 5420E/ BBMB 5420E/ HORT 5420E/ NREM 5420E/ NUTRS 5420E/ VMPPM 5420E/ VDPAM 5420E).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: two-dimensional electrophoresis, laser scanning, mass spectrometry, and database searching. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

GDCB 5420F: Introduction to Molecular Biology Techniques: Metabolomics

(Cross-listed with BMS 5420F/ EEOB 5420F/ FSHN 5420F/ BBMB 5420F/ HORT 5420F/ NREM 5420F/ NUTRS 5420F/ VMPPM 5420F/ VDPAM 5420F).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: metabolomics and the techniques involved in metabolite profiling. For non-chemistry majoring students who are seeking analytical aspects into their biological research projects. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

GDCB 5420G: Introduction to Molecular Biology Techniques: Genomic

(Cross-listed with BMS 5420G/ EEOB 5420G/ FSHN 5420G/ BBMB 5420G/ HORT 5420G/ NREM 5420G/ NUTRS 5420G/ VMPPM 5420G/ VDPAM 5420G).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

GDCB 5440: Fundamentals of Bioinformatics

(Cross-listed with BCB 5440/ COMS 5440/ CPRE 5440).

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

A practical, hands-on overview of how to apply bioinformatics to biological research. Recommended for biologists desiring to gain computational molecular biology skills. Topics include: sequence analysis, genomics, proteomics, phylogenetic analyses, ontology enrichment, systems biology, data visualization and emergent technologies. Offered odd-numbered years. (Typically Offered: Fall)

GDCB 5450: Plant Molecular, Cell and Developmental Biology

(Cross-listed with MCDB 5450/ PLBIO 5450).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Plant nuclear and organelle genomes; regulation of gene expression; hormone signaling; organization, function, and development of plant cells and subcellular structures; regulation of plant growth and development. Offered odd-numbered years. (Typically Offered: Fall)

GDCB 5560: Cellular, Molecular and Developmental Neuroscience

(Cross-listed with BMS 5560/ NEURO 5560).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Fundamental principles of neuroscience including cellular and molecular neuroscience, nervous system development, and regulatory systems. Offered odd-numbered years. (Typically Offered: Fall)

GDCB 5570: Rotations in Neuroscience

(Cross-listed with NEURO 5570).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Rotation experiences in various neuroscience research methods and techniques related to our current faculty specialties. (Typically Offered: Fall, Spring)

GDCB 5680: Statistical Bioinformatics

(Cross-listed with COMS 5680/ BCB 5680/ STAT 5680).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Statistical models for sequence data, including applications in genome annotation, motif discovery, variant discovery, molecular phylogeny, gene expression analysis, and metagenomics. Statistical topics include model building, inference, hypothesis testing, and simple experimental design, including for big data/complex models. (Typically Offered: Spring)

GDCB 5690: Structural Bioinformatics

(Cross-listed with BCB 5690/ COMS 5690/ CPRE 5690/ BBMB 5690).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Molecular structures including genes and gene products: protein, DNA and RNA structure. Structure determination methods, structural refinement, structure representation, comparison of structures, visualization, and modeling. Molecular and cellular structure from imaging. Analysis and prediction of protein secondary, tertiary, and higher order structure, disorder, protein-protein and protein-nucleic acid interactions, protein localization and function, bridging between molecular and cellular structures. Molecular evolution. (Typically Offered: Fall)

GDCB 5700: Systems Biology

(Cross-listed with COMS 5700/ CPRE 5700/ BCB 5700/ STAT 5700).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Algorithmic and statistical approaches in computational functional genomics and systems biology. Analysis of high throughput biological data obtained using system-wide measurements. Topological analysis, module discovery, and comparative analysis of gene and protein networks. Modeling, analysis, and inference of transcriptional regulatory networks, protein-protein interaction networks, and metabolic networks. Dynamic systems and whole-cell models. Ontology-driven, network based, and probabilistic approaches to information integration. (Typically Offered: Spring)

GDCB 5850: Fundamentals of Predictive Plant Phenomics

(Cross-listed with BCB 5850/ ME 5850).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Principles of engineering, data analysis, and plant sciences and their interplay applied to predictive plant phenomics. Transport phenomena, sensor design, image analysis, graph models, network data analysis, fundamentals of genomics and phenomics. Multidisciplinary laboratory exercises. (Typically Offered: Fall)

GDCB 5900: Special Topics

Credits: 1-30. Repeatable.

*Prereq: Instructor Permission for Course***Courses for graduate students:****GDCB 6610: Advanced Topics in Neuroscience**

(Cross-listed with BBMB 6610/ KIN 6610/ NEURO 6610).

Credits: 3. Contact Hours: Lecture 3.

Students will present three journal articles and two overview lectures on topics in neuroscience that are related but outside of their own research interest. Offered even-numbered years. (Typically Offered: Spring)

GDCB 6900: Seminar in GDCB

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Research seminars by faculty, invited speakers, and graduate students. Offered on a satisfactory-fail basis only.

GDCB 6960: Research Seminar

(Cross-listed with AGRON 6960/ BBMB 6960/ FOR 6960/ PLBIO 6960/ HORT 6960).

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Research seminars by faculty and graduate students. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

GDCB 6980: Seminar in Molecular, Cellular, and Developmental Biology

(Cross-listed with BBMB 6980/ MCDB 6980/ MICRO 6980/ VMPM 6980).

Credits: 1-2. Contact Hours: Lecture 2.

Repeatable.

Student and faculty presentations. (Typically Offered: Spring)

GDCB 6990: Research

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Research for thesis or dissertation. Offered on a satisfactory-fail basis only.

Geology (GEOL)

Courses primarily for undergraduates:**GEOL 1000: How the Earth Works**

Credits: 3. Contact Hours: Lecture 3.

How does the earth work, what is it made of, and how does it change through time? Plate tectonics, Earth materials, landforms, structures, climate, and natural resources. Emphasis on the observations and hypotheses used to interpret earth system processes. Students may also enroll in GEOL 1000L. (Typically Offered: Fall, Spring, Summer)

GEOL 1000L: How the Earth Works: Laboratory

Credits: 1. Contact Hours: Laboratory 2.

Students will gain understanding of how Earth processes affect their lives and how they affect the Earth, and of the complex nature of the Earth and its processes. They will gain a deep knowledge of the methods used to understand the time scales and rates of Earth processes also through an applied research experience on groundwater and surface water. (Typically Offered: Fall, Spring)

GEOL 1010: Environmental Geology: Earth in Crisis

(Cross-listed with ENVS 1010).

Credits: 3. Contact Hours: Lecture 3.

Exploration of the interactions between humans and the geologic environment, and the consequences of those interactions, on local to global scales. Discussion of water, soil, mineral, and energy resources, pollution, climate change, and natural hazards such as earthquakes, volcanism, mass wasting, and flooding. (Typically Offered: Fall, Spring, Summer)

GEOL 1030: Age of Dinosaurs

Credits: 1. Contact Hours: Lecture 1.

Introduction to the diversity of dinosaur species. Discussion of basic evolutionary theory and interpretation of fossil evidence. Overview of Mesozoic Earth history including paleogeographic and paleoclimate reconstructions. Course available via the World Wide Web. (Typically Offered: Fall)

GEOL 1050: Gems and Gemstones

Credits: 1. Contact Hours: Lecture 1.

Offered in second half of the semester. Introduction to gems and gemstones, physical and optical properties of gems and gemstones, explanation of where gems come from and how they are found, how to distinguish between synthetic and naturally occurring gems, how the value of gems are determined, and the history of famous gems. (Typically Offered: Fall)

GEOL 1080: Introduction to Oceanography

(Cross-listed with ENVS 1080).

Credits: 3. Contact Hours: Lecture 3.

Introduction to the study of oceans and the processes that helped shape them. A major focus is on how the oceans work, with special attention on geological, chemical, and biological processes. Ocean circulation and its influence on climate. Life of the oceans. Use and misuse of ocean resources. Anthropogenic impacts on the oceanic environment. (Typically Offered: Fall)

GEOL 1110: Geological Disasters

(Cross-listed with ENVS 1110).

Credits: 1. Contact Hours: Lecture 1.

Introduction to the catastrophic geologic processes with the potential to devastate human populations that continue to expand into regions at greatest risk from geologic hazards. Selected case studies and discussion of plate tectonics, climate, and earth processes explain the driving forces behind natural hazards such as earthquakes, tsunamis, volcanic eruptions, landslides, and floods. (Typically Offered: Fall, Spring, Summer)

GEOL 1120: Geoscience Orientation

(Cross-listed with MTEOR 1120).

Credits: 1. Contact Hours: Lecture 1.

Orientation course for students enrolled in the Earth, Wind and Fire Learning Community. Provides an introduction to Iowa State University and meteorology, geology, and Earth science programs for students enrolled in the department's learning community. Activities include academic and social activities, talks and presentations on academic success, resume writing, and study abroad, as well as research talks by faculty members. (Typically Offered: Fall)

GEOL 1130: Spring Geoscience Orientation for Earth, Wind and Fire Learning Community

(Cross-listed with MTEOR 1130).

Credits: 1. Contact Hours: Lecture 1.

Spring orientation course for students enrolled in the 'Earth, Wind and Fire' Learning Community. Develop and apply quantitative, data-analysis, management, and communication skills on an authentic research project in a team to focus on professionalism and resilience. Introduction to interview strategies and the importance of creating a professional image on social media. Academic and social events, plus two field trips. (Typically Offered: Spring)

GEOL 1400: Climate and Society

(Cross-listed with AGRON 1400/ ENVS 1400/ MTEOR 1400/ CLSCI 1400).

Credits: 3. Contact Hours: Lecture 3.

The climate system of our planet. How nature and our actions alter the existing energy balance leading to climate change. Past climates on our planet. The influence of climate on society and resource availability during the Holocene (~ 11,000 years ago to present) with focus on changes post industrial revolution. Significant climate events that have altered our way of life in the past. Projected changes in future climate and potential impacts on society, environment and resources. Adaption to and mitigation of climate change. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

GEOL 1600: Water Resources of the World

(Cross-listed with AGRON 1600/ ENVS 1600/ MTEOR 1600).

Credits: 3. Contact Hours: Lecture 3.

Study of the occurrence, history, development, and management of world water resources. Basic hydrologic principles including climate, surface water, groundwater, and water quality. Historical and current perspectives on water policy, use, and the role of water in society and the environment. Meets International Perspectives Requirement. (Typically Offered: Spring)

GEOL 2010: Geology for Engineers and Environmental Scientists

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Introduction to Earth materials and processes with emphasis on engineering and environmental applications. (Typically Offered: Fall)

GEOL 2020: History of the Earth

Credits: 3. Contact Hours: Lecture 3.

Tectonic, climate, and biological evolution of the Earth. Interactions between the three are emphasized. Students will learn methods used to decipher earth history, including reading papers and maps, introductory computer coding, and using rocks and fossils. Students majoring in geology must also enroll in GEOL 2020L. (Typically Offered: Spring)

GEOL 2020L: History of the Earth: Laboratory

Credits: 1. Contact Hours: Laboratory 2.

Prereq: Credit or enrollment in GEOL 2020

Introduction to the tools used to study Earth history. Students will gain familiarity with sketching/drawing, rock/mineral/fossil identification, reading maps, learning about geologic history, and how we use these tools to reconstruct the Earth's history. (Typically Offered: Spring)

GEOL 2900: Independent Study

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Independent study for freshman and sophomore students.

GEOL 2980: Cooperative Education

Credits: Required.

Prereq: GEOL 1000 or GEOL 2010, GEOL 1000L, GEOL 1020, GEOL 1020L; sophomore classification

Required of all cooperative education students. Students must register for this course prior to commencing the work period. (Typically Offered: Fall, Spring, Summer)

GEOL 3020: Summer Field Studies

Credits: 6.

Prereq: GEOL 1020, GEOL 3560, and GEOL 3680

Geologic mapping; structural, stratigraphic, sedimentologic, metamorphic, geomorphic, and environmental analyses. Study areas in the Bighorn Basin and Wind River Range and excursions to Yellowstone and Grand Teton National Parks. A 6-week summer field course required of all geology majors. (Typically Offered: Summer)

GEOL 3150: Mineralogy and Earth Materials

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or concurrent enrollment in CHEM 1630 or CHEM 1670 or CHEM 1770

Introduction to mineral classification, elementary crystal chemistry, crystal growth and morphology, mineral stability, and mineral associations. GEOL 1000 or GEOL 1010 or GEOL 2010 or equivalent recommended. (Typically Offered: Fall)

GEOL 3150L: Laboratory in Mineralogy and Earth Materials

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Credit or concurrent enrollment in CHEM 1630 or CHEM 1670 or CHEM 1770

Elements of mineral symmetry and hand-specimen mineral identification using physical properties. (Typically Offered: Fall)

GEOL 3160: Optical Mineralogy

Credits: 1. Contact Hours: Lecture 1, Laboratory 2.

Prereq: Credit or concurrent enrollment in CHEM 1630 or CHEM 1670 or CHEM 1770

Laboratory problems in mineral-identification methods utilizing optical microscopic techniques. GEOL 1000 or GEOL 1010 or GEOL 2010 or equivalent recommended. (Typically Offered: Fall)

GEOL 3240: Energy and the Environment

(Cross-listed with ENSCI 3240/ ENVS 3240/ MTEOR 3240).

Credits: 3. Contact Hours: Lecture 3.

Exploration of Earth's energy resources and the environmental and climatic impacts of energy acquisition and consumption. Renewable and non-renewable energy resources within an Earth-system context. Various environmentally-relevant topics such as water quality and availability, habitat destruction, greenhouse-gas emissions, and health and safety hazards to wildlife and human communities. Designed for students with a college-level understanding of chemistry and physics. (Typically Offered: Spring)

GEOL 3560: Structural Geology and Tectonics

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: (GEOL 1000 or GEOL 2010); PHYS 1310; PHYS 1310L

Principles of stress, strain, and rheology. Brittle and ductile behavior of rocks. Mechanics of formation, description, and classification of fractures, faults, folds, foliation, and lineation. From micro-structures to tectonic processes. Laboratory includes application of learned concepts to real-world scenarios, geometrical techniques to solve structural problems. (Typically Offered: Spring)

GEOL 3570: Geological Mapping and Field Methods

Credits: 1. Contact Hours: Laboratory 3.

Prereq: (GEOL 1000 or GEOL 2010); PHYS 1310; PHYS 1310L

Generation and interpretation of geological maps via a combination of laboratory and field exercises. Developing skills in 3D thinking, cross-section construction, stereonet analysis, field data collection, and communicating scientific results. (Typically Offered: Fall)

GEOL 3650: Igneous and Metamorphic Petrology

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: GEOL 3150, GEOL 3150L, and GEOL 3160

Nature and origin of igneous and metamorphic rocks. Emphasis on important rock-forming environments and processes and their influence on rock characteristics. Laboratory includes thin section study of rock textures and mineralogy and the interpretation of these features. (Typically Offered: Spring)

GEOL 3680: Sedimentary Geology

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: GEOL 1020

Exploration of the interplay between weathering, sedimentation, sea-level change, tectonics, and life through time that creates sedimentary rocks and stratigraphic packages. Understanding of the historical development of sedimentary geology through the development of petrography, paleontology, deep earth sampling, geophysical technologies, and geochemistry. Field and laboratory problem sets illuminate lecture material. (Typically Offered: Fall)

GEOL 3980: Cooperative Education

Credits: Required.

Prereq: GEOL 1000 or GEOL 2010, GEOL 1000L, GEOL 1020, GEOL 1020L and Junior classification

Required of all cooperative education students. Students must register for this course prior to commencing each work period. (Typically Offered: Fall, Spring, Summer)

GEOL 4020: Watershed Hydrology

(Dual-listed with GEOL 5020/ ENSCI 5020/ MTEOR 5020/ NREM 5020).

(Cross-listed with ENSCI 4020/ MTEOR 4020/ NREM 4020).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Examination of watersheds as systems, emphasizing the surface components of the hydrologic cycle. Combines qualitative understanding of hydrological processes and uncertainty with quantitative representation. Laboratory emphasizes field investigation and measurement of watershed processes. (Typically Offered: Fall)

GEOL 4040X: The Fossil Record

Credits: 3. Contact Hours: Laboratory 2, Lecture 2.

The fossil record is the ever-growing accumulation of scientific evidence used to understand the history of life and the co-evolution of ecosystems, environments, and climates. In this course, we will examine characteristics of the fossil record with a focus on broad-scale geological, biological, and environmental processes over the span of Earth history. Students will employ qualitative and quantitative techniques to interpret the fossil record and answer societally-relevant Earth system questions, overall increasing their scientific literacy with a deep time perspective.

GEOL 4060: Geology Field Course

Credits: 1-2. Repeatable.

Prereq: Instructor Permission for Course

Weekly seminar introduces students to a selected geological region or theme that is visited on a required ten-day field excursion. Introduction to field-safety leadership. (Typically Offered: Fall, Spring)

GEOL 4090: Field Methods in Hydrogeology

(Dual-listed with GEOL 5090/ ENSCI 5090). (Cross-listed with ENSCI 4090).

Credits: 3. Contact Hours: Laboratory 4.

Prereq: GEOL 4020/ENSCI 4020, GEOL 4110/ENSCI 4110 or CE 4730

Introduction to field methods used in groundwater investigations. In-field implementation of pumping tests, slug tests, monitoring well installation and drilling techniques, geochemical and water quality sampling, seepage meters, minipiezometers, stream gaging, and electronic instrumentation for data collection. Field trips to investigate water resource, water quality, and remediation projects. Offered even-numbered years. (Typically Offered: Summer)

GEOL 4110: Hydrogeology

(Dual-listed with GEOL 5110/ ENSCI 5110). (Cross-listed with ENSCI 4110).

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Physical principles of groundwater flow, nature and origin of aquifers and confining units, well hydraulics, groundwater modeling, and contaminant transport. Lab emphasizes applied field and laboratory methods for hydrogeological investigations. (Typically Offered: Spring)

GEOL 4120: Micropaleontology

(Dual-listed with GEOL 5120). (Cross-listed with ENSCI 4120).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: GEOL 1020 and GEOL 1020L

Evolution, identification and utility of major microfossil groups from the Mesozoic to present. Focus on Cenozoic applications including biostratigraphy, paleoclimate, and paleothermometry using assemblages, stable isotopes, Mg/Ca, and molecular fossils. Laboratory includes processing and analysis of specific microfossils. Major groups covered include foraminifera, calcareous nanofossils, sponge spicules, diatoms, radiolarians, and silicoflagellates. Offered even-numbered years.

(Typically Offered: Fall)

GEOL 4130: Applied and Environmental Geophysics

(Dual-listed with GEOL 5130/ CE 5130/ ENSCI 5130). (Cross-listed with CE 4130/ ENSCI 4130).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Seismic, gravity, magnetic, resistivity, electromagnetic, and ground-penetrating radar techniques for shallow subsurface investigations and imaging. Data interpretation methods. Lab emphasizes computer interpretation packages. Field work with seismic - and resistivity-imaging systems and radar. Introductory geology, algebra, and trigonometry recommended. Offered odd-numbered years. (Typically Offered: Spring)

GEOL 4140: Applied Groundwater Flow Modeling

(Dual-listed with GEOL 5140/ ENSCI 5140). (Cross-listed with ENSCI 4140).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: (GEOL 4110 or CE 4730); MATH 1650

Introduction to the principles of modeling groundwater flow systems. Finite-difference and analytic-element methods, spreadsheet models, boundary conditions, calibration, sensitivity analysis, parameter estimation, particle tracking, and post-audit analysis. Application of MODFLOW to regional flow-system analysis. Computer laboratory emphasizes assigned problems that illustrate topics discussed in the course. Offered even-numbered years. (Typically Offered: Spring)

GEOL 4150: Paleoclimatology

(Dual-listed with GEOL 5150/ ENSCI 5150). (Cross-listed with ENSCI 4150/ CLSCI 4150).

Credits: 3. Contact Hours: Lecture 3.

Introduction to mechanisms that drive climate, including the interplay between oceanic and atmospheric circulation and fluctuation in Earth's orbital parameters. Examination and analysis of past climate records ranging from historical documentation to ecological and geochemical proxies (e.g. tree ring analysis; O and C isotopes of skeletal carbonates and soils). Dating methods used to constrain and correlate climatic periods; utility of computer models to reconstruct past climates and predict future climate change. Emphasis placed on paleoclimatology and paleoecology of the late Quaternary (last ~1 million years). Offered even-numbered years. (Typically Offered: Fall)

GEOL 4160: Hydrologic Modeling and Analysis

(Dual-listed with GEOL 5160/ ENSCI 5160/ MTEOR 5160). (Cross-listed with ENSCI 4160/ MTEOR 4160).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Study of the basic principles of hydrologic modeling, including rainfall-runoff analysis, lumped and distributed modeling, conceptual and physical models, parameter estimation and sensitivity analysis, input and validation data, uncertainty analysis, and the use of models in surface water hydrology. A range of common models are applied to study hydrologic topics such as flood forecasting and land use change impacts. Previous experience with Matlab or other programming language is needed. Offered odd-numbered years. (Typically Offered: Spring)

GEOL 4190: Aqueous and Environmental Geochemistry

(Dual-listed with GEOL 5190/ ENSCI 5190). (Cross-listed with ENSCI 4190).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: CHEM 1780 and CHEM 1780L

Geochemistry of natural waters and water-rock interactions. Acid-base equilibria, carbonate chemistry and buffer systems, mineral dissolution and precipitation, sorption, ion exchange, and redox reactions. Introduction to thermodynamics and kinetics. Laboratory emphasizes chemical analysis of waters and computer modeling. Offered even-numbered years. (Typically Offered: Spring)

GEOL 4200: Mineral Resources

(Dual-listed with GEOL 5200).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: GEOL 3650

Geology and geochemistry of non-metallic and metallic ore deposits. Major processes that concentrate metals in the Earth. Geochemical conditions of ore formation using stable-isotope and fluid-inclusion studies. Laboratory emphasizes the study of metallic ores. Offered even-numbered years. (Typically Offered: Fall)

GEOL 4260: Stable Isotopes in the Environment

(Dual-listed with GEOL 5260/ ENSCI 5260). (Cross-listed with ENSCI 4260).

Credits: 3. Contact Hours: Lecture 3.

Introduction to the theory, methods and applications of stable isotopes. Primary focus on the origin, natural abundance, and fractionation of carbon, hydrogen, oxygen, nitrogen isotopes. Applications of isotopic occurrence for elucidation of physical, chemical, biological, and environmental processes. Effects of plant physiology, photosynthesis, trophic structure, diffusion, evaporation, chemical precipitation, soil and atmospheric processes, and environmental factors on isotope abundance. Offered odd-numbered years. (Typically Offered: Fall)

GEOL 4390: Seismic Methods in Geology, Engineering, and Petroleum Exploration

(Dual-listed with GEOL 5390/ CE 5390). (Cross-listed with CE 4390).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Physics of elastic-wave propagation. Seismic surveys in environmental imaging, engineering, and petroleum exploration. Reflection and refraction techniques. Data collection, processing, and geological interpretation. Field work with state-of-the-art equipment. Introductory geology, algebra, and trigonometry recommended. Offered even-numbered years. (Typically Offered: Spring)

GEOL 4440: Petroleum Geoscience and Engineering

(Dual-listed with GEOL 5440).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

The geoscience and engineering aspects of exploration, development, and production of hydrocarbon resources around the world, as well as the historical and legal frameworks through which the industry has developed. Broader discussions of safety, risk, uncertainty, cost, and integrity as relevant to the petroleum industry. Offered even-numbered years. (Typically Offered: Spring)

GEOL 4520: Intro GIS for Geoscientists

(Dual-listed with GEOL 5520/ AGRON 5520/ ENSCI 5520). (Cross-listed with AGRON 4520/ ENSCI 4520).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Introduction to geographic information systems (GIS) using ArcGIS Pro with particular emphasis on geoscientific data. Teaches typical GIS operations and analyses in the geosciences to prepare students for practical GIS use in industry and academia. Includes a class project for GEOL 5520. Very suitable for Juniors. GEOL 4520 can be taken as a substitute for CPR 3510 for the GIS Minor. (Typically Offered: Fall, Spring)

GEOL 4550: Stream Restoration

(Dual-listed with NREM 5550). (Cross-listed with NREM 4550).

Credits: 3. Contact Hours: Laboratory 3, Lecture 2.

Prereq: CE 3720 or GEOL 4020 or NREM 4070 or AECL 4180 or ABE 4310

Interdisciplinary introduction to the science and practice of stream restoration, with emphasis on restoring physical and biological integrity and ecosystem services to streams and riparian corridors. Offered odd-numbered years. (Typically Offered: Fall)

GEOL 4680: Applied Geostatistics for Geoscientists

(Dual-listed with GEOL 5680/ ENSCI 5680/ MTEOR 5680). (Cross-listed with ENSCI 4680/ MTEOR 4680).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: GEOL 4520; CRP 3510; CRP 4520; (NREM 3450 or NREM 4470)

Introduction to geospatial data collection, analysis, interpretation, and presentation. Geospatial techniques including geographic information systems (GIS), remote sensing (RS), and global positioning systems (GPS). Study of applied geostatistical analysis (e.g., interpolation and spatial regression). Offered even-numbered years. (Typically Offered: Fall)

GEOL 4740: Glacial and Quaternary Geology

(Dual-listed with GEOL 5740).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: GEOL 1000 or GEOL 2010

The study of glaciers, the landscapes and sediments they create, and their behavior during the Quaternary Period. Discussion of the flow of glaciers, glacial erosion and sediment transport, glacial landforms, Quaternary glacier/climate interactions, and the landscapes of Iowa. Laboratory emphasizes topographic map interpretation and local field trips. An introductory course in geology is recommended as background. Offered even-numbered years. (Typically Offered: Spring)

GEOL 4790: Surficial Processes

(Dual-listed with GEOL 5790/ ENSCI 5790). (Cross-listed with ENSCI 4790).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

The study of physical processes that shape Earth's surface. Topics include weathering, sediment transport, and landform genesis with emphasis on fluvial, glacial, hillslope, eolian, and coastal processes. Applications to engineering and environmental problems. Laboratory includes topographic map interpretation and local field trips. An introductory course in geology is recommended as background. (Typically Offered: Fall)

GEOL 4830: Environmental Biogeochemistry

(Dual-listed with ENSCI 5830). (Cross-listed with BIOL 4830/ ENSCI 4830).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Combined 12 credits in biology, chemistry, and physics

An exploration of biological, physical and geochemical impacts on the structure and function of ecosystems from local to global scales. Emphasis on the cycles of carbon, nitrogen, phosphorus, sulfur, and metals, and how these have been impacted by human activity. Topics may include biological feedbacks to climate change, microbial physiology and redox reactions, plant/soil feedbacks, terrestrial/aquatic linkages, early Earth processes and the origins of life. Offered odd-numbered years. (Typically Offered: Spring)

GEOL 4870: Microbial Ecology

(Dual-listed with EEOB 5870/ ENSCI 5870/ GEOL 5870/ MICRO 5870).

(Cross-listed with ENSCI 4870/ BIOL 4870/ MICRO 4870).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 6 credits in Biology and 6 credits in Chemistry

Introduction to major functional groups of autotrophic and heterotrophic microorganisms and their roles in natural and environmental systems. Consequences of microbial activity on water chemistry, weathering, and precipitation/dissolution reactions will be emphasized. (Typically Offered: Fall)

GEOL 4880: Raster GIS for Geoscientists

(Dual-listed with GEOL 5880/ AGRON 5880/ ENSCI 5880). (Cross-listed with AGRON 4880/ ENSCI 4880).

Credits: 3.

GIS course with focus on the spatial analysis and modeling of raster and triangulated irregular network (TIN) data using ArcGIS Pro. Includes practical exercises during lectures, lab exercises, homework assignments, and (for GEOL 5880) a class project. Basic knowledge of ArcGIS Pro is a plus but not required. Course can be taken concurrently to any other Intro GIS course. Sophomore classification or above recommended. Offered odd-numbered years. (Typically Offered: Spring)

GEOL 4890: Survey of Remote Sensing Technologies

(Dual-listed with MTEOR 5890/ EE 5890/ ENSCI 5890/ GEOL 5890/ NREM 5890). (Cross-listed with EE 4890/ ENSCI 4890/ MTEOR 4890/ NREM 4890).

Credits: 3. Contact Hours: Lecture 3.

Electromagnetic-radiation principles, active and passive sensors, multispectral and hyperspectral sensors, imaging radar, SAR, thermal imaging, lidar. Examples of applications. Also offered online S. (Typically Offered: Fall)

GEOL 4890L: Satellite Remote Sensing Laboratory

(Dual-listed with MTEOR 5890L/ EE 5890L/ GEOL 5890L/ NREM 5890L).

(Cross-listed with EE 4890L/ MTEOR 4890L/ NREM 4890L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Completion or concurrent enrollment in MTEOR/GEOL/NREM/ EE 4890/5890

Processing and analysis of satellite sensor data (optical and radar). Provides practical applications in an environmental context. (Typically Offered: Fall)

GEOL 4900: Independent Study

Credits: 1-3. Repeatable, maximum of 9 credits.

Prereq: 6 credits in geology; Permission of Instructor

Independent study for senior students. Graduation Restriction: No more than 9 credits of GEOL 4900 may be counted toward graduation.

GEOL 4950: Undergraduate Seminar

Credits: 1. Contact Hours: Lecture 1.

Prereq: Junior or Senior Classification

Weekly seminar on topics of current research interest. Requires written summaries of three presentations of choice. (Typically Offered: Fall, Spring)

GEOL 4980: Cooperative Education

Credits: Required.

Prereq: (GEOL 1000 or GEOL 2010); GEOL 1000L; GEOL 1020; GEOL 1020L; Permission of Department Cooperative Education Coordinator; Senior classification

Required of all cooperative education students. Students must register for this course prior to commencing each work period. (Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

GEOL 5020: Watershed Hydrology

(Dual-listed with GEOL 4020/ ENSCI 4020/ MTEOR 4020/ NREM 4020).

(Cross-listed with ENSCI 5020/ MTEOR 5020/ NREM 5020).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Examination of watersheds as systems, emphasizing the surface components of the hydrologic cycle. Combines qualitative understanding of hydrological processes and uncertainty with quantitative representation. Laboratory emphasizes field investigation and measurement of watershed processes. (Typically Offered: Fall)

GEOL 5060: Geology Field Course

Credits: 1-2. Repeatable.

Prereq: Instructor Permission for Course

Weekly seminar introduces students to a selected geological region or theme that is visited on a required ten-day field excursion. Graduate students are expected to assist in field teaching and safety leadership. (Typically Offered: Fall, Spring)

GEOL 5070: Midwestern Geology Field Trip

Credits: 1. Contact Hours: Laboratory 1.

Repeatable, maximum of 1 credits.

Prereq: Graduate Standing or Permission of Instructor

On-site inspection of various ore deposits, mining operations, and terrains dominated by igneous or metamorphic rocks. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

GEOL 5090: Field Methods in Hydrogeology

(Dual-listed with GEOL 4090/ ENSCI 4090). (Cross-listed with ENSCI 5090).

Credits: 3. Contact Hours: Laboratory 4.

Prereq: Graduate Standing or Permission of Instructor

Introduction to field methods used in groundwater investigations. In-field implementation of pumping tests, slug tests, monitoring well installation and drilling techniques, geochemical and water quality sampling, seepage meters, minipiezometers, stream gaging, and electronic instrumentation for data collection. Field trips to investigate water resource, water quality, and remediation projects. Offered even-numbered years. (Typically Offered: Summer)

GEOL 5110: Hydrogeology

(Dual-listed with GEOL 4110/ ENSCI 4110). (Cross-listed with ENSCI 5110).

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Physical principles of groundwater flow, nature and origin of aquifers and confining units, well hydraulics, groundwater modeling, and contaminant transport. Lab emphasizes applied field and laboratory methods for hydrogeological investigations. (Typically Offered: Fall)

GEOL 5120: Micropaleontology

(Dual-listed with GEOL 4120). (Cross-listed with ENSCI 5120).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Evolution, identification and utility of major microfossil groups from the Mesozoic to present. Focus on Cenozoic applications including biostratigraphy, paleoclimate, and paleothermometry using assemblages, stable isotopes, Mg/Ca, and molecular fossils. Laboratory includes processing and analysis of specific microfossils. Major groups covered include foraminifera, calcareous nannofossils, sponge spicules, diatoms, radiolarians, and silicoflagellates. Offered even-numbered years. (Typically Offered: Fall). (Typically Offered: Fall)

GEOL 5130: Applied and Environmental Geophysics

(Dual-listed with GEOL 4130/ CE 4130/ ENSCI 4130). (Cross-listed with CE 5130/ ENSCI 5130).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Seismic, gravity, magnetic, resistivity, electromagnetic, and ground-penetrating radar techniques for shallow subsurface investigations and imaging. Data interpretation methods. Lab emphasizes computer interpretation packages. Field work with seismic - and resistivity-imaging systems and radar. Introductory geology, algebra, and trigonometry recommended. Offered odd-numbered years. (Typically Offered: Spring)

GEOL 5140: Applied Groundwater Flow Modeling

(Dual-listed with GEOL 4140/ ENSCI 4140). (Cross-listed with ENSCI 5140).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Introduction to the principles of modeling groundwater flow systems. Finite-difference and analytic-element methods, spreadsheet models, boundary conditions, calibration, sensitivity analysis, parameter estimation, particle tracking, and post-audit analysis. Application of MODFLOW to regional flow-system analysis. Computer laboratory emphasizes assigned problems that illustrate topics discussed in the course. Offered even-numbered years. (Typically Offered: Spring)

GEOL 5150: Paleoclimatology

(Dual-listed with GEOL 4150/ ENSCI 4150). (Cross-listed with ENSCI 5150).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to mechanisms that drive climate, including the interplay between oceanic and atmospheric circulation and fluctuation in Earth's orbital parameters. Examination and analysis of past climate records ranging from historical documentation to ecological and geochemical proxies (e.g. tree ring analysis; O and C isotopes of skeletal carbonates and soils). Dating methods used to constrain and correlate climatic periods; utility of computer models to reconstruct past climates and predict future climate change. Emphasis placed on paleoclimatology and paleoecology of the late Quaternary (last ~1 million years). Offered even-numbered years. (Typically Offered: Fall)

GEOL 5160: Hydrologic Modeling and Analysis

(Dual-listed with GEOL 4160/ ENSCI 4160/ MTEOR 4160). (Cross-listed with ENSCI 5160/ MTEOR 5160).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Study of the basic principles of hydrologic modeling, including rainfall-runoff analysis, lumped and distributed modeling, conceptual and physical models, parameter estimation and sensitivity analysis, input and validation data, uncertainty analysis, and the use of models in surface water hydrology. A range of common models are applied to study hydrologic topics such as flood forecasting and land use change impacts. Previous experience with Matlab or other programming language is needed. Offered odd-numbered years. (Typically Offered: Spring)

GEOL 5190: Aqueous and Environmental Geochemistry

(Dual-listed with GEOL 4190/ ENSCI 4190). (Cross-listed with ENSCI 5190).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Geochemistry of natural waters and water-rock interactions. Acid-base equilibria, carbonate chemistry and buffer systems, mineral dissolution and precipitation, sorption, ion exchange, and redox reactions. Introduction to thermodynamics and kinetics. Laboratory emphasizes chemical analysis of waters and computer modeling. Offered even-numbered years. (Typically Offered: Spring)

GEOL 5200: Mineral Resources

(Dual-listed with GEOL 4200).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Geology and geochemistry of non-metallic and metallic ore deposits. Major processes that concentrate metals in the Earth. Geochemical conditions of ore formation using stable-isotope and fluid-inclusion studies. Laboratory emphasizes the study of metallic ores. Offered even-numbered years. (Typically Offered: Fall)

GEOL 5260: Stable Isotopes in the Environment

(Dual-listed with GEOL 4260/ ENSCI 4260). (Cross-listed with ENSCI 5260).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to the theory, methods and applications of stable isotopes. Primary focus on the origin, natural abundance, and fractionation of carbon, hydrogen, oxygen, nitrogen isotopes. Applications of isotopic occurrence for elucidation of physical, chemical, biological, and environmental processes. Effects of plant physiology, photosynthesis, trophic structure, diffusion, evaporation, chemical precipitation, soil and atmospheric processes, and environmental factors on isotope abundance. Offered odd-numbered years. (Typically Offered: Fall)

GEOL 5330: Erosion and Sediment Transport

(Cross-listed with ABE 5330/ ENSCI 5330/ NREM 5330).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Soil erosion processes, soil loss equations and their application to conservation planning, sediment properties, initiation of sediment motion and over land flow, flow in alluvial channels and theory of sediment transport, channel stability, reservoir sedimentation, wind erosion, BMPs for controlling erosion. Offered even-numbered years. (Typically Offered: Fall)

GEOL 5390: Seismic Methods in Geology, Engineering, and Petroleum Exploration

(Dual-listed with GEOL 4390/ CE 4390). (Cross-listed with CE 5390).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Physics of elastic-wave propagation. Seismic surveys in environmental imaging, engineering, and petroleum exploration. Reflection and refraction techniques. Data collection, processing, and geological interpretation. Field work with state-of-the-art equipment. Introductory geology, algebra, and trigonometry recommended. Offered even-numbered years. (Typically Offered: Spring)

GEOL 5440: Petroleum Geoscience and Engineering

(Dual-listed with GEOL 4440).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

The geoscience and engineering aspects of exploration, development, and production of hydrocarbon resources around the world, as well as the historical and legal frameworks through which the industry has developed. Broader discussions of safety, risk, uncertainty, cost, and integrity as relevant to the petroleum industry. Offered even-numbered years. (Typically Offered: Spring)

GEOL 5520: Intro GIS for Geoscientists

(Dual-listed with GEOL 4520/ AGRON 4520/ ENSCI 4520). (Cross-listed with AGRON 5520/ ENSCI 5520).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Introduction to geographic information systems (GIS) using ArcGIS Pro with particular emphasis on geoscientific data. Teaches typical GIS operations and analyses in the geosciences to prepare students for practical GIS use in industry and academia. Includes a class project for GEOL 5520. Very suitable for Juniors. GEOL 4520 can be taken as a substitute for CPR 3510 for the GIS Minor. (Typically Offered: Fall, Spring)

GEOL 5550: Stream Restoration

(Dual-listed with NREM 4550). (Cross-listed with NREM 5550).

Credits: 3. Contact Hours: Laboratory 3, Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Interdisciplinary introduction to the science and practice of stream restoration, with emphasis on restoring physical and biological integrity and ecosystem services to streams and riparian corridors. Offered odd-numbered years. (Typically Offered: Fall)

GEOL 5590: Quantitative Methods in Geology

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Analysis of geologic data on applied and quantitative basis using MATLAB. Introduction to basic programming with special focus to applied geoscience problems such as stress and strain analysis, particle tracking for fracture propagation and strain field visualization, basic tectonic modeling, red noise filtering. Toolkit development for effective handling of large data sets and picture analysis. (Typically Offered: Fall)

GEOL 5680: Applied Geostatistics for Geoscientists

(Dual-listed with GEOL 4680/ ENSCI 4680/ MTEOR 4680). (Cross-listed with ENSCI 5680/ MTEOR 5680).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Introduction to geospatial data collection, analysis, interpretation, and presentation. Geospatial techniques including geographic information systems (GIS), remote sensing (RS), and global positioning systems (GPS). Study of applied geostatistical analysis (e.g., interpolation and spatial regression). Offered even-numbered years. (Typically Offered: Fall)

GEOL 5740: Glacial and Quaternary Geology

(Dual-listed with GEOL 4740).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

The study of glaciers, the landscapes and sediments they create, and their behavior during the Quaternary Period. Discussion of the flow of glaciers, glacial erosion and sediment transport, glacial landforms, Quaternary glacier/climate interactions, and the landscapes of Iowa. Laboratory emphasizes topographic map interpretation and local field trips. An introductory course in geology and is recommended as background. Offered even-numbered years. (Typically Offered: Spring)

GEOL 5790: Surficial Processes

(Dual-listed with GEOL 4790/ ENSCI 4790). (Cross-listed with ENSCI 5790).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

The study of physical processes that shape Earth's surface. Topics include weathering, sediment transport, and landform genesis with emphasis on fluvial, glacial, hillslope, eolian, and coastal processes. Applications to engineering and environmental problems. Laboratory includes topographic map interpretation and local field trips. An introductory course in geology is recommended as background. (Typically Offered: Fall)

GEOL 5870: Microbial Ecology

(Dual-listed with BIOL 4870/ ENSCI 4870/ GEOL 4870/ MICRO 4870).

(Cross-listed with ENSCI 5870/ EEOB 5870/ MICRO 5870).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to major functional groups of autotrophic and heterotrophic microorganisms and their roles in natural and environmental systems. Consequences of microbial activity on water chemistry, weathering, and precipitation/dissolution reactions will be emphasized. (Typically Offered: Fall)

GEOL 5880: Raster GIS for Geoscientists

(Dual-listed with GEOL 4880/ AGRON 4880/ ENSCI 4880). (Cross-listed with AGRON 5880/ ENSCI 5880).

Credits: 3.

Prereq: (GEOL 4520; CRP 4510; CRP 4520; NREM 3450; NREM 4460; AE 4080) or graduate standing

GIS course with focus on the spatial analysis and modeling of raster and triangulated irregular network (TIN) data using ArcGIS Pro. Includes practical exercises during lectures, lab exercises, homework assignments, and (for GEOL 5880) a class project. Basic knowledge of ArcGIS Pro is a plus but not required. Course can be taken concurrently to any other Intro GIS course. Sophomore classification or above recommended. Offered odd-numbered years. (Typically Offered: Spring)

GEOL 5890: Survey of Remote Sensing Technologies

(Dual-listed with MTEOR 4890/ EE 4890/ ENSCI 4890/ GEOL 4890/ NREM 4890). (Cross-listed with EE 5890/ ENSCI 5890/ MTEOR 5890/ NREM 5890).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Electromagnetic-radiation principles, active and passive sensors, multispectral and hyperspectral sensors, imaging radar, SAR, thermal imaging, lidar. Examples of applications. Also offered online S. (Typically Offered: Fall)

GEOL 5890L: Satellite Remote Sensing Laboratory

(Dual-listed with MTEOR 4890L/ EE 4890L/ GEOL 4890L/ NREM 4890L). (Cross-listed with EE 5890L/ MTEOR 5890L/ NREM 5890L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Processing and analysis of satellite sensor data (optical and radar). Provides practical applications in an environmental context. (Typically Offered: Fall)

GEOL 5900A: Special Topics: Surficial Processes

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

GEOL 5900B: Special Topics: Stratigraphy

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

GEOL 5900C: Special Topics: Sedimentation

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

GEOL 5900D: Special Topics: Paleontology

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

GEOL 5900E: Special Topics: Petrology

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

GEOL 5900F: Special Topics: Structural Geology

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

GEOL 5900G: Special Topics: Geochemistry

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

GEOL 5900H: Special Topics: Hydrogeology

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

GEOL 5900I: Special Topics: Earth Science

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

GEOL 5900J: Special Topics: Mineral Resources

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

GEOL 5900K: Special Topics: Geophysics

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

GEOL 5900L: Special Topics: Mineralogy

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

GEOL 5900M: Special Topics: Tectonics

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

GEOL 5900N: Special Topics: Paleocology and Paleoclimatology

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

GEOL 5900O: Special Topics: Isotope Geochemistry

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

GEOL 5900P: Special Topics: Computational Methods and GIS

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

GEOL 5900R: Special Topics: Surface Hydrology

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

GEOL 5900S: Special Topics: Oceanography

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

GEOL 5950A: Graduate Seminar: Presentation Required

(Cross-listed with MTEOR 5950A).

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Weekly seminar on topics of current research interest. All students seeking a graduate degree must enroll during each semester of residence. Students pursuing a non-thesis option for the M.S. in Earth Science must enroll for one semester. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

GEOL 5950B: Graduate Seminar: Attendance Only

(Cross-listed with MTEOR 5950B).

Credits: Required. Contact Hours: Lecture 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Attendance only. Weekly seminar on topics of current research interest. All students seeking a graduate degree must enroll during each semester of residence. Students pursuing a non-thesis option for the M.S. in Earth Science must enroll for one semester. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

GEOL 5990: Creative Component

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Courses for graduate students:**GEOL 6100A: Advanced Seminar: Earth Materials**

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

(Typically Offered: Fall, Spring)

GEOL 6100B: Advanced Seminar: Economic Geology

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

(Typically Offered: Fall, Spring)

GEOL 6100C: Advanced Seminar: Environmental Geochemistry

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

(Typically Offered: Fall, Spring)

GEOL 6100D: Advanced Seminar: Geophysics

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

(Typically Offered: Fall, Spring)

GEOL 6100E: Advanced Seminar: Geotectonics

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

(Typically Offered: Fall, Spring)

GEOL 6100F: Advanced Seminar: Hydrogeology

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

(Typically Offered: Fall, Spring)

GEOL 6100G: Advanced Seminar: Surficial Processes

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

(Typically Offered: Fall, Spring)

GEOL 6100H: Advanced Seminar: Sedimentation and Stratigraphy

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

(Typically Offered: Fall, Spring)

GEOL 6100I: Advanced Seminar: Paleocology and Paleoclimatology

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

(Typically Offered: Fall, Spring)

GEOL 6100J: Advanced Seminar: Isotope Geochemistry

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

(Typically Offered: Fall, Spring)

GEOL 6100K: Advanced Seminar: Computational Methods and GIS

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

(Typically Offered: Fall, Spring)

GEOL 6990A: Research: Surficial Processes

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

GEOL 6990B: Research: Stratigraphy

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

GEOL 6990C: Research: Sedimentation

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

GEOL 6990D: Research: Paleontology

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

GEOL 6990E: Research: Petrology

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

GEOL 6990F: Research: Structural Geology

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

GEOL 6990G: Research: Geochemistry

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

GEOL 6990H: Research: Hydrogeology

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

GEOL 6990I: Research: Earth Science

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

GEOL 6990J: Research: Mineral Resources

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

GEOL 6990K: Research: Geophysics

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

GEOL 6990L: Research: Mineralogy

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

GEOL 6990M: Research: Tectonics

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

GEOL 6990N: Research: Paleoecology and Paleoclimatology

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

GEOL 6990O: Research: Isotope Geochemistry

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

GEOL 6990P: Research: Computational Methods and GIS

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

GEOL 6990R: Research: Surface Hydrology

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

GEOL 6990S: Research: Geoscience Education

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

German (GER)

Courses primarily for undergraduates:

GER 1010: Elementary German I

Credits: 4. Contact Hours: Lecture 4.

Beginning level development of reading, writing, listening comprehension, and speaking in German within the context of German culture. For beginning-level learners who have little or no prior exposure to German. (Typically Offered: Fall, Summer)

GER 1020: Elementary German II

Credits: 4. Contact Hours: Lecture 4.

Prereq: GER 1010

Beginning level development of reading, writing, listening comprehension, and speaking in German within the context of German culture. For beginning level learners with only one semester of German (or exposure equivalent to two years or less in high school.) Meets International Perspectives Requirement. (Typically Offered: Spring, Summer)

GER 2010: Intermediate German I

Credits: 4. Contact Hours: Lecture 4.

Prereq: GER 1020

Intermediate level development of reading, writing, listening comprehension, and speaking in German within the context of German culture. Intensive review of basic grammar covered in the first-year German class (or equivalent high school courses) while exploring cultural topics and themes. Meets International Perspectives Requirement. (Typically Offered: Fall)

GER 2020: Intermediate German II

Credits: 4. Contact Hours: Lecture 4.

Prereq: GER 2010

Intermediate level development of reading, writing, listening comprehension, and speaking in German within the context of German culture. Emphasis on intermediate level grammar and communication about topics and themes beyond the personal realm. Meets International Perspectives Requirement. (Typically Offered: Spring)

GER 3010: Reading

Credits: 3. Contact Hours: Lecture 3.

Prereq: GER 2020

Emphasis on reading with further development of grammar using a variety of texts. Meets International Perspectives Requirement. (Typically Offered: Fall)

GER 3020: Composition

Credits: 3. Contact Hours: Lecture 3.

Prereq: GER 2020

Emphasis on writing skills, with further development of grammar and reading skills using a variety of current and historical materials. Meets International Perspectives Requirement. (Typically Offered: Spring)

GER 3040: German for Global Professionals

Credits: 3. Contact Hours: Lecture 3.

Prereq: GER 2020

Communication in business and professional contexts in German-speaking countries. Development of effective communication strategies and project management in the workplace. Cultural contexts of business and professional practice. Preparation for internships. Meets International Perspectives Requirement. (Typically Offered: Fall)

GER 3050: Conversation

Credits: 3. Contact Hours: Lecture 3.

Prereq: GER 2020

Intensive conversational and listening practice in German. GER 3010 recommended. Meets International Perspectives Requirement. (Typically Offered: Spring)

GER 3200: Germany Today

Credits: 3. Contact Hours: Lecture 3.

Prereq: GER 3010 or GER 3040

Selected topics dealing with contemporary German society and culture. Introduction to materials, resources, and forms of communication available on the Internet, and in other electronic and print media. Meets International Perspectives Requirement. (Typically Offered: Spring)

GER 3300: German Literature and Culture

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: GER 3010 or permission of instructor

Selected readings in German literature from Classicism to present. Emphasis on techniques of reading and analysis of literary texts. Graduation Restriction: No more than six credits of GER 3300 may be counted toward the major. Meets International Perspectives Requirement. (Typically Offered: Fall)

GER 3700: German Studies in English

Credits: 3-4. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: Sophomore classification

Topics vary according to faculty interest. Author, genre or period study, women writers, cinema, or contemporary theory. Three credits: English, open to all students. Four credits: Required for German concentration credit, supplementary readings and compositions in German. For enrollment in fourth credit, 6 credits in GER at the 3000-level. Meets International Perspectives Requirement.

GER 3700G: Studies in English Translation: German Topics on Women or Feminism

(Cross-listed with WGS 3700G).

Credits: 3-4. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: Sophomore classification

Topics vary according to faculty interest. Author, genre or period study, women writers, cinema, or contemporary theory. Three credits: English, open to all students. Four credits: Required for German concentration credit, supplementary readings and compositions in German. For enrollment in fourth credit, 6 credits in GER at the 3000-level. Meets International Perspectives Requirement.

GER 3710: The Holocaust in Text, Image, and Memory

Credits: 3-4. Contact Hours: Lecture 4.

Prereq: Sophomore classification

Examination of such topics as the origins and expressions of Anti-Semitism in central Europe, the political events and structures of the Holocaust, the reality of ghettos and concentration camps, the impact of technological modernization on the Final Solution, and resistance to the Nazis. Materials will include non-fictional texts, literature, art, and music. Three credits: English, open to all students. Four credits: required for German major credit, supplementary readings and compositions in German. Four credits: required for German concentration credit, supplementary readings and compositions in German. For enrollment in fourth credit, 6 credits in GER at the 3000-level. Meets International Perspectives Requirement.

GER 3750: Grimms' Tales

Credits: 3-4. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Emphasis on the Grimm tales: theoretical approaches to the tales from the late 19th and early 20th centuries; perversions of these traditional tales by the National Socialists (Nazis). Readings in contemporary Grimm scholarship. Taught in English. Three credits: English, open to all students. Four credits: required for German concentration credit, supplementary readings and compositions in German. For enrollment in fourth credit, 6 credits in GER at the 3000-level. Meets International Perspectives Requirement.

GER 3780: German Film and Media Studies

Credits: 3-4. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Analysis and interpretation of film or media in German society. Study of media production and reception within multicultural and global contexts. Thematic emphases based on faculty and student interest including: 1) film directors, genres, movements (e.g. New German Cinema), aesthetics, and cinematography or 2) media studies (e.g. television, mass press, popular culture). Three credits: English, open to all students. Four credits: required for German concentration credit, supplementary readings and compositions in German. Counts towards the World Film Studies Minor. For enrollment in fourth credit, 6 credits in GER at the 3000-level. Meets International Perspectives Requirement. (Typically Offered: Spring)

GER 3950: Study Abroad

Credits: 1-10.

Prereq: 12 credits in GER; Department Permission

Supervised instruction in language and culture of Germany; formal class instruction at level appropriate to student's training, augmented by practical living experience. Meets International Perspectives Requirement.

GER 4760: Topics in German Cultural Studies

Credits: 3-4. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Key topics and themes in German history and culture up to the modern era. Three credits: Taught in English, open to all students. Four credits: Required for German concentration credit, supplementary readings and compositions in German. For enrollment in fourth credit, six credits in GER at the 3000-level. Meets International Perspectives Requirement. (Typically Offered: Spring)

GER 4900: Independent Study

Credits: 1-6. Repeatable, maximum of 9 credits.

Prereq: 6 credits in German and permission of department chair

Designed to meet the needs of students who seek work in areas other than those in which courses are offered, or who desire to integrate a study of literature or language with special problems in major fields. Graduation Restriction: No more than 9 credits of GER 4900 may be counted toward graduation.

GER 4990: Internship in German

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: 9 credits in GER at the 3000-level; Permission of Advisor; Permission of World Languages and Cultures Internship Coordinator

Work experience using German language skills in the public or private sector, combined with academic work under faculty supervision.

Available only to majors and minors. Graduation Restriction: GER 4990 may be repeated to a maximum of 6 credits. No more than 3 credits of GER 4990 may be applied to the major. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

GER 5900A: Special Topics in German: Literature or Literary Criticism

Credits: 2-4. Repeatable.

Prereq: Permission of instructor; 6 credits of 4000 level German

GER 5900B: Special Topics in German: Linguistics

Credits: 2-4. Repeatable.

Prereq: Permission of instructor; 6 credits of 4000 level German

GER 5900C: Special Topics in German: Language Pedagogy

Credits: 2-4. Repeatable.

Prereq: Permission of instructor; 6 credits of 4000 level German

GER 5900D: Special Topics in German: Civilization

Credits: 2-4. Repeatable.

Prereq: Permission of instructor; 6 credits of 4000 level German

Gerontology (GERON)

Courses primarily for undergraduates:

GERON 2340: Young Adulthood Through Later Life

(Cross-listed with HDFS 2340).

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 2300 or HDFS 1020

Exploration of the health, individual and social factors associated with adult development including emerging, younger, middle, and older adulthood. Information is presented from a biopsychosocial lens of change across the lifespan. . (Typically Offered: Spring)

GERON 3730: Death as a Part of Living

(Cross-listed with HDFS 3730).

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 2300 or HDFS 1020

Consideration of death in the life span of the individual and the family with opportunity for exploration of personal and societal attitudes.

(Typically Offered: Fall, Spring, Summer)

GERON 3770: Aging and the Family

(Cross-listed with HDFS 3770).

Credits: 3. Contact Hours: Lecture 3.

Interchanges of older adults and their families. Emphasis on role changes, social interaction, and independence as influenced by health, finances, lifestyles, and community support. (Typically Offered: Fall, Summer)

GERON 3780: Retirement Planning and Employee Benefits

(Cross-listed with HDFS 3780).

Credits: 3. Contact Hours: Lecture 3.

Financial needs analysis for retirement, characteristics of employer-sponsored and individual retirement plans, tax implications of retirement plans, Social Security funding and benefits, strategies for meeting varying retirement needs in a diverse society, financial counseling and planning practice, and overview of employee benefits. (Typically Offered: Spring)

GERON 4660: Gerontology Prepracticum Seminar

Credits: 1. Contact Hours: Lecture 1.

Prepracticum training for students planning a gerontology practicum. Exploration of possible agencies for the practicum, in-depth study of a selected agency, and development of goals and objectives for the practicum. (Typically Offered: Fall, Spring, Summer)

GERON 4670: Gerontology Practicum

Credits: 3-6. Repeatable.

Supervised field experience related to aging. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

GERON 4900: Independent Study

Credits: 1-30.

Prereq: Instructor Permission for Course

Consult program coordinator for procedure. (Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

GERON 5010: Seminar

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

(Typically Offered: Fall, Spring, Summer)

GERON 5010J: Gerontology Seminar: Gerontechnology

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Gerontology Seminar: Gerontechnology. (Typically Offered: Fall, Spring, Summer)

GERON 5010M: Gerontology Seminar: Spiritual & Aging

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Gerontology Seminar: Spiritual & Aging. (Typically Offered: Fall, Spring, Summer)

GERON 5100: Survey of Gerontology

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Provides an overview of important gerontological issues. (Typically Offered: Fall, Spring, Summer)

GERON 5210: Biological Principles of Aging

(Dual-listed with BIOL 4210). (Cross-listed with EEOB 5210).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Basic biological principles of aging. Course modules include an introduction to the aging process, body systems and normal aging, and environment and the biology of aging. In addition, disorders and diseases of aging, prevention and treatment and exercise and aging topics will be covered. (Typically Offered: Summer)

GERON 5220: Long-Term Care

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Administration principles involved in the planning, organizing and directing of long-term care agencies. Includes an in-depth exposure to federal and state standards and regulations governing long-term care. (Typically Offered: Fall)

GERON 5230: Mental Health and Aging

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to the range of issues involved in aging and mental health. From a systems framework the major emotional and psychiatric problems encountered in old age will be examined including mood, anxiety, adjustment and personality disorders, dementia, cognitive problems, substance abuse, and suicide. Barriers to treatment and cohort and cultural issues will be explored. (Typically Offered: Spring)

GERON 5240: Cognitive Health

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Cognitive skills form the foundation for functioning in everyday life and these skills take on added importance in older adulthood. This course focuses on selected theoretical approaches and current research related to cognitive aging. We will review normative and non-normative cognitive changes, assessment techniques, and prevention/intervention efforts. Throughout the course we will keep the role of environment and life-span implications in the forefront of our discussion. (Typically Offered: Summer)

GERON 5300: Perspectives in Gerontology

(Cross-listed with HDFS 5300).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Overview of current aging issues including theory and research, critical social and political issues in aging, the interdisciplinary focus of gerontology, career opportunities, and aging in the future. (Typically Offered: Fall)

GERON 5310: Foundations in Integrative Aging Studies

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to foundational concepts in the interdisciplinary field of aging studies, including: core theories of adult development and aging how to be critical consumers of aging research; developing writing and other professional skills; and exploring career options in aging. Offered even-numbered years. (Typically Offered: Spring)

GERON 5340: Adult Development

(Cross-listed with HDFS 5340).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Exploration of the biological, psychological and social factors associated with aging. Although the focus is on the later years, information is presented from a life-span developmental framework. Empirical studies are reviewed and their strengths, limitations and implications for normative and optimal functioning are discussed. (Typically Offered: Spring)

GERON 5400: Nutrition and Physical Activity in Aging

(Cross-listed with DIET 5400).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

WWW only. Basic physiologic changes during aging and their impacts in health and disease. The focus will be on successful aging with special emphasis on physical activity and nutrition. Practical application to community settings is addressed. (Typically Offered: Fall)

GERON 5450: Economics, Public Policy, and Aging

(Cross-listed with HDFS 5450).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Policy development in the context of the economic status of the older adult population. Retirement planning and the retirement decisions; social security and public transfer programs; intra-family transfers to/from the aged; private pensions; financing medical care; prospects and issues for the future. (Typically Offered: Fall)

GERON 5630: Environments for the Aging

(Dual-listed with HDFS 4630/ GERON 4630). (Cross-listed with HDFS 5630).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Emphasis on independent living within residential settings including specialized shelter, supportive services and housing management. Application of criteria appropriate for accessibility and functional performance of activities; universal design principles. Creative project provides service learning opportunities. (Typically Offered: Spring)

GERON 5710: Design for All People

(Cross-listed with ARCH 5710).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Principles and procedures of inclusive design in response to the varying ability level of users. Assessment and analysis of existing buildings and sites with respect to standards and details of accessibility for all people, including visually impaired, mentally impaired, and mobility restricted users. Design is neither a prerequisite nor a required part of the course. Enrollment open to students majoring in related disciplines. Credit counts toward fulfillment of History, Theory, Culture requirements. (Typically Offered: Spring)

GERON 5770: Aging in the Family Setting

(Cross-listed with HDFS 5770).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Theories and research related to personal and family adjustments in later life affecting older persons and their intergenerational relationships. Related issues including demographics also are examined through the use of current literature. (Typically Offered: Spring)

GERON 5840: Program Evaluation and Research Methods in Gerontology

(Cross-listed with HDFS 5840).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Overview of program evaluation, research methods, and grant writing in gerontology. Includes application of quantitative and qualitative methods in professional settings. (Typically Offered: Spring)

GERON 5890: Systems Neuroscience: Brain, Behavior, and Nutrition-Related Integrative Physiology

(Cross-listed with FSHN 5890/ NUTRS 5890/ NEURO 5890/ PSYCH 5890).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Qualified Undergraduate with Permission of Instructor

Structural, functional, and biochemical aspects of brain and non-motor behavior across the human lifespan. Types of neuroimaging used to assess the brain. Current research is leveraged to gauge how nutrition, diseases related to nutrition, and associated physiological processes influence the brain, particularly for common developmental, psychological, and neurological disorders. (Typically Offered: Spring)

GERON 5900: Special Topics

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Consult program coordinator for procedure. (Typically Offered: Fall, Spring, Summer)

GERON 5910: Internship

Credits: 1-9. Repeatable, maximum of 9 credits.

Prereq: Instructor Permission for Course

Supervised experience in an area of gerontology. (Typically Offered: Fall, Spring, Summer)

GERON 5940: Professional Seminar in Gerontology

(Cross-listed with HDFS 5940).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

An integrative experience for gerontology students designed to be taken near the end of the degree program. By applying knowledge gained in earlier coursework, students will strengthen skills in ethical decision-making behavior, applying these skills in gerontology-related areas such as advocacy, professionalism, family and workplace issues. Students from a variety of professions will bring their unique perspectives to bear on topics of common interest. (Typically Offered: Summer)

GERON 5990: Creative Component

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

Courses for graduate students:

GERON 6300: Theories of Aging

Credits: 3. Contact Hours: Lecture 3.

Historical, contemporary, and interdisciplinary basis of aging theory. Biological, psychological, sociological, and human developmental conceptualizations of aging will be critically assessed. Emphasis will be placed on conceptual models, as well as theoretical development and application within gerontological research and the field of aging. (Typically Offered: Summer)

GERON 6350: Adult Development, Aging, and Health

(Cross-listed with HDFS 6350).

Credits: 3. Contact Hours: Lecture 3.

Review of the impact of the growing older adult population as well as individual development and aging on individuals, families, and society. Exploration of theoretical perspectives applied to adult development and aging and distinction of normative and non-normative changes in adulthood. Discussion of methods to assess development across adulthood and consideration of the role of individual and environmental factors impacting efforts to optimize adult development. Offered odd-numbered years. (Typically Offered: Fall)

GERON 6990: Research

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

Global Resource Systems (GLOBE)

Courses primarily for undergraduates:

GLOBE 1100: Orientation

Credits: 1. Contact Hours: Lecture 1.

An introduction to Global Resource Systems (GRS) program. University and career acclimation, development of educational and professional skills, participation in GRS Learning Community. Assessed service-learning component. (Typically Offered: Fall)

GLOBE 1200: Geography of Global Resource Systems

Credits: 3. Contact Hours: Lecture 3.

A survey of geographic concepts with a specific focus on the distribution of natural and human-generated resources and the demand for those resources on a global scale. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

GLOBE 2010: Introduction to Global Resource Systems

Credits: 3. Contact Hours: Lecture 3.

A systematic analysis of natural, physical, and socio-economic resources. Examine ways communities prioritize, save, use, and invest in community resources to address their needs and wants in a sustainable way, and the global implications of resource systems decisions. Assessed service-learning component. (Typically Offered: Fall, Spring)

GLOBE 2110: Issues in Global Resource Systems

Credits: 1. Contact Hours: Lecture 1.

Repeatable, maximum of 4 credits.

Discussion of topics of current importance in global resource systems.

Graduation Restriction: A maximum of 4 credits of GLOBE 2110 may be used towards degree requirements. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

GLOBE 2200: Globalization and Sustainability

(Cross-listed with ANTHR 2200/ ENVIS 2200/ SOC 2200/ ME 2200/ MATE 2200).

Credits: 3. Contact Hours: Lecture 3.

An introduction to understanding the key global issues in sustainability. Focuses on interconnected roles of energy, materials, human resources, economics, and technology in building and maintaining sustainable systems. Applications discussed will include challenges in both the developed and developing world and will examine the role of technology in a resource-constrained world. Graduation Restriction: Cannot be used for technical elective credit in any engineering department. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

GLOBE 2210: Apprenticeship

Credits: Required. Repeatable.

Prereq: Approval by the Global Resource Systems Faculty Coordinator

Practical work experience in approved domestic or international settings such as with a company, research laboratory, governmental agency or non-governmental organization. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

GLOBE 2220X: Global Engagement

(Cross-listed with POLS 2220X).

Credits: 3. Contact Hours: Lecture 3.

Engagement with social and political issues on a global scale.

Contributions of individual action, non-governmental organizations, and governments to changing societal and international outcomes.

Techniques for identifying and addressing problems around the world. Meets International Perspectives Requirement. (Typically Offered: Fall)

GLOBE 2900: Independent Study

Credits: 1-2. Repeatable.

Prereq: Permission of the instructor and approval by the Global Resource Systems Faculty Coordinator

Independent study on topics of special interest to the student.

Comprehensive report required. Intended primarily for first-year students and sophomores. (Typically Offered: Fall, Spring, Summer)

GLOBE 2900H: Independent Study: Honors

Credits: 1-2. Repeatable.

Prereq: Permission of the instructor and approval by the Global Resource Systems Faculty Coordinator; Membership in the University Honors Program

Independent study on topics of special interest to the student.

Comprehensive report required. Intended primarily for first-year students and sophomores. (Typically Offered: Fall, Spring, Summer)

GLOBE 3030: Agricultural, Food and Natural Global Resource Systems

Credits: 3. Contact Hours: Lecture 3.

Prereq: GLOBE 2010 and ECON 1010 or ECON 1020 or permission of instructor.

In-depth analysis of the opportunities, constraints and consequences of agricultural, food and natural resource systems. Topics integrate global natural resources with agriculture and food systems, nutrition and health, sustainable development, and societal structures, including gender, migration and urbanization. Course content utilizes a systems approach. (Typically Offered: Fall)

GLOBE 3040: Socio-Economic Global Resource Systems

Credits: 3. Contact Hours: Lecture 3.

Prereq: GLOBE 2010 and ECON 1010 or ECON 1020 or permission of instructor.

In-depth analysis of the opportunities, constraints and consequences of social, economic and political global resource systems. Topics integrate agriculture and food production, globalization, population, economic planning, energy, security, trade, and policy and their role in defining different world regions. Course content utilizes a systems approach. (Typically Offered: Spring)

GLOBE 3200: Global Resource Systems Internship Preparation

Credits: 1. Contact Hours: Lecture 1.

Prereq: Instructor Permission for Course

Students enrolled in this course intend to enroll in GLOBE 3210 or 3220 in the following term. Topics provide a pre-departure orientation, including logistical, academic, cultural, and personal requirements for completion of an experiential supervised work experience. (Typically Offered: Fall, Spring)

GLOBE 3210: Internship - Global

Credits: 3-6. Repeatable.

Prereq: GLOBE 3200, Junior or Senior and enrollment in Global Resource Systems major; permission of the instructor and approval by the Global Resource Systems Faculty Coordinator

A supervised learning experience including an analysis of an international location's resource system via immersion in a foreign culture lasting at least five weeks. The experience should focus on the region and technical area consistent with the student's degree track. Course expenses paid by student. Graduation Restriction: A maximum of 12 credits of GLOBE 3210 and 3220 may be used for degree requirements. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

GLOBE 3220: Internship - United States

Credits: 3-6. Repeatable.

Prereq: GLOBE 3200, Junior or Senior and enrollment in Global Resource Systems major; permission of the instructor and approval by the Global Resource Systems Faculty Coordinator

A supervised learning experience including an analysis of a domestic location's resource system via immersion in a different culture within the United States lasting at least five weeks. Designed for international students and for students who are not in a position to leave the United States. Course expenses paid by student. Graduation Restriction: A maximum of 12 credits of GLOBE 3210 and 3220 may be used for degree requirements. (Typically Offered: Fall, Spring, Summer)

GLOBE 3300: Global Health Disparities

(Cross-listed with VMPPM 3300).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior classification

Historical and contemporary factors contributing to disparities in health outcomes for persons disadvantaged by income, location, ethnicity, sexual orientation, and abilities. Analysis and evaluation of health promotional materials, such as campaigns, and community-based interventions focused on reducing global health disparities. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Spring)

GLOBE 3350: The Economics of Global Agricultural Food and Bio-energy

(Cross-listed with ECON 3350).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 1010

Applied economic analysis of the determinants of world agricultural production, marketing, and use in feed, food, fiber, biofuel, and other applications, and global food processing and consumption. Analysis of market case studies and various data on global agricultural production and transformation, land and resource use, demography, economic activity, nutrition and health trends. Meets International Perspectives Requirement.

GLOBE 3600: Global Health

(Cross-listed with VMPPM 3600/ MICRO 3600).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2110

Explores human health across the world with particular emphasis on low- and lower-middle-income countries. Attention is given to the interconnectedness of health determinants, problems, and solutions found in global health, including the role of animals and the environment. Broad in scope, highlighting different cultures and the historical foundations of global health. Topics include colonialism, poverty, emerging diseases, climate change, biodiversity, one health, maternal and child health, HIV, malaria, urbanization, noncommunicable diseases and more. Current events will be a feature of all class meetings. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

GLOBE 3850: Economic Development

(Cross-listed with ECON 3850).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 1020

Current problems of developing countries, historical experiences and interrelationships between developed and developing countries, theories of economic growth and economic development, measurements and predictions of economic performance of developing countries, and alternative policies and reforms for economic development. Topics to include poverty, income inequality, population growth, and environmental and economic development. Meets International Perspectives Requirement.

GLOBE 3980: Cooperative Education

Credits: Required.

Prereq: Permission of faculty coordinator for the major.

Students must complete GLOBE 3980 Cooperative Education Approval Form and register for GLOBE 3980 before commencing each work period. Work periods for students in cooperative education related to Global Resource Systems. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

GLOBE 4010: Senior Project

Credits: 3.

Prereq: Senior classification in Global Resource Systems

Research project in collaboration with faculty that complements and furthers a student's experiences from GLOBE 3210 and 3220 while simultaneously bringing into focus entire four-year experience. Student will write a research report and make either an oral or poster presentation. (Typically Offered: Fall, Spring, Summer)

GLOBE 4010H: Senior Project: Honors

Credits: 3.

Prereq: Senior classification in Global Resource Systems; Membership in the University Honors Program

Research project in collaboration with faculty that complements and furthers a student's experiences from GLOBE 3210 and 3220 while simultaneously bringing into focus entire four-year experience. Student will write a research report and make either an oral or poster presentation. (Typically Offered: Fall, Spring, Summer)

GLOBE 4020: Responses to Global Resource System Challenges

Credits: 3. Contact Hours: Lecture 3.

Capstone analysis of critical global resource challenges facing both developed and developing countries. Students will use research skills to investigate specific global resource issues and use communications skills to work as a team to integrate their research, develop an interdisciplinary perspective, and evaluate potential solutions to resource challenges. (Typically Offered: Spring)

GLOBE 4310X: Global Healthcare Delivery Systems

Credits: 3. Contact Hours: Lecture 3.

Exploration of structures and functions of healthcare delivery systems. Concepts, scope, challenges, and current strategies of existing health care delivery systems are discussed. Strategies to enhance healthcare delivery systems through case studies. Course content emphasis on low- and upper-middle income nations and utilizes systems approach. (Typically Offered: Fall)

GLOBE 4320X: Field Course on Global Public Health Services Delivery

Credits: 3. Contact Hours: Lecture 3.

Exploration of global public health infrastructures and processes through experiential learning. Discussion of challenges in global public health and application of best practices to enhance quality of public health service delivery in low- and upper-middle income country through a field trip. Location and duration of international travel will vary. Course fee will vary by location. (Typically Offered: Spring)

GLOBE 4410: International Animal Agriculture

(Cross-listed with ANS 4410).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ANS 2230 or ANS 2250 or ANS 2260 or ANS 2290 or ANS 2350 or instructor permission

An overview of animal agriculture with emphasis in developing countries. Historical, economic, environmental, and political considerations will be assessed and evaluated. Issues related to gender, resilience and sustainability for different production systems including alternative livestock species, will be investigated. The role of animal source foods in attainment of global food security will be discussed. Meets International Perspectives Requirement. (Typically Offered: Spring)

GLOBE 4800: Engineering Analysis of Biological Systems

(Dual-listed with ABE 5800). (Cross-listed with ENSCI 4800/ ABE 4800).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: ABE 3800 or Permission of Department

Systems-level quantitative analysis of various biological systems, including applications in foods, feeds, biofuels, bioenergy, and other bio-based systems. Introduction to techno-economic analysis and life-cycle assessment of these systems at multiple production scales. Applying these tools to evaluate and improve cost and sustainability performance. Students enrolled in ABE 5800 will be required to conduct additional learning activities. (Typically Offered: Fall)

GLOBE 4820: Soils of the Tropics

(Cross-listed with AGRON 4820).

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: AGRON 3540 and 9 credits in AGRON, GLOBE, ENSCI, or related discipline

Properties, classification, and geographic distribution of tropical and near-tropical soils and landscapes with emphasis on their suitability for cropping. (Typically Offered: Spring)

GLOBE 4900A: Independent Study: General

Credits: 1-4. Repeatable.

Prereq: Permission of the instructor and approval by the Global Resource Systems Faculty Coordinator

Independent study on topics of special interest to the student. Comprehensive report required. Intended primarily for juniors and seniors. Graduation Restriction: A maximum of 9 credits of all (university-wide) 4900 courses may be used for degree requirements. (Typically Offered: Fall, Spring, Summer)

GLOBE 4900E: Independent Study: Entrepreneurship

Credits: 1-4. Repeatable.

Prereq: Permission of the instructor and approval by the Global Resource Systems Faculty Coordinator

Independent study on topics of special interest to the student. Comprehensive report required. Intended primarily for juniors and seniors. Graduation Restriction: A maximum of 9 credits of all (university-wide) 4900 courses may be used for degree requirements. (Typically Offered: Fall, Spring, Summer)

GLOBE 4900H: Independent Study: Honors

Credits: 1-4. Repeatable.

Prereq: Permission of Instructor; Membership in the University Honors Program

Independent study on topics of special interest to the student.

Comprehensive report required. Intended primarily for juniors and seniors.

Graduation Restriction: A maximum of 9 credits of all (university-wide)

4900 courses may be used for degree requirements. (Typically Offered: Fall, Spring, Summer)

GLOBE 4900Z: Independent Study: Service Learning

Credits: 1-4. Repeatable.

Independent study on topics of special interest to the student.

Comprehensive report required. Intended primarily for juniors and

seniors. Assessed service-learning component. Graduation Restriction: A

maximum of 9 credits of all (university-wide) 4900 courses may be used

for degree requirements. (Typically Offered: Fall, Spring, Summer)

GLOBE 4930: Workshop in Global Resource Systems

Credits: 1-3. Contact Hours: Lecture 2.

Repeatable, maximum of 4 times.

Workshop experience in selected topics in global resource systems.

Variable format may include lecture, recitation, laboratory, and field.

Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

GLOBE 4940A: Service Learning: International

Credits: 1-30. Repeatable, maximum of 12 credits.

Selected projects that result in outcomes benefiting a non-Iowa State University entity while instilling professional ethics and accomplishing student learning goals. Course expenses paid by student. Assessed service-learning component. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

GLOBE 4940B: Service Learning: Domestic

Credits: 1-30. Repeatable, maximum of 12 credits.

Prereq: Instructor Permission for Course

Selected projects that result in outcomes benefiting a non-Iowa State University entity while instilling professional ethics and accomplishing student learning goals. Course expenses paid by student. Assessed service-learning component. (Typically Offered: Fall, Spring, Summer)

GLOBE 4940C: Service Learning: U.S. Diversity Project

Credits: 3. Repeatable.

Prereq: Instructor Permission for Course

Selected projects that result in outcomes benefiting a non-Iowa State University entity, while instilling professional ethics and accomplishing student learning goals. Academic work under faculty supervision may include written reports, presentations, and guided readings. Course expenses paid by student. Assessed service-learning component. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall, Spring, Summer)

GLOBE 4950: Global Resource Systems Study Abroad Course Preparation

Credits: 1-2. Contact Hours: Lecture 2.

Repeatable.

Global resource systems topics will include the agricultural industries, climate, crops, culture, economics, food, geography, government, history, livestock, marketing, natural resources, public policies, soils, and preparation for travel to locations to be visited. Students enrolled in this course intend to register for GLOBE 4940A, 4960 or 4970 the following term. (Typically Offered: Fall, Spring)

GLOBE 4960: Global Resource Systems Study Abroad

Credits: 2-4. Repeatable.

Extended field trips abroad to study global resource systems. Location and duration of trips will vary. Pre-trip sessions arranged through GLOBE 4950. Trip expenses paid by student. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

GLOBE 4960B: Global Resource Systems Domestic Travel Study

Credits: 1-4. Repeatable, maximum of 4 times.

Limited enrollment. Extended domestic field trips to study global resource systems topics. Location and duration of trips will vary. Pre-trip sessions arranged. Trip expenses paid by student. (Typically Offered: Fall, Spring, Summer)

GLOBE 4970: Deans Global Ag and Food Leadership Program

Credits: 1-4. Repeatable.

Prereq: 2 credits of GLOBE 4950

An integrated agricultural and food production and policy program that allows students to assess, analyze and evaluate complex, country-specific situations and to develop their skills, knowledge and abilities via team-oriented projects that involve complex issues such as development of effective foreign food aid and agricultural and food production systems, drivers of world hunger, sustainable resource management and efficacy of policy, and the role of the USA and the United Nations and other development agencies in these systems. International location and duration of program will vary. Pre-trip sessions arranged through GLOBE 4950. Trip expenses paid by students. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

GLOBE 4990: Undergraduate Research

Credits: 1-30.

Prereq: Instructor Permission for Course

Research projects in collaboration with faculty. (Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

GLOBE 5010X: Global Resource Systems and Analysis

Credits: 3. Contact Hours: Lecture 3.

An advanced, systematic analysis of global resource systems. Examination of global, regional, and local community capitals and resources, and assessment of perspectives of diverse stakeholders across cultures and societies regarding global resources.

GLOBE 5020X: Evaluation of Global Resource Systems and Applications

Credits: 3. Contact Hours: Lecture 3.

Evaluate approaches to community development that recognize community capitals, stakeholder perspectives, and sustainability.

Graduate Studies (GRST)

Graduate students may enroll in Graduate Studies (GRST) courses for professional development or to fulfill certain enrollment requirements. No major is granted in Graduate Studies.

Courses primarily for graduate students, open to qualified undergraduates:

GRST 5310X: Thriving in Graduate School

Credits: 1. Contact Hours: Lecture 1.

Prereq: Graduate Standing or Permission of Instructor

Part one of a four-part series of courses in the Center for Communication Excellence's (CCE's) Academic Communication Practices (AcComp) Certification Track. Focus on identifying and overcoming challenges associated with the transition to graduate school. Orientation to Graduate College standards, resources, and requirements. Determining goals for graduate education. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

GRST 5320X: Mapping Graduate School Trajectory

Credits: 1. Contact Hours: Lecture 1.

Prereq: Graduate Standing or Permission of Instructor

Part two of a four-part series of courses in the Center for Communication Excellence's (CCE's) Academic Communication Practices (AcComp) Certification Track. Focus on planning for empirical research and responsible research standards. Utilizing Graduate College, CCE, and university resources to succeed in graduate school. Orientation to creative component/thesis/dissertation expectations and guidelines. Identifying strategies to achieving goals in graduate education. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

GRST 5330X: Sustaining Productivity through Accountability in Graduate School

Credits: 1. Contact Hours: Lecture 1.

Prereq: Graduate Standing or Permission of Instructor

Part three of a four-part series of courses in the Center for Communication Excellence's (CCE's) Academic Communication Practices (AcComp) Certification Track. Focus on reporting and disseminating research findings, maintaining accountability, and producing high quality communication. Preparation for creative component/thesis/dissertation phase and meeting of Graduate College requirements. Executing strategies to achieving goals in graduate education. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

GRST 5340X: Attaining Success in Graduate School

Credits: 1. Contact Hours: Lecture 1.

Prereq: Graduate Standing or Permission of Instructor

Part four of a four-part series of courses in the Center for Communication Excellence's (CCE's) Academic Communication Practices (AcComp) Certification Track. Focus on preparing creative component/thesis/dissertation and readying for the job market. Preparation for final oral exam phase and meeting the graduation requirements. Achieving goals in graduate education. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

GRST 5360: Preparing Publishable Thesis Chapters

(Cross-listed with ENGL 5360).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Instructor Permission for Course

Reporting original research results within the norms for writing of a student's discipline. Emphasis on preparing thesis/dissertation chapters that will be both acceptable to the Graduate College and ready for submission to a refereed journal in the student's discipline. Focus on reporting results from student-generated original research, norms for discourse within disciplines, and how thesis chapters differ from journal manuscripts. (Typically Offered: Fall, Spring)

GRST 5400A: English for Teaching Purposes (Intermediate-Low)

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 3 credits.

Prereq: Instructor Permission for Course

Emphasis on pronunciation improvement and greater fluency in spoken English. Placement based upon OECT test results. Persons whose native language is English cannot take GRST 5400 for credit. No more than one section of GRST 5400 may be taken per semester; up to two sections total. Graduation Restriction: Credit for GRST 5400 does not apply toward graduation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

GRST 5400B: English for Teaching Purposes (Intermediate-Mid)

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 3 credits.

Prereq: Instructor Permission for Course

Placement based upon OECT test results. Persons whose native language is English cannot take GRST 5400 for credit. No more than one section of GRST 5400 may be taken per semester; up to two sections total. Graduation Restriction: Credit for GRST 5400 does not apply toward graduation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

GRST 5400C: English for Teaching Purposes (Intermediate-High)

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 3 credits.

Prereq: Instructor Permission for Course

For students who have completed GRST 5400A or GRST 5400B but have not reached the passing level on the OECT test. Placement based upon OECT test results. Persons whose native language is English cannot take GRST 5400 for credit. No more than one section of GRST 5400 may be taken per semester; up to two sections total. Graduation Restriction: Credit for GRST 5400 does not apply toward graduation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

GRST 5400D: English for Teaching Purposes (Advanced)

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 3 credits.

Prereq: Instructor Permission for Course

Developing explanations, leading discussions and handling questions in a teaching environment. Placement based upon OECT test results. Persons whose native language is English cannot take GRST 5400 for credit. No more than one section of GRST 5400 may be taken per semester; up to two sections total. Graduation Restriction: Credit for GRST 5400 does not apply toward graduation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

GRST 5400E: English for Teaching Purposes (Supervised Independent Study)

Credits: 1. Contact Hours: Lecture 1.

Repeatable, maximum of 1 credits.

Prereq: Instructor Permission for Course

Seminar with individual observation and consultation. Placement based upon OECT test results. Persons whose native language is English cannot take GRST 5400 for credit. No more than one section of GRST 5400 may be taken per semester; up to two sections total. Graduation Restriction: Credit for GRST 5400 does not apply toward graduation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

GRST 5480X: Improving Academic and Professional Speaking Skills

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Emphasis on improving oral communication skills in the areas of academic presentations as well as professional and interpersonal communication fundamentals. Offered to graduate students in any discipline. In-depth lectures, discussions, and coaching provided. Video and anonymous peer review of individual speeches. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

GRST 5650: Responsible Conduct of Research in Science and Engineering

Credits: 1. Contact Hours: Lecture 1.

Prereq: Graduate Standing or Permission of Instructor

Ethical and legal issues facing researchers in the sciences and engineering. (Typically Offered: Fall, Spring)

GRST 5660: Communications in Science

Credits: 2. Contact Hours: Lecture 2.

Repeatable, maximum of 8 credits.

Prereq: Graduate Standing or Permission of Instructor

Focus on enhancing professional communication skills to convey scientific knowledge and discoveries to broader audiences. Emphasis on developing best practices for communicating science to a wide range of specialist and non-specialist audiences including disciplinary researchers, interdisciplinary scholars, industry professionals, governmental bodies, media representatives, and the general public. (Typically Offered: Fall)

GRST 5670: Time Management and Mentoring

Credits: 0.5. Contact Hours: Lecture 0.5.

Prereq: Graduate Standing or Permission of Instructor

Balancing life and career; mentoring; lab management. (Typically Offered: Fall, Spring, Summer)

GRST 5680: The Interview Process

Credits: 0.5. Contact Hours: Lecture 0.5.

Prereq: Graduate Standing or Permission of Instructor

Applying and interviewing for academia, industry and government.
(Typically Offered: Fall, Spring, Summer)

GRST 5690: Grant Writing

(Cross-listed with ENGL 5690).

Credits: 1. Contact Hours: Lecture 1.

Prereq: Graduate Standing or Permission of Instructor

Writing a winning proposal. (Typically Offered: Spring)

GRST 5700: Teaching Practices

Credits: 0.5. Contact Hours: Lecture 0.5.

Prereq: Graduate Standing or Permission of Instructor

Preparation of a teaching portfolio and course materials; lecturing, technology. (Typically Offered: Fall, Spring, Summer)

GRST 5850: Preparing Future Faculty Introductory Seminar

Credits: 2. Contact Hours: Lecture 2.

Prereq: Instructor permission and admission into the Preparing Future Faculty Program

Development of job application materials for faculty positions. Considerations of faculty life issues such as job searches, tenure expectations, position responsibilities, and work-life balance. Visiting speakers from a variety of institutions share their experiences. Written components include presentation reflections and preparation of an application-ready academic job packet. (Typically Offered: Fall)

GRST 5860: Preparing Future Faculty Intermediate Seminar

Credits: 0-3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Development of additional job application materials for faculty positions and a working knowledge of a variety of other faculty skills to successfully navigate the first years on the job: inclusive classroom, ethics, public speaking, career management, and teaching skills from course design to delivery and assessment. (Typically Offered: Spring)

GRST 5870: Preparing Future Faculty Teaching Practicum

Credits: 1-3. Repeatable.

Prereq: GRST 5850, credit or enrollment in GRST 5860, instructor permission

Participants complete a stand-alone teaching experience at Iowa State or another institution of higher education. Written components include journaling, peer observation, reading reflection, and a teaching portfolio suitable for the academic job search process. (Typically Offered: Fall, Spring)

GRST 5880: Preparing Future Faculty Special Topics

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

In-depth study of topic providing further academic professional development. Written components include journaling, project management, a project report, and a reading reflection. (Typically Offered: Fall, Spring)

Courses for graduate students:

GRST 6800: Doctoral Post Prelim (Continuous) Registration

Credits: Required. Repeatable.

Reserved for doctoral students on pre-approved leave (medical, military, maternity, family/emergency) who have passed the preliminary exam and have not yet taken the final exam. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

GRST 6810A: Required Registration: Doctoral Continuous Registration

Credits: 1. Repeatable.

Course is available for students pursuing doctoral degrees who have passed their preliminary oral examination. Continuous enrollment is required for PhD students during fall and spring semesters between the preliminary oral exam and their final oral examination. Graduation Restriction: This course cannot be used toward graduation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

GRST 6810B: Required Registration: Final Exam Only

Credits: 1. Repeatable.

Course is available for students who are ready to have their Final Oral Examination. Enrollment is required for students during the semester of their final oral examination. Late registration of this course requires that the Request for Final Oral Examination has been submitted. Graduation Restriction: This course cannot be used toward graduation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

GRST 6810C: Required Registration: Graduate Assistant Enrollment

Credits: 1. Repeatable.

Offered on a satisfactory-fail basis only.

GRST 6970: Curricular Practical Training

Credits: Required. Repeatable.

Professional work period. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

GRST 6980: Graduate Internship: Part-Time CPT

Credits: Required. Repeatable.

Internship course for graduate students completing part-time internship. Internship is fewer than 20 hours per week or fewer than 90 days. International students must have approved part-time CPT prior to the semester of enrollment. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

Graphic Design (ARTGR)

Courses primarily for undergraduates:

ARTGR 2700: Graphic Design Studio I

Credits: 3. Contact Hours: Studio 6.

Prereq: Acceptance into ARTGR major; DSNS 1020; DSNS 1310

Introduction to the fundamental skills required in the graphic design profession. (Typically Offered: Fall)

ARTGR 2710: Graphic Design Studio II

Credits: 3. Contact Hours: Studio 6.

Prereq: Enrollment in ARTGR major; ARTGR 2700

Reinforces and further explores the fundamental skills, principles, and tools required for effective visual communication. (Typically Offered: Spring)

ARTGR 2720: Digital Photography for Graphic Design

Credits: 3. Contact Hours: Studio 6.

Prereq: Enrollment in ARTGR major; concurrent enrollment in ARTGR 2700 or ARTGR 2710

This course will address the development of 'seeing' as a medium design, expression, and visual communication including compositional dynamics, advanced digital image manipulation, software usage and support, digital camera operations along with scanning and other digital input devices, color management, digital format for presentation and printing with digital ready formats. (Typically Offered: Fall, Spring)

ARTGR 2730: Typography I

Credits: 3. Contact Hours: Studio 6.

Prereq: Credit or concurrent enrollment in ARTGR 2700

Emphasizes foundational typographic principles from letterform construction to hierarchies of extended text, directed toward typographic vocabulary, and typographic organization. Students will also understand both classical and contemporary typographic forms, as well as having the ability to construct typographic compositions and systems. (Typically Offered: Fall)

ARTGR 2740: Typography II

Credits: 3. Contact Hours: Studio 6.

Prereq: Enrollment in ARTGR major; ARTGR 2730; concurrent enrollment in ARTGR 2710

Advances the skills and principles learned in Graphic Design Typography I. Exploration of more complex problems that address typographic hierarchy, context, sequence and typography and image. (Typically Offered: Spring)

ARTGR 2750: Graphic Technology I

Credits: 3. Contact Hours: Studio 6.

Prereq: ARTGR Major

Basic 2-dimensional computer skills for graphic design.

ARTGR 2760: Graphic Technology II

Credits: 3. Contact Hours: Studio 6.

Prereq: ARTGR Major

Basic 3-dimensional computer skills for graphic design. (Typically Offered: Spring)

ARTGR 2810: Visual Communication and Branding

Credits: 3. Contact Hours: Lecture 3.

Prereq: ARTGR Major

Introduction to basic principles of visual communication that contribute to the successful comprehension of intended visual messages; these include promotional messages, such as corporate branding and marketing campaigns, as well as informational messages, such as those used in computer interface design or in the clear presentation of diagrammatic data. Emphasis is placed on sensitivity to the diversity of the intended American or global audience, and to the cross-cultural differences that may affect the ways that visual messages are interpreted. Methods for creating brand experiences are explored as they apply to both small and large enterprises, ranging from personal brand to corporate brand identities. (Typically Offered: Fall)

ARTGR 3700: Graphic Design Studio III

Credits: 3. Contact Hours: Studio 6.

Prereq: Enrollment in ARTGR major; ARTGR 2710 and ARTGR 2740

Creation and design of images and symbols for communication. Application and integration of typography with images and symbols. (Typically Offered: Fall)

ARTGR 3710: Graphic Design Studio IV

Credits: 3. Contact Hours: Studio 6.

Prereq: ARTGR 3700

Development and preparation of design concepts for application to the printing and electronic publishing process. Creative problem-solving skills, introduction to systems design. (Typically Offered: Spring)

ARTGR 3720: Graphic Materials and Processes

Credits: 3. Contact Hours: Lecture 3.

Prereq: Enrollment in ARTGR major; Junior classification or above

Introduction to the processes and materials involved in graphic design production. Course covers production ranging from pre-press to digital media.

ARTGR 3770: Graphic Design Internship Seminar

Credits: 1. Contact Hours: Lecture 1.

Prereq: Enrollment in ARTGR major; Junior classification or above

Professional preparation for graphic design internship.

ARTGR 3780: Critical Issues in Graphic Design

Credits: 2. Contact Hours: Lecture 2.

Prereq: Enrollment in ARTGR major; credit or concurrent enrollment in ARTGR 3700

Lecture, discussion and writing about the critical issues facing the communications field today and in the future.

ARTGR 3830: A Concise History of Graphics and Sports

Credits: 3. Contact Hours: Lecture 3.

Prereq: ARTGR Major

This introduction to basic concepts of branding in design explores the processes of sports, graphics of sports, design criteria of sport objects, consumer trends, and social importance of sports will be discussed. This course takes a historical perspective of sport graphics and objects starting at the first known understanding of what could be considered 'Sport,' from ancient times to the present. Interpretation of sport graphics and sport objects. Measuring the sports impact and associated graphics with emotions; sounds that date the sport or strengthen our memories of them, photographs of objects and people from different periods, images of industrial, sport, agrarian and city landscapes to remind us of the dominant role played by sport/graphics or that sport object in the country of its origin. (Typically Offered: Spring)

ARTGR 3870: Graphic Design History/Theory/ Criticism I

(Dual-listed with ARTGR 5870).

Credits: 3. Contact Hours: Lecture 3.

Late nineteenth century to the 1990s. This course will explore the cultural, social, political, industrial, and technological forces that have influenced the practice of graphic design in Britain, Europe, and the United States. Students will study the historical issues and problems facing designers, their clients, and their publics.

ARTGR 3880: Graphic Design History/Theory/ Criticism II

(Dual-listed with ARTGR 5880).

Credits: 3. Contact Hours: Lecture 3.

Critical issues that affect the contemporary practice of graphic design as it relates to the United States. Students will study a variety of issues that include, but are not exclusive to, new media, gender, class, design and the public sphere, design as social action, postmodern design theory, sustainability, and ethical practice.

ARTGR 3910: Graphic Design Field Study

Credits: 1. Contact Hours: Lecture 1.

Repeatable, maximum of 2 credits.

Prereq: Enrollment in ARTGR major; Junior classification or above

Travel, study, and tours of areas of interest within the graphic design profession such as print production companies, design studios, and museums. Offered on a satisfactory-fail basis only.

ARTGR 4630: 3D Motion Graphics

(Dual-listed with ARTGR 5630).

Credits: 3. Contact Hours: Studio 6.

Prereq: Enrollment in ARTGR major; Junior classification or above

3D visualization in a Motion Graphics context. Emphasis on design in 3D computer animation as it relates to various electronic media. (Typically Offered: Spring)

ARTGR 4640: Digital Imaging

(Dual-listed with ARTGR 5640).

Credits: 3. Contact Hours: Studio 6.

Prereq: Enrollment in ARTGR major; Junior classification or above

Studio in experimental techniques using the digital drawing tablet combined with manual drawing mediums, exploring the digital tablet, scanner, and camera as ways to collect and make images, conceptual and compositional development of digital techniques and software, and connecting digital techniques to visual processes and ideation. Understanding of different ways of working digitally while exploring image-making processes.

ARTGR 4700: Graphic Design Studio V

Credits: 3. Contact Hours: Studio 6.

Prereq: Enrollment in ARTGR major; ARTGR 3710

Advanced design systems as applied to corporate identity and environmental graphic design. Symbolology as an integrated component of communication systems. (Typically Offered: Fall)

ARTGR 4710: Graphic Design Capstone

Credits: 3. Contact Hours: Studio 6.

Prereq: Enrollment in ARTGR major; ARTGR 4700 or Permission of Instructor

Experience design and innovation in a multi-disciplinary design studio. Class will use unique research, design, evaluation, creativity, and innovation methodologies to solve human problems on special topics. Designed solutions will be in the form of products, artifacts, interfaces, information, and human environments. (Typically Offered: Spring)

ARTGR 4720: Photography and Narrative Messaging

(Dual-listed with ARTGR 5720).

Credits: 3. Contact Hours: Studio 6.

Prereq: Enrollment in ARTGR major; Junior classification or above

Photography as a tool for creating conceptually-driven images and metaphors. Emphasis is on photography as an evocative storytelling device for a range of audiences and design applications. Compositional and technical aspects are explored to ensure successful interpretation of the photograph's intended message.

ARTGR 4730: Multimedia Design

(Dual-listed with ARTGR 5730).

Credits: 3. Contact Hours: Laboratory 6.

Prereq: Junior, Senior or Graduate classification and in the graphic design program

The design of visual, aural and textual communication for electronic media.

ARTGR 4740: Exhibition Design

(Dual-listed with ARTGR 5740).

Credits: 3. Contact Hours: Studio 6.

Prereq: Junior, Senior or Graduate classification and in the graphic design program

Exhibition Design.

ARTGR 4750: Advanced Typography

(Dual-listed with ARTGR 5750).

Credits: 3. Contact Hours: Studio 6.

Prereq: Junior, Senior or Graduate classification and in the graphic design program

Typographic theory exploring traditional and non-traditional forms, both historical and contemporary typographic achievements.

ARTGR 4760: Graphic Design Methodology

(Dual-listed with ARTGR 5760).

Credits: 3. Contact Hours: Studio 6.

Prereq: Junior, Senior or Graduate classification and in the graphic design program

Analysis and application of scientific, systematic, and non-traditional problem-solving and problem-seeking techniques.

ARTGR 4770: Graphic Design Practicum

Credits: 3. Contact Hours: Studio 6.

Repeatable, maximum of 6 credits.

Prereq: Junior, Senior, or Graduate classification in graphic design program AND Permission of Instructor

Graphic design outreach and problem solving. Individual and group projects for non-profit clients selected by the instructor.

ARTGR 4780: Graphic Design Advanced Web Design

(Dual-listed with ARTGR 5780).

Credits: 3. Contact Hours: Laboratory 6.

Prereq: Junior, Senior or Graduate classification and in the graphic design program

The development of advanced and experimental web design.

ARTGR 4790: Wayfinding Design

(Dual-listed with ARTGR 5790).

Credits: 3. Contact Hours: Studio 6.

Prereq: Junior, Senior or Graduate classification and in the graphic design program

Study of the navigational challenges of built environments and outdoor spaces, including site analysis, development of navigational plans, and design of wayfinding sign systems. Issues of function, accessibility, legibility, and fabrication are considered.

ARTGR 4800: Graphic Design Internship

Credits: 3.

Prereq: Enrollment in ARTGR major; Junior classification or above

Graphic design experience in an off-campus professional environment. (Typically Offered: Summer)

ARTGR 4810: Graphic Design Professional Practices

Credits: 3. Contact Hours: Lecture 3.

Prereq: Enrollment in ARTGR major; ARTGR 4700 or Permission of Instructor

Professional design management: ethics, setting up a new business, client/designer relationships, contractual options, billing practices, and effective operating procedures. (Typically Offered: Spring)

ARTGR 4820: Professional Presentation

Credits: 3.

Prereq: Enrollment in ARTGR major; Junior classification or above

Exploration and development of job application materials and presentation skills.

ARTGR 4830: Science + Design: Interpretation of Natural Resources in Montana

(Dual-listed with NREM 5830/ ARTGR 5830). (Cross-listed with NREM 4830).

Credits: 3. Contact Hours: Lecture 1, Studio 4.

Prereq: Enrollment in ARTGR major; ARTGR 2710 or BIOL 2110; Permission of Instructor.

Interdisciplinary service-learning. Design and production of natural resource related interpretive signs for Montana natural areas. Field-work experience followed by on-campus studio. (Typically Offered: Fall)

ARTGR 4840: Selected Studies in Graphic Design

(Dual-listed with ARTGR 5840).

Credits: 1-3. Contact Hours: Studio 6.

Repeatable, maximum of 12 credits.

Prereq: Junior, Senior or Graduate classification and in the graphic design program

Special issues related to graphic design. Topics vary each time offered. Topics not to be repeated. Graduation Restriction: Topics may not be repeated. (Typically Offered: Fall, Spring, Summer)

ARTGR 4890: Design Ethics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Enrollment in ARTGR major; Junior classification or above

Historical and contemporary issues in ethics and decision-making related to visual arts, related visual communication, and design disciplines, including education/training, professional practice and research, the social role of design, and the implications and consequences of designed artifacts and systems.

ARTGR 4900A: Independent Study: Theory, Criticism, and Methodology

Credits: 1-6. Repeatable.

Prereq: Enrollment in ARTGR major; Permission of Instructor

Student must have completed related graphic design coursework appropriate to planned independent study. (Typically Offered: Fall, Spring, Summer)

ARTGR 4900B: Independent Study: Two-Dimensional Design

Credits: 1-6. Repeatable.

Prereq: Enrollment in ARTGR major; Permission of Instructor

Student must have completed related graphic design coursework appropriate to planned independent study. (Typically Offered: Fall, Spring, Summer)

ARTGR 4900C: Independent Study: Three-Dimensional Design

Credits: 1-6. Repeatable.

Prereq: Enrollment in ARTGR major; Permission of Instructor

Student must have completed related graphic design coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis. (Typically Offered: Fall, Spring, Summer)

ARTGR 4900H: Independent Study: Honors

Credits: 1-6. Repeatable.

Prereq: Enrollment in Graphic Design major; Permission of Instructor; Membership in the University Honors Program

Student must have completed related graphic design coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis. (Typically Offered: Fall, Spring, Summer)

ARTGR 4900I: Internship/Cooperative (In-Depth Experience Other Than ARTGR 4800)

Credits: 1-6. Repeatable.

Prereq: Enrollment in ARTGR major; Permission of Instructor

Student must have completed related graphic design coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis. (Typically Offered: Fall, Spring, Summer)

ARTGR 4910: Publication Design

(Dual-listed with ARTGR 5910).

Credits: 3.

Prereq: Junior, Senior or Graduate classification and in the graphic design program

The philosophy, concepts, and structures of publication design.

ARTGR 4920: Graphic Design Systems Thinking

(Dual-listed with ARTGR 5920).

Credits: 3. Contact Hours: Studio 6.

Prereq: Junior, Senior or Graduate classification and in the graphic design program

The philosophy, concepts, and structures of systems thinking in graphic design.

ARTGR 4930: Workshop

Credits: 1-3. Contact Hours: Studio 6.

Repeatable.

Prereq: Enrollment in ARTGR major; Junior classification or above

Intensive 2 to 4 week studio exploration. Topics vary each time offered.

ARTGR 4950: Graphic Design Abroad

(Dual-listed with ARTGR 5950).

Credits: 3.

Prereq: Enrollment in ARTGR major; Permission of Instructor

International study abroad program with visits to design studios, art museums, and educational facilities. (Typically Offered: Summer)

ARTGR 4960: Graphic Design Semester Abroad

Credits: Required. Repeatable.

Prereq: Enrollment in ARTGR major; Junior classification or above

Study and tours of museums, galleries, artist and/or designer studios, and other areas of interest within art and design. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

ARTGR 4970: Graphic Design Field Study

Credits: 1. Repeatable.

Prereq: Enrollment in ARTGR major; Junior classification or above

Introduction to places related to graphic design in urban environments such as museums and design studios. Culture and context of design in the urban environment. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

ARTGR 5100: Graphic Design Theory

Credits: 3. Contact Hours: Lecture 3.

Prereq: Enrollment in ARTGR graduate program or instructor permission

This course will investigate graphic design as a tool to represent and create imageability in the mind of the audience, through relevant readings in graphic design theory and principles of visual organization in various media. (Typically Offered: Fall)

ARTGR 5110: Graphic Design Graduate Studio I

Credits: 3. Contact Hours: Studio 6.

Prereq: Enrollment in ARTGR graduate program or instructor permission

Introduction to a range of research topics, methods, and ideas that are predicated on learning through the process of creation. (Typically Offered: Fall)

ARTGR 5120: Audience and Perception

Credits: 3. Contact Hours: Studio 6.

Prereq: Enrollment in ARTGR graduate program or instructor permission

Theory and investigation of systems, structures, principles of visual organization for communication through the experimental application of traditional and non-traditional media. Studio problems will be influenced by social, cultural, environmental, or technological factors. (Typically Offered: Fall)

ARTGR 5200: Design & Cultural Semiotics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to semiotics as it relates to art, design and culture. Historical and contemporary vantage points and the importance of designers as makers of meaning. Key concepts of semiotics and the interrelationship between message, meaning, design and culture. (Typically Offered: Spring)

ARTGR 5210: Graphic Design Graduate Studio II

Credits: 3. Contact Hours: Studio 6.

Prereq: Graduate Standing or Permission of Instructor

In this advanced graduate graphic design studio led by a variety of faculty, students will be introduced to a range of research topics, methods and ideas that are predicated on learning through the process of creation. (Typically Offered: Spring)

ARTGR 5220: Critical Media

Credits: 3. Contact Hours: Studio 6.

Prereq: Graduate Standing or Permission of Instructor

Advanced theory and investigation of critical media and application of principles of visual organization for communication. Through hypothetical design work with critical media tools, studio problems will examine and be informed by social, cultural, environmental, or technological factors. (Typically Offered: Spring)

ARTGR 5300: User Engagement

Credits: 3. Contact Hours: Studio 6.

Prereq: Enrollment in ARTGR graduate program or instructor permission

The exploration and design of interface/interaction with products, systems, and technologies.

ARTGR 5310: Graphic Design Graduate Project Preparation

Credits: 1. Contact Hours: Lecture 1.

Prereq: Graduate Standing or Permission of Instructor

Exploration, formulation, and structuring of graduate thesis/creative component topics, investigation of design research and creative scholarship. (Typically Offered: Fall)

ARTGR 5400: Design for Behavioral Change

Credits: 3. Contact Hours: Studio 6.

Prereq: Graduate Standing or Permission of Instructor

The exploration and design of educational experiences and artifacts as they relate to the social, emotional, and behavioral aspects of society.

ARTGR 5630: 3D Motion Graphics

(Dual-listed with ARTGR 4630).

Credits: 3. Contact Hours: Studio 6.

Prereq: Graduate Standing or Permission of Instructor

3D visualization in a Motion Graphics context. Emphasis on design in 3D computer animation as it relates to various electronic media. (Typically Offered: Spring)

ARTGR 5640: Digital Imaging

(Dual-listed with ARTGR 4640).

Credits: 3. Contact Hours: Studio 6.

Prereq: Graduate Standing or Permission of Instructor

Studio in experimental techniques using the digital drawing tablet combined with manual drawing mediums, exploring the digital tablet, scanner, and camera as ways to collect and make images, conceptual and compositional development of digital techniques and software, and connecting digital techniques to visual processes and ideation. Understanding of different ways of working digitally while exploring image-making processes.

ARTGR 5720: Photography and Narrative Messaging

(Dual-listed with ARTGR 4720).

Credits: 3. Contact Hours: Laboratory 6.

Prereq: Graduate Standing or Permission of Instructor

Photography as a tool for creating conceptually-driven images and metaphors. Emphasis is on photography as an evocative storytelling device for a range of audiences and design applications. Compositional and technical aspects are explored to ensure successful interpretation of the photograph's intended message.

ARTGR 5730: Multimedia Design

(Dual-listed with ARTGR 4730).

Credits: 3. Contact Hours: Laboratory 6.

Prereq: Graduate Standing or Permission of Instructor

The design of visual, aural and textual communication for electronic media.

ARTGR 5740: Exhibition Design

(Dual-listed with ARTGR 4740).

Credits: 3. Contact Hours: Studio 6.

Prereq: Graduate Standing or Permission of Instructor

Visual communication applied to exhibition design focusing on educational or interactive museum exhibitions, trade show booth design, and modular unit design for traveling exhibitions. Translation of graphic information to a three-dimensional space.

ARTGR 5750: Advanced Typography

(Dual-listed with ARTGR 4750).

Credits: 3. Contact Hours: Studio 6.

Prereq: Graduate Standing or Permission of Instructor

Typographic theory exploring traditional and non-traditional forms, both historical and contemporary typographic achievements.

ARTGR 5760: Graphic Design Methodology

(Dual-listed with ARTGR 4760).

Credits: 3. Contact Hours: Studio 6.

Prereq: Graduate Standing or Permission of Instructor

Analysis and application of scientific, systematic, and non-traditional problem-solving and problem-seeking techniques.

ARTGR 5780: Graphic Design Advanced Web Design

(Dual-listed with ARTGR 4780).

Credits: 3. Contact Hours: Laboratory 6.

Prereq: Graduate Standing or Permission of Instructor

The development of advanced and experimental web design.

ARTGR 5790: Wayfinding Design

(Dual-listed with ARTGR 4790).

Credits: 3. Contact Hours: Studio 6.

Prereq: Graduate Standing or Permission of Instructor

Study of the navigational challenges of built environments and outdoor spaces, including site analysis, development of navigational plans, and design of wayfinding sign systems. Issues of function, accessibility, legibility, and fabrication are considered.

ARTGR 5830: Science + Design: Interpretation of Natural Resources in Montana

(Dual-listed with NREM 4830/ ARTGR 4830). (Cross-listed with NREM 5830).

Credits: 3. Contact Hours: Lecture 1, Studio 4.

Prereq: Graduate Standing or Permission of Instructor

Interdisciplinary service-learning. Design and production of natural resource related interpretive signs for Montana natural areas. Field-work experience followed by on-campus studio. (Typically Offered: Fall)

ARTGR 5840: Selected Studies in Graphic Design

(Dual-listed with ARTGR 4840).

Credits: 1-3. Contact Hours: Studio 6.

Repeatable, maximum of 12 credits.

Prereq: Graduate Standing or Permission of Instructor

Special issues related to graphic design. Topics vary each time offered. Topics not to be repeated. Graduation Restriction: Topics may not be repeated. (Typically Offered: Fall, Spring, Summer)

ARTGR 5870: Graphic Design History/Theory/ Criticism I

(Dual-listed with ARTGR 3870).

Credits: 3. Contact Hours: Lecture 3.

Late nineteenth century to the 1990s. This course will explore the cultural, social, political, industrial, and technological forces that have influenced the practice of graphic design in Britain, Europe, and the United States. Students will study the historical issues and problems facing designers, their clients, and their publics.

ARTGR 5880: Graphic Design History/Theory/ Criticism II

(Dual-listed with ARTGR 3880).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate enrollment in the Graphic Design Program or graduate enrollment in College of Design or permission of instructor

Critical issues that affect the contemporary practice of graphic design as it relates to the United States. Students will study a variety of issues that include, but are not exclusive to, new media, gender, class, design and the public sphere, design as social action, postmodern design theory, sustainability, and ethical practice.

ARTGR 5890: Design and Ethics

(Cross-listed with HCI 5890).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Issues in ethics and decision-making as they relate to technology, design, design research, HCI, and the design industry. (Typically Offered: Fall, Spring)

ARTGR 5900A: Special Topics: Theory, Criticism, and Methodology

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Written approval of instructor and department chair on required form in advance of semester of enrollment.

ARTGR 5900B: Special Topics: Two-Dimensional Design

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Written approval of instructor and department chair on required form in advance of semester of enrollment. (Typically Offered: Fall, Spring, Summer)

ARTGR 5900C: Special Topics: Three-Dimensional Design

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Written approval of instructor and department chair on required form in advance of semester of enrollment. (Typically Offered: Fall, Spring, Summer)

ARTGR 5910: Publication Design

(Dual-listed with ARTGR 4910).

Credits: 3.

Prereq: Graduate Standing or Permission of Instructor

The philosophy, concepts, and structures of publication design.

ARTGR 5920: Graphic Design Systems Thinking

(Dual-listed with ARTGR 4920).

Credits: 3. Contact Hours: Studio 6.

Prereq: Graduate Standing or Permission of Instructor

The philosophy, concepts, and structures of systems thinking in graphic design.

ARTGR 5930: Workshop

Credits: 1-3. Contact Hours: Studio 6.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Intensive 2 to 4 week studio exploration. Topics vary each time offered.

ARTGR 5950: Graphic Design Abroad

(Dual-listed with ARTGR 4950).

Credits: 3.

Prereq: Graduate Standing or Permission of Instructor

International study abroad program with visits to design studios, art museums, and educational facilities. (Typically Offered: Summer)

ARTGR 5990: Creative Component

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

Courses for graduate students:**ARTGR 6100: Thesis Preparation Studio**

Credits: 3. Contact Hours: Studio 6.

Initial development and exploration of graduate thesis topic, investigation of design research and creative scholarship. Determine Faculty Committee and Program of Study and file forms with Graduate College. (Typically Offered: Spring)

ARTGR 6200: Graduate Thesis Studio I

Credits: 3. Contact Hours: Laboratory 6.

Prereq: Enrollment in ARTGR graduate program or instructor permission

Advanced creative scholarship in specialized area of focus within graphic design. Culminates in a development plan, preliminary design work, and supporting documentation. (Typically Offered: Fall)

ARTGR 6300: Graduate Thesis Studio II

Credits: 3. Contact Hours: Studio 6.

Advanced research component in specialized area of focus within graphic design. Advances a development plan, preliminary design work, and supporting documentation. (Typically Offered: Spring)

ARTGR 6900: Advanced Topics

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

ARTGR 6990: Research-Thesis

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

Health Studies (HS)

Courses primarily for undergraduates:**HS 1050: First Aid and Emergency Care**

Credits: 2.

Discussion and application of the basic techniques of utilizing bloodborne pathogen safety measures, administering first aid and cardiopulmonary resuscitation. ARC layperson certification available. (Typically Offered: Fall, Spring, Summer)

HS 1100: Personal and Consumer Health

Credits: 3. Contact Hours: Lecture 3.

Physical, mental, emotional and social aspects of health as a basis for understanding and promoting health, and preventing poor health conditions. Study of personal responsibility on the long-term benefits of maintaining a high level of wellness and health. Identification and mitigation of negative lifestyle habits. (Typically Offered: Fall, Spring)

HS 1670X: The Science of Health Behavior Change

Credits: 3. Contact Hours: Lecture 3.

A theory- and evidence-based approach to the understanding of health behavior change. Practical approaches to promote introspection, increase self-awareness, motivation, confidence, and alignment between lifestyle and personal values. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Summer)

HS 2750: Health Education in the Elementary School

Credits: 3. Contact Hours: Lecture 3.

Prereq: HDFS 1020 or HDFS 2260 or PSYCH 2300

The application of instructional strategies related to health education and physical education for teachers at the elementary level. Graduation Restriction: Credit for both HS 2750 and 3750 may not be applied toward graduation. (Typically Offered: Fall, Spring)

HS 2850: Pre-Internship in Kinesiology and Health

(Cross-listed with KIN 2850).

Credits: 1-2.

Prereq: Kinesiology and Health major; credit or concurrent enrollment in KIN 2580; Permission of Internship Coordinator

Pre-internship experience with a health organization based on option. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

HS 2900: Independent Study

Credits: 1. Repeatable, maximum of 3 credits.

Prereq: 2nd semester Freshmen or Sophomore classification; Permission of Instructor

Study under supervision of faculty. (Typically Offered: Fall, Spring)

HS 3050: Instructor's First Aid and Cardiopulmonary Resuscitation

Credits: 2.

Prereq: HS 1050

Discussion and practice of skills needed to teach CPR, AED, and first aid content related to the American Red Cross curriculum. Instructor candidates must possess valid certification for adult and pediatric CPR/AED/First Aid at beginning of course. (Typically Offered: Fall, Spring)

HS 3100: Community and Public Health

Credits: 3. Contact Hours: Lecture 3.

Prereq: HS 1100

Introduction to community health problems, programs of prevention, environmental health agencies, and health services. Study of local, state, and national community health agencies, their purposes and functions. (Typically Offered: Fall, Spring)

HS 3500: Human Diseases

Credits: 3. Contact Hours: Lecture 3.

Prereq: HS 1100 AND [(BIOL 2550 and BIOL 2560) OR BIOL 1550]

Discussion of disease process and ill-health in the twentieth century. Emphasis on epidemiology, prevention, treatment, and the understanding of the etiology of communicable and noncommunicable diseases. (Typically Offered: Fall, Spring)

HS 3750: Teaching-Learning Process in Health Education

Credits: 3. Contact Hours: Lecture 3.

Prereq: HS 1050; HS 1100

Principles, methods, materials, and resources involved in the teaching of health. Includes organization and development of the health education curriculum (K-12). Graduation Restriction: Credit for both HS 2750 and 3750 may not be applied toward graduation. (Typically Offered: Fall)

HS 3800: Worksite Health Promotion

Credits: 3. Contact Hours: Lecture 3.

Prereq: KIN 2580

The design and implementation of worksite health promotion programs and the benefits these programs have for both employees and employers. Review of various health risk appraisals and planning theory-based incentive programs designed to promote positive lifestyles. (Typically Offered: Spring)

HS 3850: Preparation and Search Strategies for Kinesiology and Health Internships

(Cross-listed with KIN 3850).

Credits: 0.5. Contact Hours: Lecture 0.5.

Prereq: Junior classification

Preparation of relevant material for a successful internship/career search. Specific internship timeline, process, procedures will be reviewed. Course needs to be taken a minimum of two semesters prior to required internship. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

HS 4170A: Supervised Teaching in Health Education in the Secondary School: Initial Endorsement

Credits: 16.

Prereq: HS 3750

Students must be fully admitted to Teacher Education and must apply for approval to enroll at the beginning of the semester prior to registering. (Typically Offered: Fall, Spring)

HS 4170B: Supervised Teaching in Health Education in the Secondary School: Additional Endorsement

Credits: 1-30.

Prereq: HS 3750

Students must be fully admitted to Teacher Education and must apply for approval to enroll at the beginning of the semester prior to registering. (Typically Offered: Fall, Spring)

HS 4300: Community Health Program Development

Credits: 3. Contact Hours: Lecture 3.

Techniques of needs assessment, program design, administration, and evaluation of community health education programs in various settings. (Typically Offered: Fall)

HS 4640: Physical Activity Epidemiology

(Dual-listed with HS 5640).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (HS 3500 or KIN 3580); (STAT 1010 or STAT 1040 or STAT 2260)

Understanding health benefits of physical activity on chronic disease prevention and health promotion throughout the life span, from clinical and public health perspectives. Discussion and application of real-life physical activity assessment, research, guidelines, and promotion in population levels. (Typically Offered: Fall, Spring)

HS 4850: Internship in Health Studies

Credits: 8-12.

Prereq: Senior classification; Permission of Internship Coordinator

Advance registration required. Supervised experience in health related agencies. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

HS 4850A: Internship in Health Studies: Community and Public Health

Credits: 8-12.

Prereq: KIN major; C- or better in (KIN 3580; KIN 3590; KIN 3660; HS 3100; HS 3500; HS 4300); Cumulative GPA 2.0; Permission of Internship Coordinator

Observation and practice in selected community and public health agencies. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

HS 4850B: Internship in Health Studies: Physical Activity and Health Promotion

Credits: 8-12.

Prereq: KIN major; C- or better in (KIN 3580; KIN 3590; KIN 3660; KIN 4580; KIN 4670; HS 3500); Cumulative GPA 2.0; Permission of Internship Coordinator

Observation and practice in selected physical activity and health promotion agencies. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

HS 4900: Independent Study

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

HS 5640: Physical Activity Epidemiology

(Dual-listed with HS 4640).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (HS 3500 or KIN 3580); (STAT 1010 or STAT 1040 or STAT 2260)

Understanding health benefits of physical activity on chronic disease prevention and health promotion throughout the life span, from clinical and public health perspectives. Discussion and application of real-life physical activity assessment, research, guidelines, and promotion in population levels. (Typically Offered: Fall, Spring)

Healthcare Management (HCM)

Courses primarily for undergraduates:

HCM 3010: Introduction to the US Healthcare Industry

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Introduces and provides an overview of the US healthcare delivery system for healthcare managers. Includes the theoretical basis for the system, its history and development, the resources that comprise it, as well as its overall planning, organization, management, evaluation, quality, professions, and its major health policy issues. Examines how healthcare policy is developed at the federal and state levels, considers the influence of all constituencies in policy formation, and compares existing policy and policy formation in other countries to the U.S. Explores how the healthcare policy environment affects the work of healthcare managers. (Typically Offered: Fall, Spring, Summer)

HCM 3020: Economics for Healthcare Managers

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or enrollment in HCM 3010 or FS HN 4300

Explores the economic influences and underpinnings of the healthcare delivery system. Examines the importance of economics in healthcare decisions, both demand and supply-side factors, and how third-party payers and public policy influence consumption and production of healthcare. Introduces evaluation of clinical outcomes using cost-effectiveness and other decision-analysis tools, as well as topics such as asymmetry of information, comparative healthcare systems, and healthcare policy. (Typically Offered: Fall, Spring)

HCM 3030: Healthcare Quality Management

(Cross-listed with SCM 3030).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or enrollment in HCM 3010 or FS HN 4300

Addresses the manager's role in improving healthcare quality and outcomes, including clinical and organizational improvement, and quality improvement practices. Explores how healthcare delivery systems can better measure outcomes from both patient and organizational perspectives. Analyzes quality improvement programs and examines their adaptability to the healthcare environment. (Typically Offered: Fall, Spring)

HCM 3910: Internship in Healthcare Management

Credits: 3. Repeatable.

Prereq: At least 12 hours of HCM coursework with a cumulative HCM-specific GPA of 2.0 or better AND departmental permission

The internship is an integrative experience in a healthcare setting that allows students to apply the skills and knowledge obtained through their academic preparation in healthcare management. The internship consists of a minimum of 120 contact hours. Students are required to submit written and/or oral reports to the instructor of record on the internship experience as it relates to the healthcare management curriculum. Students may be responsible for facility-specific fees associated with the completion of organizational requirements, such as training and immunization.

HCM 3980: Cooperative Education

Credits: Required. Repeatable.

Prereq: At least 12 hours of HCM coursework with a cumulative HCM-specific GPA of 2.0 or better AND departmental permission

Students who wish to remain enrolled in Iowa State and work full-time in a healthcare management position can complete the Cooperative Education course. The cooperative education experience in a healthcare setting that allows students to apply the skills and knowledge obtained through their academic preparation in healthcare management. Students are required to submit written and/or oral reports to the instructor of record on the internship experiences as it relates to the healthcare management curriculum. Students may be responsible for facility-specific fees associated with completion of organizational requirements, such as training and immunization. Offered on a satisfactory-fail basis only.

HCM 4010: Financial Management for Healthcare Organizations

(Cross-listed with ACCT 4010).

Credits: 3. Contact Hours: Lecture 3.

Prereq: FIN 3010 and credit or enrollment in HCM 3010

Examination of the current accounting system for, and the financing of, health care and the factors affecting the industry. Exploration and analysis of budgetary concepts, financial management, cost accounting, and management under rate control and competition, as well as the differences between the goods and service industries. Additional areas of discussion include the practical application of health care finance theory as it applies to the current healthcare environment. The revenue and expense applications will be explored in-depth, particularly in relation to the delivery of health care services. Specific emphasis will be placed on understanding the components of the income statement and balance sheet, developing a budget, and using these financial statements for analyzing operational changes. (Typically Offered: Fall, Spring)

HCM 4020: Law and Regulatory Environment in Healthcare

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or enrollment in HCM 3010 or FS HN 4300

An in-depth look at the legal and regulatory environment of healthcare management and practice. Explores aspects of employer-employee relations in the health care setting and legal ramifications of patient treatment and medical records. Discusses the importance of healthcare managers being familiar with the laws and regulations of healthcare. Included may be considerations of governmental, accreditation, and professional associations' oversight.

HCM 4030: Healthcare Information Systems

(Cross-listed with MIS 4030).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MIS 3010 and credit or enrollment in HCM 3010

Explores the critical role information technologies and systems play in healthcare organizations. The focus is on evaluating and implementing software and IT systems that facilitate delivery of health care; understanding information technology governance, data privacy, and security; planning and project management; and tracking future developments of information technology in healthcare management. Introduction to Electronic Health Records (EHR) and other Management and Financial Information System applications used by healthcare organizations.

HCM 4040X: Cost-Effectiveness Analysis in Healthcare

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 1130 and FIN 3010 and STAT 2260

Introduces cost-effectiveness analysis in the healthcare context.

Examines different forms of economic evaluations for healthcare interventions or technology, and how this impacts managerial decision-making. Includes cost-effectiveness, cost-utility, cost-benefit, cost-consequence, and cost-minimization analyses. Develops knowledge and skills in how to use these methods for evidence-based and ethical decisions in healthcare and other types of organizations. (Typically Offered: Spring)

HCM 4530X: Current Issues in Healthcare Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: HCM 3010

Designed to complement the required curriculum in the Healthcare Management (HCM) major. Explores a rotating selection of cutting edge and timely topics in the area of HCM, with an emphasis on the application of HCM knowledge and skills to the challenges facing today's organizations. Develops an awareness and understanding of the range, scope, and complexity of management-related issues in the modern (and post-pandemic) healthcare organization. Opportunities to apply introduced HCM knowledge, skills, and tools through class projects and exercises.

HCM 4900: Independent Study in Healthcare Management

Credits: 3. Repeatable.

Prereq: Instructor permission and department permission and at least 12 hours of HCM coursework with a cumulative HCM-specific GPA of 2.0 or better

At least 12 hours of HCM coursework with a cumulative HCM-specific GPA of 2.0 or better. Instructor permission and department permission required.

Courses primarily for graduate students, open to qualified undergraduates:

HCM 5040X: Advanced Cost-Effectiveness Analysis in Healthcare

Credits: 3. Contact Hours: Lecture 3.

Focuses on cost-effectiveness analysis as a decision-oriented tool that takes both costs and consequences of actions into account in a systematic way. Includes methods such as decision analysis, Markov models, and different ways of conducting sensitivity analysis. Discusses ethical implications of using cost-effectiveness analysis for managerial decision-making in healthcare organizations. (Typically Offered: Fall, Spring)

Higher Education (HGED)

Courses primarily for undergraduates:

HGED 4120X: Intercollegiate Athletics in U.S. Higher Education

(Dual-listed with HGED 5120X).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior or Senior Classification

This course examines the role and impact of intercollegiate athletics in U.S. higher education institutions. Topics include governance, policy, compliance, student-athlete welfare, equity, legal and ethical issues, and the relationship between athletics and academic missions.

Courses primarily for graduate students, open to qualified undergraduates:

HGED 5040: History of Higher Education in the United States

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Survey course in the history of higher education in the United States, from the colonial era to the present. Emphasis is placed on enduring debates about the purpose(s) of higher education and issues of equity and access along lines of race, class, and gender. Readings include primary and secondary materials.

HGED 5120X: Intercollegiate Athletics in U.S. Higher Education

(Dual-listed with HGED 4120X).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate standing

Role and impact of intercollegiate athletics in U.S. higher education institutions. Topics include governance, policy, compliance, student-athlete welfare, equity, legal and ethical issues, and the relationship between athletics and academic missions.

HGED 5380: Foundations of Engineering Education

(Cross-listed with ENGR 5380/ AERE 5380).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to the field of engineering education, with an emphasis on engineering education history, existing challenges, teaching and learning pedagogies and theories, research opportunities, and research methodologies. The course goal is to develop students as scholars and to have students think critically about engineering and education. Students will apply the knowledge gained from this course to propose a research project related to their own discipline. The proposal is intended to help students learn and apply the key elements of engineering education research. This course is intended for students with a variety of interests and career goals, including those interested in learning to conduct engineering education research, exploring research discoveries about teaching and learning, and engaging with the engineering education community. (Typically Offered: Fall)

HGED 5440: Foundations of Leadership

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to leading in higher education. Course will include concepts, competencies, and skills necessary for leading higher education organizations, the various roles leaders may fill within the higher education sector, using assessment for improvement as a leader in higher education.

HGED 5520: Introduction to Higher Education in the United States

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Overview of higher education in the United States, including a brief history, the functions, organization, external influences, funding, and the major issues impacting postsecondary institutions today.

HGED 5610: College Teaching

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Educational theories, methods and strategies for the improvement of college instruction. Assist potential college instructors in developing knowledge of protocol, assessment, and the scholarship and art of teaching. Emphasis on the unique challenge of college teaching in a changing student population environment.

HGED 5620: Curriculum Development in Colleges

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Modes of curriculum design, development, and change in colleges. Development of curricular leadership and evaluation strategies.

HGED 5680: Global Education Policy Analysis

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Assessment of global education policy issues in education. Analysis of policies, implementation strategies, and policy outcomes.

HGED 5720: Resource Management in Higher Education

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate standing

An examination of resource management in higher education. Planning, allocation, and administration of financial, human, and physical resources in colleges and universities.

HGED 5730: Equity, Diversity, and Inclusion in Student Affairs

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Explores theories of equity, diversity, and inclusion to build knowledge and skills related to social justice in student affairs practice.

HGED 5740: Student Affairs Practice in Higher Education

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to the profession of Student Affairs in higher education. As a survey course, readings, learning artifacts, and class discussions will be used to uncover a breadth of topics related to the student affairs profession. Course content is organized around, but will not be limited to, the history, philosophical underpinnings, values, ethics, and standards espoused, as well as the concepts of learning and community development.

HGED 5750: Organization and Administration of Student Affairs

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Topics related to organization and administration of student affairs in higher education. The course surveys organizational and administrative aspects of student affairs within the broader context of post-secondary education with particular attention paid to organizational development, budget and finance, and law and policy.

HGED 5760: Student Development in Higher Education

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Theories of student and adult development and their applications in student affairs programs, services, and activities are reviewed. Emphasis is placed on theories exploring psychosocial, cognitive, moral, and social identity development as well as on integrated theories of development.

HGED 5770: Campus Environments and Cultures

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Study of the impact of the college environment on students and use of environmental theory to create positive learning situations for students.

HGED 5780: Students in U.S. Higher Education

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

The relationship between college students and characteristics from 1950 to the present. Traditional assumptions about the impact of higher education on students will be reviewed and challenged. Campus issues and concerns relative to commuters and residential life. Participants will analyze institutional responses to students through college missions, organizational development, structure, core curriculum and retention.

HGED 5790: Advising and Supporting

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Development of effective, basic counseling skills. Understanding of group dynamics. Ability to work effectively in groups.

HGED 5800: Current Topics in Community Colleges

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Current issues and new directions in community college practice, policy, and research.

HGED 5810: Community College Partnerships

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate standing

Overview of the community environment in which community colleges serve and the external groups with whom they partner, including environmental scanning, partner development, strategic planning, and maintaining relationships.

HGED 5820: The Comprehensive Community College

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

The community college as a unique social and educational institution: its history, philosophy, functions, programs, faculty and student characteristics, organization and finance, trends, and issues. Reviews current research and exemplary community college practices internationally, nationally, and in Iowa.

HGED 5830X: Governance and Oversight of Higher Education

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to governance and oversight of higher education, including federal and state roles, boards of trustees, governance structures, external oversight, regulation, strategic planning, and legal issues.

HGED 5900A: Special Topics: Student Services

Credits: 1-4.

Prereq: Instructor Permission for Course

Independent study on specific topics arranged with an instructor.

HGED 5900B: Special Topics: Community Colleges

Credits: 1-4.

Prereq: Instructor Permission for Course

Independent study on specific topics arranged with an instructor.

HGED 5900C: Special Topics: Current Issues

Credits: 1-4.

Prereq: Instructor Permission for Course

Independent study on specific topics arranged with an instructor.

HGED 5900D: Special Topics: International Higher Education

Credits: 1-4.

Prereq: Instructor Permission for Course

Independent study on specific topics arranged with an instructor.

HGED 5900E: Special Topics: Federal and State Affairs

Credits: 1-4.

Prereq: Instructor Permission for Course

Independent study on specific topics arranged with an instructor.

HGED 5900F: Special Topics: Law in Higher Education

Credits: 1-4.

Prereq: Instructor Permission for Course

Independent study on specific topics arranged with an instructor.

HGED 5900G: Special Topics: Institutional Research

Credits: 1-4.

Prereq: Instructor Permission for Course

Independent study on specific topics arranged with an instructor.

HGED 5910: Supervised Field Experience

Credits: 1-4. Repeatable.

Prereq: Instructor Permission for Course

Supervised on-the-job field experience.

HGED 5930: Workshops

Credits: 1-5. Contact Hours: Lecture 5.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

HGED 5980: Capstone Seminar

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

The primary goal of this course is for advanced students to demonstrate their preparedness to progress in the field of Student Affairs as educators who are able to apply concepts and formal (and informal) theories addressed in previous course and fieldwork to their professional student affairs thinking and practices.

HGED 5990: Creative Component

Credits: 1-30.

Prereq: Instructor Permission for Course

Courses for graduate students:**HGED 6150A: Seminars in Higher Education: Student Services**

Credits: 1-4. Contact Hours: Lecture 4.

HGED 6150B: Seminars in Higher Education: Community Colleges

Credits: 1-4. Contact Hours: Lecture 4.

HGED 6150C: Seminars in Higher Education: Current Issues

Credits: 1-4. Contact Hours: Lecture 4.

HGED 6150D: Seminars in Higher Education: International Higher Education

Credits: 1-4. Contact Hours: Lecture 4.

HGED 6150E: Seminars in Higher Education: Federal and State Affairs

Credits: 1-4. Contact Hours: Lecture 4.

HGED 6150F: Seminars in Higher Education: Law in Higher Education

Credits: 1-4. Contact Hours: Lecture 4.

HGED 6150G: Seminars in Higher Education: Institutional Research

Credits: 1-4. Contact Hours: Lecture 4.

HGED 6150H: Seminars in Higher Education: Research Designs in Higher Education

Credits: 1-4. Contact Hours: Lecture 1.

HGED 6580: Program Evaluation & Decision-Making in Community Colleges

Credits: 3. Contact Hours: Lecture 3.

Prereq: Admission to Ed.D. program

Focus on theoretical and practical issues of program evaluation and decision-making within the community college sector of higher education. Includes components of theory, design, implementation, analysis, and application of results for program improvement.

HGED 6630: Community College Students

Credits: 3. Contact Hours: Lecture 3.

Prereq: Admission to Ed.D. program

Comprehensive understanding of students in American community colleges while enhancing research skills and a scholar-practitioner approach to working with students. Examine the curricula in place that serve a diverse student population with different educational objectives. Examine student types found in comprehensive community colleges including transfer, career & technical, adult basic education, and English language learners.

HGED 6640: College Organization and Administration

Credits: 3. Contact Hours: Lecture 3.

Examination of administrative organization and behavior using theories and lenses to understand topics such as: communications, leadership, resource allocation, strategic planning, and institutional governance.

HGED 6650: Financing Higher Education

Credits: 3. Contact Hours: Lecture 3.

Lectures, discussions, and individual investigation relating to financial administration in colleges and universities. Budgeting, auxiliary enterprises, administration of financial planning, fund raising, examination of theories on expenditures. Designed for persons aspiring to serve as college administrators.

HGED 6660: Academic Issues and Cultures

Credits: 3. Contact Hours: Lecture 3.

Examination of institutional culture and issues in higher education focusing on the roles and responsibilities of faculty and academic administrators.

HGED 6670: Leadership & Change in Community Colleges

Credits: 3. Contact Hours: Lecture 3.

Prereq: Admission to Ed.D. program

An examination of advanced community college leadership practice. Team-based leadership, leadership strategies, planning, and change.

HGED 6680: Workforce, Economic & Community Development in Community Colleges

Credits: 3. Contact Hours: Lecture 3.

Prereq: Admission to Ed.D. program

This course provides an overview of how community colleges influence workforce, economic, and community development through their education missions.

HGED 6730: Diversity and Inclusion in Higher Education

Credits: 3. Contact Hours: Lecture 3.

Critical understanding of issues of diversity and inclusion in higher education. There are multiple dimensions to diversity and inclusion, far too complicated to cover in one course. Therefore, the goal of this seminar is to provide a general understanding of theory, research, and practices related to diversity and inclusion issues. Considers intersectional perspectives of diversity and inclusion within higher education.

HGED 6760: Student Development Theory II

Credits: 3. Contact Hours: Lecture 3.

An examination of social identity theories including those exploring race, ethnicity, gender, class, ability, sexuality, and spirituality. An exploration of how social identity is influenced by the dynamics of power and oppression in education and society and how to enhance the college experiences of students from diverse backgrounds.

HGED 6900: Advanced Special Topics

Credits: 1-4. Repeatable.

*Prereq: Instructor Permission for Course***HGED 6990: Research**

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

History (HIST)

Courses primarily for undergraduates:**HIST 1950: Introduction to History**

Credits: 1. Contact Hours: Lecture 1.

Introduction to the discipline of history and how historians think and work. Focus on research methodologies, writing and analytical practices of historians, and specialization in the discipline.

HIST 2010: Introduction to Western Civilization I

Credits: 3. Contact Hours: Lecture 3.

Western civilization from ancient Mediterranean world to 1500. Social and cultural developments; economic and political ideas and institutions; problems of historical change and continuity. Meets International Perspectives Requirement. (Typically Offered: Fall)

HIST 2020: Introduction to Western Civilization II

Credits: 3. Contact Hours: Lecture 3.

Western civilization from 1500 to present. Social and cultural developments; economic and political ideas and institutions; problems of historical change and continuity. Meets International Perspectives Requirement. (Typically Offered: Spring)

HIST 2070: Chinese Civilization

Credits: 3. Contact Hours: Lecture 3.

Origins, development, decline and transformation of China from earliest times to 1911. Meets International Perspectives Requirement.

HIST 2110: Ancient Empires: From Sargon to Caesar

Credits: 3. Contact Hours: Lecture 2, Discussion 1.

Development of empires in the Near East and Mediterranean from the Akkadians to the fall of Rome. Discussion of the Hittites, Assyrians, Persians, Athenians, Macedonians (including the conquests of Alexander the Great), Carthaginians, and Romans; examination of imperialism as well as the social, cultural, and economic consequences of empire. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

HIST 2120: Medieval Kingdoms

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Survey of political, social, and cultural developments in western Europe for the entire medieval period, 300-1500.

HIST 2210: Survey of United States History I

Credits: 3. Contact Hours: Lecture 3.

Colonial foundations: revolution, confederation, and constitution; nationalism and democracy; sectional disunity, Civil War, and reunion. (Typically Offered: Fall)

HIST 2220: Survey of United States History II

Credits: 3. Contact Hours: Lecture 3.

Industrialization; emergence as a great power; boom and depression; war, internationalism and Cold War; modern industrial society. (Typically Offered: Spring)

HIST 2550: Modern World History, Globalization in Perspective

Credits: 3. Contact Hours: Lecture 3.

World history from 1500 to present. Globalization; colonization and empire; political revolutions; industrialization; modernization. Meets International Perspectives Requirement.

HIST 2710: The History of Sports in the United States

Credits: 3. Contact Hours: Lecture 3.

Professionalization of sports from their origins as invented recreational activities to their present status as fiscally privileged, legally protected cultural icons. Covering the period from the 17th to the end of the 20th century. (Typically Offered: Spring)

HIST 2720: Game Design and History

(Cross-listed with GAME 2720).

Credits: 3. Contact Hours: Lecture 3.

Students will play digital and analog games, discover how games work, and develop skills to create their own games. The course is a historically informed examination of games which develop game mechanics, build worlds, and tell stories about or represent the past. (Typically Offered: Spring)

HIST 2800: Introduction to History of Science I

Credits: 3. Contact Hours: Lecture 3.

Ideas of nature from ancient Greece to the seventeenth-century scientific revolution. Meets International Perspectives Requirement.

HIST 2810: Introduction to History of Science II

Credits: 3. Contact Hours: Lecture 3.

Science from seventeenth-century scientific revolution to Darwin and Einstein. Meets International Perspectives Requirement.

HIST 2840: Wonders of the World, Global History of Innovation

Credits: 3. Contact Hours: Lecture 3.

Innovation across cultures from the ancient "Seven Wonders of the World" to the modern world, with developments in Egypt, Greece, Rome, the Islamic World, India, China, Europe, and the Americas. Topics include major inventions, agricultural technologies, architecture, manufacturing, warfare, engineering, printing, entertainment, transport, and communications. Meets International Perspectives Requirement. (Typically Offered: Fall)

HIST 3010: The Historian's Toolbox

Credits: 3. Contact Hours: Lecture 3.

Prereq: History major; Sophomore classification

Foundations of the discipline with emphasis on the purpose, practice, and methodology of History. Required of majors. (Typically Offered: Fall, Spring)

HIST 3040: Cultural Heritage of the Ancient World

(Cross-listed with CLST 3040).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Historical examination of art, literature, thought, and religious beliefs of major civilizations of the ancient Mediterranean countries until the end of the 8th century.

HIST 3070: American Popular Culture

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Social practices, beliefs and material traits of everyday life in America from the mid-19th century to the present. Includes literature, music, theater and other entertainments. Dime novels, vaudeville, rock and roll music, Hollywood and establishment of professional athletic leagues are among the cultural artifacts and phenomena considered.

HIST 3100: Africa to 1880

(Cross-listed with AFAM 3100).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Survey of the history of African societies, cultures and civilizations from earliest times to 1880. Evolution of states across the continent; social, economic, political, and cultural developments; nature and consequences of African interactions and relationship with Europeans. Meets International Perspectives Requirement.

HIST 3110: Africa under Colonial Rule

(Cross-listed with AFAM 3110).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Development of Africa from imposition of colonial rule to independence, including processes of European domination, African reaction and resistance, emergence of nationalism, and dismantling of colonialism. Meets International Perspectives Requirement.

HIST 3180: History of Early Modern Europe, 1450-1789

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Survey of major themes in the social, political, cultural, and religious history of early modern Europe, including the eras of renaissance and reformation, the age of exploration, development of the modern individual and household, and enlightenment.

HIST 3200: History of Modern Europe, 1789 to Present

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Survey of major themes in the social, political, and religious history of Europe from the French Revolution to the present. Topics to be covered include the French Revolution, nationalism, the Industrial Revolution, the Russian Revolution, World Wars I and II, the Cold War, the fall of the Soviet Union, and the history of globalization. Meets International Perspectives Requirement. (Typically Offered: Fall)

HIST 3250: Society and Politics in England, 1525-1700

Credits: 3. Contact Hours: Lecture 3.

Social, cultural, demographic, and economic experiences. Religious Reformation. Growth of the State (and Empire) and political institutions.

HIST 3270: History of the British Empire

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Development of British Empire from origins in the seventeenth century to dissolution in the twentieth century. Attention given to empire in S. Pacific, N. America, India and S. Asia, Hong Kong, Africa and the Middle East, as well as theories of empire and the impact of immigration on British society. Irish history also covered. Meets International Perspectives Requirement.

HIST 3310: History of the Islamic World to 1800

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Survey of the Islamic world from pre-Islamic Arabia to the 19th century covering the life of the Prophet Muhammad, the spread of Islam through the Arab conquests and the Caliphal dynasties of the Umayyads and the Abbasids, the Mongol conquests, Turkic migrations from Central Asia, and the rise of the Ottoman Empire. (Typically Offered: Fall)

HIST 3360: Ancient China

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

History of China from the beginning of civilization through the Opium War; examines social, political, economic, and cultural developments. Meets International Perspectives Requirement.

HIST 3370: Modern China

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

History of China from the Opium War through the founding of the PRC; examines the reforms and revolutions in China's road toward modernity. Meets International Perspectives Requirement.

HIST 3390: US-Asian Relations

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Survey of US-East Asian (Japan, China, Korea) relations from the late 18th century to the end of the Cold War. Meets International Perspectives Requirement.

HIST 3400: Colonial Latin America

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Colonial Latin American history from European discovery and colonization to 1825.

HIST 3410: Modern Latin America

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Modern Latin American history from 1826 to present. Meets International Perspectives Requirement.

HIST 3450X: History of American Business

Credits: 3. Contact Hours: Lecture 3.

American business history from the Revolution to present; reviews agriculture, industrialization, technological change, depressions, wars, globalization.

HIST 3500: Global History of Aviation

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Explores the global history of aviation with emphasis on the ways in which different societies and cultures have developed, used, and thought about flight. Meets International Perspectives Requirement.

HIST 3530: History of African Americans I

(Cross-listed with AFAM 3530).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Examines African roots of black culture and the African American experience in the United States from the colonial period through the Civil War. Topics include Atlantic Slave Trade, slavery and American identity, abolition, the emergence of Black Nationalism, and black participation in the Civil War. Meets U.S. Cultures and Communities Requirement.

HIST 3540: History of African Americans II

(Cross-listed with AFAM 3540).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Explores African American political thought and political action from Reconstruction to the present. Topics include rise of Jim Crow segregation, urban migration, Garvey movement, Harlem Renaissance, Depression and world wars, Pan-Africanism, civil rights, Black Power, and black feminism. Meets U.S. Cultures and Communities Requirement.

HIST 3570: American Family History

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

The impact on American families from colonial times onward of agricultural change, industrialization, urbanization, and wars and depressions.

HIST 3620: Global Environmental History

(Cross-listed with ENVS 3620).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Survey of the interactions of human communities with their environments from the beginnings of human history to the present. Topics include the domestication of animals, the agricultural revolution, industrialization, urbanization, deforestation, hydraulic management, fossil fuel consumption, and climate change. (Typically Offered: Fall)

HIST 3630: U. S. Environmental History

(Cross-listed with ENVS 3630).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Survey of the interactions of human communities with the North American environment. Focus on the period from presettlement to the present, with a particular concentration on natural resources, disease, settlement patterns, land use, and conservation policies.

HIST 3640: The Mythic Wild West

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Examination of the history of the mythic American West, including how people have thought about the region, the myths that emerged from the West, and the role the mythical West played in the formation of American identity. (Typically Offered: Summer)

HIST 3650: American Agriculture I: The Maya to McCormick's Reaper

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

North American agricultural development to 1865. American Indian agricultural systems, European background and agricultural revolution, agriculture in the colonial era, early republic and antebellum period. Topics include origins of modern crops, agriculture's role in the economy, politics, and settlement of the U.S., slavery, rural and frontier life, and mechanization.

HIST 3660: American Agriculture II: Homestead Act to GMOs

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

American agricultural development since 1865. Post-Civil War adjustments; westward expansion; economic boom and bust; mechanization; Dust Bowl and environmental challenges; Great Depression and New Deal; changing rural life; scientific and technological advances; farm crisis and late twentieth century challenges.

HIST 3670: America Eats

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Thematic approach to the development of the American agricultural system through the topics of food and eating. Changes in American food systems from Native American, pre-contact diets through modern innovations such as fast food, organics, and eating locally.

HIST 3700: History of Iowa

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Survey of major social, cultural and economic developments in Iowa from the late 1700s. Emphasis on minority groups, pioneer life, early economic development, industrial development, educational and religious development, and outstanding personalities.

HIST 3710: Mexican American History

(Cross-listed with USLS 3710).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

History of the Mexican American community in the U.S. from the 1820s to the present. Topics include community development, employment, social marginalization, racism/discrimination, depression and world wars, civil rights, ethnic power and politics. Offered even-numbered years. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall)

HIST 3720: Latina/o History

(Cross-listed with USLS 3720).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Historical and cultural heritage of Latinas/os in the United States. The histories of Mexican, Puerto Rican, Cuban, and other Latin American peoples in the U.S. emphasizing political and cultural convergence and congruencies. Meets U.S. Cultures and Communities Requirement.

HIST 3740: Sex, Gender, and Culture in the Ancient Mediterranean World

(Cross-listed with CLST 3740/ WGS 3740).

Credits: 3. Contact Hours: Lecture 3.

Survey of the roles of women and others on the margins and the issues that impacted them in the ancient Greek and Roman worlds. Evidence from literature, the visual arts, and archaeology. Contemporary approaches to studying women, gender, and sexuality in ancient history. Intersections of gender categories with ideas of slave and free status, citizenship, and ethnicity. Readings from ancient and modern sources. Meets International Perspectives Requirement.

HIST 3800: History of Women in Science, Technology, and Medicine

(Cross-listed with WGS 3800).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

History of women's relationship to the fields of science, technology, and medicine, as students and professionals, consumers, subjects and patients, family members, workers and citizens. Concentrates especially on 19th and 20th century United States, concluding with an examination of current issues of special interest to women in science, technology, and medicine. Meets U.S. Cultures and Communities Requirement.

HIST 3820: History and Philosophy of the Scientific Revolution

(Cross-listed with PHIL 3820).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 3 credits in PHIL or Permission of Instructor

The emergence of empirical science as the authoritative methodology for production of knowledge about the natural world in the period between Copernicus and Kant. Scientific progress achieved during the period, including the work of Galileo, Descartes, and Newton. The re-shaping of epistemology in the Western intellectual tradition. Implications for philosophy and historiography. Offered odd-numbered years. (Typically Offered: Spring)

HIST 3830: Technology, Public Science, and European Culture, 1715-Present

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

A survey from the Age of Enlightenment to the end of the twentieth century of the relationship between science, technology, and public or popular culture in a comparative European context (including Russia and the former Soviet Union). Meets International Perspectives Requirement.

HIST 3840: Roman Italy: An Introduction

(Cross-listed with CLST 3840).

Credits: 2. Contact Hours: Lecture 2.

Repeatable.

Prereq: Instructor Permission for Course

Introduction to the topography, history, archaeology, monuments, and art of Rome from the 8th century BCE to the 5th century CE; attention given to the culture of modern Italy, preparatory to study abroad in Rome. Enrollment limited to students participating in CLST 3850/HIST 3850. Meets International Perspectives Requirement. (Typically Offered: Spring)

HIST 3850: Study Abroad: Roman Italy: Building the Empire

(Cross-listed with CLST 3850).

Credits: 3. Repeatable, maximum of 6 credits.

Prereq: CLST 3840/HIST 3840, Instructor Permission Required

Supervised on-site instruction in the history, archaeology, monuments, and art of Rome and environs from the 8th century BCE to the 5th century CE; attention given to the culture of modern Italy. Meets International Perspectives Requirement. (Typically Offered: Summer)

HIST 3860: History of Women in America

(Cross-listed with WGS 3860).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

A survey of social, economic, and political aspects of women's role from colonial era to present; emphasis on employment, education, concepts of sexuality, and changing nature of the home. Meets U.S. Cultures and Communities Requirement.

HIST 3870: First Ladies in U.S. History

(Cross-listed with POLS 3870/ WGS 3870).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Evolution of the role and office of the First Lady in U.S. history, including her political activism, social impact, and international influence. Analysis of the authority, intersectionality and agency of First Ladies in the aggregate and exploration of how individual First Ladies have interpreted and adapted this unique public position. Offered even-numbered years. (Typically Offered: Fall)

HIST 3890: American Military History

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

American military experience from the Pequot War to Vietnam, including King Philip's War, the French & Indian Wars, the American Revolution, the War of 1812, the Mexican-American War, the Civil War, the Spanish-American War, World Wars I & II, and the Korean War. Meets International Perspectives Requirement.

HIST 3900: World Military History

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Covers military history from the Napoleonic era through the mid- and late-19th century wars, the First and Second World Wars, and wars of national liberation and regional conflicts since 1945. Meets International Perspectives Requirement.

HIST 3910: American Diplomatic History

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

A study of US foreign relations during the twentieth century, including the rise to global power, the First World War, diplomacy during prosperity and depression, the Second World War, the Cold War, relations with Latin America, East and South Asia and Africa, the search for markets, and the perceptions of American foreign policy held by the US, its allies and adversaries, and others.

HIST 3960A: Topics in History: Europe

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Prereq: Sophomore classification

Specialized topics in history; topics vary each time offered.

HIST 3960B: Topics in History: U.S. and North America

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Prereq: Sophomore classification

Specialized topics in history; topics vary each time offered.

HIST 3960C: Topics in History: Global

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Prereq: Sophomore classification

Specialized topics in history; topics vary each time offered.

HIST 4020: Greek Civilization

(Cross-listed with CLST 4020).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Ancient Greece from the Bronze Age to the Hellenistic period; evolution of the Greek polis and its cultural contributions, with a particular emphasis on the writings of Herodotus and Thucydides.

HIST 4030: Roman Civilization

(Cross-listed with CLST 4030).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Ancient Rome from the Regal Period to the fall of the Western Empire; evolution of Roman institutions and Rome's cultural contributions studied through original sources.

HIST 4050: Transformations of the Early Medieval World

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Examines major political, religious, and cultural transformations in Western Europe and the Mediterranean, 300-1000. Major topics include the fall of Rome, rise of Christianity, Germanic kingdoms, and Carolingian empire.

HIST 4060: The Birth of Europe in the High Middle Ages

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Examines political, economic, religious, and cultural forms emerging in Europe, 1000-1300, that still characterize Western society to this day. Major topics include the medieval agricultural revolution, English and French monarchies, crisis of church and state, and growth of the papacy and personal religion.

HIST 4070: Crises of the Late Middle Ages

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Examines major political, economic, religious, and intellectual crises that beset Europe, 1300-1500, paving the way for early modernity. Major topics include Black Death, 100 Years War, papal schism, and origins of Renaissance and Reformation.

HIST 4100: The Holocaust in History

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Historical and historiographical coverage of the Holocaust. Actions of perpetrators, experiences of the murdered, and inaction or action of bystanders within global, European, German, and Jewish history. Topics include history, historical methods, and contemporary and historical commemoration of the Holocaust. Seminar discussion format. Meets International Perspectives Requirement. (Typically Offered: Spring)

HIST 4140: European Cultural and Intellectual History

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

A study of the development of key themes in European thought: nature, man, God, society, history, and creativity from Rousseau to Post-Modernism.

HIST 4190: History of Modern France

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

From absolutism to revolution and the rise of modern democracy.

HIST 4200: France's Revolutionary Century, 1715-1815

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

An in-depth investigation of the French Revolution, its causes and consequences, beginning in the Ancien Regime and ending with the fall of Napoleon.

HIST 4210: History of Russia I

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Russia to 1850. Origins of Russian people; Byzantine influences; Mongol invasion; rise of Moscow; Westernization. Meets International Perspectives Requirement.

HIST 4220: History of Russia II

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Russia since 1850. Reform and revolution; transformation of society; USSR as a world power; recent changes. Meets International Perspectives Requirement.

HIST 4230: The Russian and Soviet Mind: Intellectual and Cultural Life, 1762-1991

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Russian intellectual history from the reign of Catherine the Great to the collapse of Communism. Discussion of Russian literary, philosophical and cultural trends in the nineteenth century and the relationship between intellectual & cultural figures and the Soviet state in the twentieth century.

HIST 4240: History of Modern Germany

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Political, social, and cultural history of Germany from the 19th century to the present. Meets International Perspectives Requirement.

HIST 4270: Crime and Policing in England 1550-1850

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Course examines different forms and ideas of criminality and the nature and development of law enforcement in England between 1550 and 1856. Significant issues will include the nature of criminal records and statistics, the legal system, the politics of the law and its links with social relations, policing, female crime, juvenile delinquency, organized crime, riots, 'social crime,' and the treatment of crime in creative literary texts.

HIST 4280: Punishment, Mentalities, and Society in England, 1550-1868

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Explores the history of punishing criminals in England and shows how interdisciplinary perspectives, ideas, and practices of punishment are related to mentalities, and socio-economic change. Issues of significance examined: violence, civility, manners, madness, public punishment, execution, imprisonment, transportation, mercy, the rise of asylums, and penal reform.

HIST 4290: Monstrous London: London's Histories 1500-1800

Credits: 3-4.

Prereq: Sophomore classification

Study of London's social, economic, cultural, political, and environmental history 1500-1800, using both quantitative and qualitative methods to examine contemporary and secondary sources. Course combines standard lecture and discussion format with one week of intensive study abroad for 4th hour of course credit.

HIST 4310: Modern England

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

England since 1850. Parliamentary and constitutional development; social reform and economic change; imperial Britain; welfare state. Meets International Perspectives Requirement.

HIST 4350: History of the Modern Middle East

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Ottoman and Qajar reform movements; constitutional revolutions; European legal imperialism; colonialism; World War I and the mandate system; Israeli-Palestinian conflict; Arab nationalism; the Islamic Revolution in Iran; Islamist movements; oil resources; terrorism; sectarianism. Meets International Perspectives Requirement. (Typically Offered: Spring)

HIST 4410: History of Modern Mexico and Central America

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Political, economic, and social development of Mexico and Central America in nineteenth and twentieth centuries.

HIST 4420: Rebellions and Revolutions in Latin America

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Survey of rebellions, revolutionary movements, and social revolutions in the twentieth century, including Guatemalan, Cuban, Mexican, Chilean, and Nicaraguan cases. Meets International Perspectives Requirement.

HIST 4490: US Gilded Age, 1877-1900

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

U.S. History from the end of Reconstruction to the turn of the twentieth century. Discussion of prominent themes, including the opening of the West, the emergence of big business, rapid urbanization, immigration, race relations, American imperialism, and social reform. Offered even-numbered years. (Typically Offered: Spring)

HIST 4500: Colonial America

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Exploration, colonization, and development of political, economic, religious, and cultural institutions of North American colonies before 1754. Topics also include social history, emergence of African-American slavery, relations with American Indians.

HIST 4510: American Revolutionary Era

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Participants, ideas, and events leading to independence and the foundation of the United States, 1754 to 1789. Topics include political, military, social, cultural history, also issues of gender and race relations.

HIST 4530: Law and Society in U.S. History: Crime, Race, Family, Work and Property

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

The development of both law and the legal system from colonial times to the present, highlighting their crucial role in aspects of American life such as marriage, family, employment, racial identification, and economic exchange. Topics will include important past legal disputes, the different levels of courts, the various actors in the legal process (e.g., police, prosecutors, prisoners, judges and juries), the relationship between the individuals and institutions that comprise the legal system.

HIST 4540: Early American Republic

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Examination of the United States from the Constitutional Convention up to the Mexican War. Topics include the Washington, Jefferson, and Jackson administrations, the War of 1812, slavery and the South, economic and social development, Westward expansion and reform.

HIST 4550: U.S. Civil War and Reconstruction Era

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Examination of the social and economic contradictions that led to Civil War and the reconstruction of American freedom and democracy. Topics include the Mexican War, sectional conflict and the crisis of disunion, economic, political and social aspects of civil war, emancipation, and reconstruction.

HIST 4570: History of American Sexualities

(Cross-listed with WGS 4570).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

The social construction of American sexualities from the colonial era to the present with particular emphasis on how ideas about sex and sexuality have shaped American public life, including education, public policy, party politics, and racial justice. Meets U.S. Cultures and Communities Requirement.

HIST 4580: U.S. 1900 to 1945

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

America in transition and crisis: Progressivism, World War I, the twenties, the Great Depression, and World War II.

HIST 4590: U.S. 1945 to the Present

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Modern American history with an emphasis on political, socio-cultural, ethno-racial, and military history. Topics include the Cold War, the wars in Korea and Vietnam, civil rights and Black/ethnic Power, modern feminism, and the conservative movement.

HIST 4600: The Great Plains

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

History of the Great Plains from prehistoric period. Emphasis on agricultural and rural development, Native Americans, cattle ranching, land policy, agrarian reform movements and federal policy.

HIST 4610: The American South

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

History of the American South from colonial period to present. Emphasis on economic, social, and political change in this rural region.

HIST 4650: The American West

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

History of trans-Mississippi West from 1800 to present, concentrating on settlement and regional identity. Emphasis on the state, the environment, urbanization, agriculture, Native Americans, and minority communities.

HIST 4680: History of Rural America

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

History of rural America from the colonial period to the present. Emphasizes immigration, ethnicity, religion, social and cultural change, and agriculture in relation to rural settlement, institution building, demographic change, gender, class, and political and economic development.

HIST 4690X: History of Racial Violence in Europe and the United States, 1865-1945

(Cross-listed with AFAM 4690X).

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Permission of Instructor; Sophomore classification

History of racial and genocidal violence comparing the experiences of Black, Latino/a/x, Native, and Asian peoples in the United States with Jewish people, the Romani, and people of African descent in Europe. The class focuses on the forms of individual and state-sponsored violence, culminating in the Holocaust. Field trip to Washington, D.C. Meets U.S. Cultures and Communities Requirement.

HIST 4730: Civil Rights and Ethnic Power

(Cross-listed with AFAM 4730/ USLS 4730).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Comparative history of the civil rights and ethnic power movements (African American, Chicano, American Indian, Puerto Rican, among others) in the U.S. from World War II to the present. Topics include institutional foundations, leadership, gender and racial dynamics, and the convergences and divergences of these differing ethnic struggles for rights. Meets U.S. Cultures and Communities Requirement.

HIST 4790: China and the Cold War

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Important events in China's Cold War involvement, connections between domestic and foreign affairs, factors and rationales in China's foreign policy making the relationship between China's Cold War experience and recent developments.

HIST 4800A: Pre-Student Teaching Experience III: History/Social Sciences

(Cross-listed with EDUC 4800A).

Credits: 2. Repeatable, maximum of 2 credits.

Prereq: Admitted to the Educator Preparation Program

Supervised participation in a 5-12 school setting. Permission of History/Social Sciences coordinator required prior to enrollment. Two, half-days per week needed for school experience. Clinical Supervision Level 3. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

HIST 4810: Public History

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 3 credits.

Prereq: Sophomore classification

Development of theories and methods in the field of public history. Emphasis on practical applications such as archival research, museum interpretation, historic preservation, and oral history within the context of United States history. (Typically Offered: Fall)

HIST 4820: Birth, Death, Medicine, and Disease

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

History of medicine, sickness, and public health from ancient times to the twenty-first century in the US, Europe, and around the world. Topics include changing ideas of health and illness, development of doctors and hospitals, social and ethical issues in health care, and epidemics from cholera to AIDS.

HIST 4880: American Stuff, Colonial Times to the Present

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Inventions, innovations, artifacts, and material culture in the United States, from homespun cloth and the Colt revolver, through the transcontinental railroad and Model T, to fast food and the iPhone.

HIST 4890: The World at War

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: Sophomore classification

In-depth exploration of a particular global conflict (topic varies; e.g., the French and Indian War, the Napoleonic Wars, World War I, World War II, the Vietnam War, and post-Cold War U.S. overseas conflicts) by focusing on multiple aspects of that conflict such as belligerents' justification, diplomacy, manpower policy, technology, strategies and tactics, morality, protest, civilian and military experiences, gender roles, the aftermath of conflict, and collective memory and memorialization. (Typically Offered: Spring)

HIST 4900: Independent Study

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: Permission of Department Chair for Course

Reading and reports on problems selected in conference with each student. No more than 6 credits of HIST 4900 may be counted toward graduation with a major in History. No credits of HIST 4900 may count toward a minor in History. Graduation Restriction: No more than 6 credits of HIST 4900 may be counted toward graduation with a major in History. No credits of HIST 4900 may count toward a minor in History.

HIST 4950: Historiography and Research Writing

Credits: 3. Contact Hours: Lecture 3.

Variable topics seminar that focuses on historiographical and research skills and writing. Required of majors. (Typically Offered: Fall, Spring)

HIST 4960A: Advanced Topics in History: Europe

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Prereq: Sophomore classification

Specialized topics in history, topics vary each time offered.

HIST 4960B: Advanced Topics in History: U.S. and North America

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Prereq: Sophomore classification

Specialized topics in history, topics vary each time offered.

HIST 4960C: Advanced Topics in History: Global

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Prereq: Sophomore classification

Specialized topics in history, topics vary each time offered.

HIST 4980: Methods of Teaching History/Social Sciences

(Dual-listed with HIST 5980). (Cross-listed with EDUC 4980).

Credits: 3. Contact Hours: Lecture 3.

Theories and processes of teaching and learning secondary history/social sciences. Emphasis on development and enactment of current methods, assessments, and curriculum materials for providing appropriate learning experiences. (Typically Offered: Fall, Spring)

Courses primarily for graduate students, open to qualified undergraduates:

HIST 5100: Readings Seminar in East Asian History

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Readings in East Asian history. Topics vary each time offered.

HIST 5110A: Readings Seminar in American History: Colonial Period

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Readings in American history. Topics vary each time offered.

HIST 5110B: Readings Seminar in American History: Nineteenth Century

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Readings in American history. Topics vary each time offered.

HIST 5110C: Readings Seminar in American History: Twentieth Century

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Readings in American history. Topics vary each time offered.

HIST 5110E: Readings Seminar in American History: Social and Cultural

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Readings in American history. Topics vary each time offered.

HIST 5110F: Readings Seminar in American History: West

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Readings in American history. Topics vary each time offered.

HIST 5110G: Readings Seminar in American History: The South

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Readings in American history. Topics vary each time offered.

HIST 5120A: Readings Seminar in European History: Ancient

(Cross-listed with CLST 5120A).

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Readings in European history.

HIST 5120B: Readings Seminar in European History: Medieval and Early Modern

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Readings in European history.

HIST 5120C: Readings Seminar in European History: Modern

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Readings in European history.

HIST 5130: Readings Seminar in Latin American History

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Readings in Latin American history. Topics vary each time offered.

HIST 5300: Readings Seminar in Modern Russian/Soviet History

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Readings in modern Russian history. Topics vary each time offered.

HIST 5500B: Proseminar in European Rural and Agricultural History: Twentieth Century Europe

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Proseminar in European Rural and Agricultural History: Twentieth Century Europe.

HIST 5520A: Readings Seminar in American Rural and Agricultural History: American Agriculture

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Readings in American agricultural history. Topics vary each time taught.

HIST 5520B: Readings Seminar in American Rural and Agricultural History: Agrarian Reform Movements

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Readings on American agrarian reform movements. Topics vary each time taught.

HIST 5520C: Readings Seminar in American Rural and Agricultural History: Midwestern Rural Society

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Readings on American Midwestern rural society. Topics vary each time taught.

HIST 5520D: Readings Seminar in American Rural and Agricultural History: Women in Rural Life

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Readings on American women and rural life. Topics vary each time taught.

HIST 5540A: Readings Seminar in Environmental History: American

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Readings in American environmental history. Topics vary each time offered.

HIST 5540B: Readings Seminar in Environmental History: European

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Readings in European environmental history. Topics vary each time taught.

HIST 5540C: Readings Seminar in Environmental History: Global

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Readings in global environmental history. Topics vary each time taught.

HIST 5750: Readings Seminar in the History of Technology

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Readings in the history of technology. Topics vary each time taught.

HIST 5830A: Historical Methods: Narrative

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Study of the methodologies of historical narrative.

HIST 5830B: Historical Methods: Statistical Evidence and Analysis

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Study of methodologies of using statistical evidence in writing history.

HIST 5830C: Historical Methods: Issues in Historiography

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Prereq: Graduate Standing or Permission of Instructor

Study of issues surrounding the development of historiography and historical theories.

HIST 5850: Teaching Methods for the Modern Europe Survey

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Pedagogy and historiography of Europe, from the Protestant Reformation to the present. Pedagogical topics covered include general principles of survey-course construction, lecture technique, and textbook evaluation; historiographical topics will include the Reformation, the Enlightenment, the Industrial Revolution, the French Revolution, the rise of Nationalism, imperialism, the two World Wars, the Cold War and decolonization. (Typically Offered: Spring)

HIST 5860: Readings Seminar in Women's and Gender History

(Cross-listed with WGS 5860).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Readings in women's and gender history.

HIST 5900: Special Topics

Credits: 1-3. Repeatable.

Prereq: Permission of Department Chair for Course

(Typically Offered: Fall, Spring, Summer)

HIST 5910: Directed Readings in History

Credits: 1-3. Repeatable, maximum of 9 credits.

Prereq: Graduate Standing or Permission of Instructor

Individually directed readings in History for doctoral students preparing for preliminary examinations in Rural, Agricultural, Technological and Environmental History (RATE). Graduation Restriction: Only 9 credits of HIST 5910 may count toward graduation. (Typically Offered: Fall, Spring, Summer)

HIST 5930A: Research Seminar in American History: Colonial Period

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Topics vary each time offered.

HIST 5930B: Research Seminar in American History: Nineteenth Century

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Topics vary each time offered.

HIST 5930C: Research Seminar in American History: Twentieth Century

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Topics vary each time offered.

HIST 5930F: Research Seminar in American History: West

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Topics vary each time offered.

HIST 5940A: Research Seminar in European History: Ancient

(Cross-listed with CLST 5940A).

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Topics vary each time offered.

HIST 5940B: Research Seminar in European History: Medieval and Early Modern

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Topics vary each time offered.

HIST 5940C: Research Seminar in European History: Modern

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Topics vary each time offered.

HIST 5980: Methods of Teaching History/Social Sciences

(Dual-listed with EDUC 4980/ HIST 4980).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Theories and processes of teaching and learning secondary history/ social sciences. Emphasis on development and enactment of current methods, assessments, and curriculum materials for providing appropriate learning experiences. (Typically Offered: Fall, Spring)

HIST 5990: Creative Component

Credits: 1-6. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

Courses for graduate students:

HIST 6100: Research Seminar in American Rural and Agricultural History

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Emphasis varies each time offered.

HIST 6120: Research Seminar in Environmental History

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Emphasis varies each time offered.

HIST 6140: Research Seminar in the History of Technology

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Emphasis varies each time offered.

HIST 6990: Research

Credits: 1-6. Repeatable.

Prereq: Instructor Permission for Course

Graduate student thesis research. (Typically Offered: Fall, Spring, Summer)

Honors (HON)

Courses primarily for undergraduates:

HON 1210: First-Year Honors Seminar

Credits: 1. Contact Hours: Laboratory 2.

Prereq: Membership in the First-Year Honors Program

Orientation to Iowa State University and to the University Honors Program. Students will meet and work with other high-ability students for the purpose of exchanging ideas and considering alternative futures as a basis for launching personalized academic programs and professional careers. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

HON 2900: Special Problems

Credits: 1-2.

Prereq: Membership in the University Honors Program

Independent study on topics of an interdisciplinary nature. Intended primarily for freshmen and sophomores. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

HON 2900H: Honors

Credits: 1-2.

Prereq: Membership in the University Honors Program

Independent research study as a part of the First-Year Honors Mentor program (FHMP), which offers first-year honors students the opportunity to get research experiences with a faculty mentor. The main objectives of the FHMP are to develop students' interest in and understanding of academic research and to help them identify a research area for an honors capstone project. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

HON 2900U: Undergraduate Research

Credits: 1-30.

Prereq: Membership in the University Honors Program

Independent study as a continuation of the First-Year Honors Mentor program (FHMP), which offers second-year honors students the opportunity to continue research experiences with the same FHMP faculty mentor as in the HON 2900H course. The main objectives are to extend students' involvement in research and understanding of an academic field and to help them identify a research area for an honors capstone project. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

HON 3020: First-Year Honors Leadership Development

Credits: 2. Contact Hours: Laboratory 2, Lecture 1.

Prereq: Membership in the University Honors Program

Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

HON 3210: University Honors Seminars

Credits: 1-2. Contact Hours: Lecture 2.

Repeatable.

Prereq: Membership in University Honors Program or First-Year Honors Program

Interdisciplinary seminars on topics to be announced in advance. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

HON 3220: University Honors Seminars

Credits: 1-2. Contact Hours: Lecture 2.

Repeatable.

Prereq: Membership in the University Honors Program

Interdisciplinary seminars on topics to be announced in advance. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

HON 3230: University Honors Seminars

Credits: 1-2. Contact Hours: Lecture 2.

Repeatable.

Prereq: Membership in the University Honors Program

Interdisciplinary seminars on topics to be announced in advance. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

HON 3240: University Honors Seminars

Credits: 1-2. Contact Hours: Lecture 2.

Repeatable.

Prereq: Membership in the University Honors Program

Interdisciplinary seminars on topics to be announced in advance. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

HON 4900A: Independent Study: Capstone

Credits: 1-6. Repeatable.

Prereq: Membership in the University Honors Program

Independent study on topics of an interdisciplinary nature for students following the Primary College Honors Track. Intended primarily for juniors and seniors. (Typically Offered: Fall, Spring, Summer)

HON 4900B: Independent Study: Innovation Pathway

Credits: 1-6. Repeatable.

Prereq: Membership in the University Honors Program

Independent study on topics of an interdisciplinary nature for students following the Innovation Honors Track. Intended primarily for juniors and seniors. (Typically Offered: Fall, Spring, Summer)

Horticulture (HORT)

Courses primarily for undergraduates:

HORT 1100: Professional and Educational Development in Horticulture

Credits: 1. Contact Hours: Lecture 1.

Intended for first-year students and others new to the horticulture curriculum. Introduction to professional and educational development within horticulture. Focus is on university and career acclimation. Assessed service-learning component. (Typically Offered: Fall)

HORT 1210: Home Horticulture

Credits: 3. Contact Hours: Discussion 1, Lecture 2.

Growing plants in and around the home including requirements for growing indoor plants, plant propagation, landscape design, and maintaining trees, lawns, flower, fruit, and vegetable gardens. Recitation includes demonstrations and hands-on activities that illustrate principles of designing, growing and maintaining plants for both indoor and outdoor gardens. (Typically Offered: Fall, Spring)

HORT 1310: Floral Design

Credits: 2. Contact Hours: Lecture 1, Laboratory 2.

Introduces basic geometric design of fresh arrangements, corsages, and holiday arrangements. Includes use of tools and supplies. (Typically Offered: Fall, Spring)

HORT 1320: Wedding and Event Floral Design

Credits: 2. Contact Hours: Lecture 1, Laboratory 2.

Prereq: HORT 1310

Principles of design and proper mechanics for ceremony flowers, reception flowers, personal flowers, bridal bouquets, and event florals. Flower and plant materials that are commonly used in the event industry. Plan, design, cost, order, and create florals for a wedding, then present as the final project for implementation. (Typically Offered: Fall, Spring)

HORT 1930A: Topics in Horticulture: Greenhouse Crops

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

Practical courses in the field of horticulture. Graduation Restriction: A maximum of 6 credits of HORT 1930 may be used toward the total of 128 credits required for graduation. (Typically Offered: Fall, Spring, Summer)

HORT 1930B: Topics in Horticulture: Nursery Crops

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

Practical courses in the field of horticulture. Graduation Restriction: A maximum of 6 credits of HORT 1930 may be used toward the total of 128 credits required for graduation. (Typically Offered: Fall, Spring, Summer)

HORT 1930C: Topics in Horticulture: Turfgrass

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

Practical courses in the field of horticulture. Graduation Restriction: A maximum of 6 credits of HORT 1930 may be used toward the total of 128 credits required for graduation. (Typically Offered: Fall, Spring, Summer)

HORT 1930D: Topics in Horticulture: Fruit Crops

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

Practical courses in the field of horticulture. Graduation Restriction: A maximum of 6 credits of HORT 1930 may be used toward the total of 128 credits required for graduation. (Typically Offered: Fall, Spring, Summer)

HORT 1930E: Topics in Horticulture: Vegetable Crops

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

Practical courses in the field of horticulture. Graduation Restriction: A maximum of 6 credits of HORT 1930 may be used toward the total of 128 credits required for graduation. (Typically Offered: Fall, Spring, Summer)

HORT 1930F: Topics in Horticulture: Cross-Commodity

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

Practical courses in the field of horticulture. Graduation Restriction: A maximum of 6 credits of HORT 1930 may be used toward the total of 128 credits required for graduation. (Typically Offered: Fall, Spring, Summer)

HORT 1930G: Topics in Horticulture: Landscape Horticulture

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable, maximum of 6 credits.

Practical courses in the field of horticulture. Graduation Restriction: A maximum of 6 credits of HORT 1930 may be used toward the total of 128 credits required for graduation. (Typically Offered: Fall, Spring, Summer)

HORT 2210: Principles of Horticulture Science

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Credit or enrollment in BIOL 2110

Biological principles of growing horticultural crops including anatomy, reproduction, light, temperature, water, nutrition, and growth and development. Laboratory exercises emphasize environmental factors and permit detailed observation of plant growth. (Typically Offered: Fall, Spring)

HORT 2330: House Plants and Interiorscaping

Credits: 2. Contact Hours: Lecture 1, Laboratory 2.

Basic introduction to indoor houseplants and interiorscapes. Understand plant selection, identification, maintenance, and problem solving. Learn current houseplant trends, commercial interior plant design, and installation. A beneficial course for students with an interest in house plants, retail plant sales, Interiorscaping, event design, or gardening. (Typically Offered: Fall, Spring)

HORT 2400: Trees, Shrubs, and Woody Vines for Landscaping

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Identification of trees, shrubs, and woody vines. Factors influencing the horticultural use of woody plants. Field trips outside of regular class time may be required. (Typically Offered: Fall)

HORT 2760: Grape and Wine Science

(Cross-listed with FSHN 2760).

Credits: 3. Contact Hours: Lecture 4.

An introduction to viticulture (grape growing) and enology (wine making) to increase understanding of the science, including grape biology, chemistry, sensory of grape production and winemaking. Knowledge and the practical applications of grape growing and winemaking will be emphasized. No wine tasting. High school biology and chemistry or 3 credits of college biology and chemistry recommended.

HORT 2810: Landscape Graphics

Credits: 2. Contact Hours: Studio 4.

Introduction to computer and hand rendering techniques of landscape graphics. Students will gain proficiency in plan view and elevation graphics. Intensive studio and computer based instruction. (Typically Offered: Fall)

HORT 2830: Pesticide Application Certification

(Cross-listed with AGRON 2830/ FOR 2830/ ENT 2830).

Credits: 2. Contact Hours: Lecture 2.

Core background and specialty topics in agricultural, and horticultural pesticide applicator certification. Students can select certification categories and have the opportunity to obtain pesticide applicator certification at the completion of the course. Commercial pesticide applicator certification is emphasized. (Typically Offered: Spring)

HORT 2910A: Horticulture Professional Development: Turfgrass Competition

Credits: 1. Contact Hours: Laboratory 2.

Repeatable, maximum of 4 credits.

Prereq: Instructor Permission for Course

Intensive training in preparation for intercollegiate competition in turfgrass, planting, design, plant identification, installation, cost estimating, and other skills at national contests in horticulture. Students must compete in related national competition to earn credit. Graduation Restriction: Only one credit of HORT 2910A, 2910B, or 2910C may count toward Horticulture credits for graduation. A maximum of four credits of any combination of HORT 2910A, 2910B, and 2910C may count toward credits for graduation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

HORT 2910B: Horticulture Professional Development: Landscape Competition

Credits: 1. Contact Hours: Lecture 1.

Repeatable, maximum of 4 credits.

Prereq: Instructor Permission for Course

Intensive training in preparation for intercollegiate competition in planting, design, plant identification, installation, cost estimating, and other skills at national contests in horticulture. Students must compete in related national competition to earn credit. Graduation Restriction: Only one credit of HORT 2910A, 2910B, or 2910C may count toward Horticulture credits for graduation. A maximum of four credits of any combination of HORT 2910A, 2910B, and 2910C may count toward credits for graduation. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

HORT 2910C: Horticulture Professional Development: Cross-Commodity

Credits: 1. Contact Hours: Laboratory 2.

Repeatable, maximum of 4 credits.

Prereq: Instructor Permission for Course

Intensive training in preparation for intercollegiate competition in planting, plant identification and other skills at national contests in horticulture. Students must compete in related national competition to earn credit. Graduation Restriction: Only one credit of HORT 2910A, 2910B, or 2910C may count toward Horticulture credits for graduation. A maximum of four credits of any combination of HORT 2910A, 2910B, and 2910C may count toward credits for graduation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

HORT 3210: Horticulture Physiology

Credits: 3. Contact Hours: Lecture 3.

Prereq: HORT 2210 or BIOL 2110

Principles of plant physiology relating to growth and development of horticultural plants including plant water relations, membrane transport, photosynthesis, photomorphogenesis, respiration, and phytohormones. Emphasis on plant's responses to environmental factors (temperature, water, and light) including cellular and whole-plant physiology under stressful environments. (Typically Offered: Fall)

HORT 3220: Plant Propagation

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: HORT 2210 or BIOL 2110

Fundamental principles underlying sexual and asexual propagation of plants; practice in reproducing plants by use of seeds, cuttings, layering, grafting and budding and tissue culture. (Typically Offered: Spring)

HORT 3300: Herbaceous Ornamental Plants

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: HORT 2210 or Permission of Instructor

Identification, botanical characteristics, origins, propagation, uses and general culture of herbaceous annual and perennial plants for Midwestern gardens and landscapes. (Typically Offered: Fall)

HORT 3310: Hydroponic Crop Production

Credits: 2. Contact Hours: Lecture 2.

Prereq: AGRON 1810 or HORT 2210 or 3 credits in Biological Sciences

Principles and practices of hydroponic systems, crop production and culture, aquaponic systems, and new food and medicinal crops for hydroponic systems. Offered even-numbered years. (Typically Offered: Fall)

HORT 3320: Greenhouse and Nursery Operations and Management

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: HORT 2210

Operation and management of greenhouses, nurseries, and other controlled environment agriculture structures and facilities. Principle of site selection, facility design and methods of monitoring and manipulating environmental, cultural, and management factors such as light, temperature, fertility, substrate, etc., to maximize production efficiency. Emphasis placed on the principles of production of both ornamental and food crops. Greenhouse analysis project required. (Typically Offered: Spring)

HORT 3380: Seed Science and Technology

(Cross-listed with AGRON 3380).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: (AGRON 1810 or HORT 2210); 3 credits of BIOL

Seed production, maturation, dormancy, vigor, deterioration, and related aspects of enhancement, conditioning, storage, and quality evaluation. Aspects of the seed industry and regulation of seed marketing. (Typically Offered: Fall)

HORT 3410: Woody Plant Cultivars: Shade Trees, Ornamental Trees and Woody Shrubs

Credits: 2. Contact Hours: Lecture 2.

Prereq: HORT 2400 or LA 2210 or LA 2220

Cultivars of the most prevalent and economically important woody landscape plants will be taught. The importance of cultivars to the nursery and landscaping professions and suggestions for their proper usage will be discussed. (Typically Offered: Spring)

HORT 3420: Landscape Plant Installation, Establishment, and Management

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: HORT 2400 or LA 2210 or LA 2220

Principles and practices involved with the establishment and management of landscapes. Laboratory work involves site evaluation, installation techniques, postplant care, and management of established landscape plants. (Typically Offered: Spring)

HORT 3510: Turfgrass Establishment and Management

(Cross-listed with AGRON 3510).

Credits: 3. Contact Hours: Lecture 3.

Prereq: HORT 2210 or AGRON 1810 or BIOL 2110

Principles and practices of turfgrass propagation, establishment, and management. Specialized practices relative to professional lawn care, golf courses, athletic fields, highway roadsides, and seed and sod production. The biology and control of turfgrass pests. (Typically Offered: Fall)

HORT 3510L: Turfgrass Establishment and Management Laboratory

(Cross-listed with AGRON 3510L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Credit or enrollment in HORT 3510

Those enrolled in the horticulture curriculum are required to take 3510L in conjunction with 3510 except by permission of the instructor. (Typically Offered: Fall)

HORT 3540: Soils and Plant Growth

(Cross-listed with AGRON 3540).

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 1820; 3 credits of BIOL

Effects of chemical, physical, and biological properties of soils on plant growth, with emphasis on nutritive elements, pH, organic matter maintenance, and rooting development. (Typically Offered: Fall, Spring)

HORT 3540L: Soils and Plant Growth Laboratory

(Cross-listed with AGRON 3540L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: AGRON or HORT major AND (Credit or concurrent enrollment in AGRON 3540)

Laboratory exercises in soil testing that assess a soil's ability to support nutritive requirements for plant growth. (Typically Offered: Fall, Spring)

HORT 3760: Fundamentals of Field Production of Horticultural Food Crops

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 1810 or HORT 2210

An introduction to field production of fruit and vegetable crops and the theoretical and practical knowledge required for successfully producing them. Topics will include basic principles and practices of fruit and vegetable production, site selection, soil techniques, irrigation management, equipment and tools, integrated pest management, season extension strategies, postharvest handling and food safety, marketing, and basic business planning for fruit and vegetable enterprises. Additionally, this course will prepare students for HORT 4610 and HORT 4710, that are advanced level courses focusing on fruit and vegetable production. (Typically Offered: Fall)

HORT 3800: Principles of Garden Composition

Credits: 2. Contact Hours: Lecture 2.

Functional and aesthetic aspects of landscape planning as a basis for design decisions; emphasis on spatial design and plant selection. Includes site analysis, design process, and design principles. (Typically Offered: Spring)

HORT 3810: Beginning Garden Composition Studio

Credits: 2. Contact Hours: Studio 4.

Prereq: HORT 2810; (HORT 2400 or HORT 3300); concurrent enrollment in HORT 3800

Introduction to landscape design process. Intensive studio-based projects implementing principles of landscape design, concept development, and graphic communication. (Typically Offered: Spring)

HORT 3910: Horticultural Management Experience

Credits: 1. Repeatable.

Prereq: HORT 2210; Department Permission

A structured work experience for the student to gain insight into management operations associated with production and management of horticultural crops. A report of 10 or more pages describing the student's experience is required. One credit is given for each term the student is enrolled in the course. Graduation Restriction: A maximum of two credits may be used toward the horticultural sciences course requirements, and two additional credits may be used toward the 128 credits required for graduation. (Typically Offered: Fall, Spring, Summer)

HORT 3980: Cooperative Education

Credits: Required. Repeatable.

Prereq: Department Permission for Course

Students must register for this course before commencing each work period. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

HORT 4210: Introduction to Plant Breeding

(Cross-listed with AGRON 4210).

Credits: 3. Contact Hours: Lecture 3.

Prereq: GEN 3200 or BIOL 3130

Fundamental principles of plant breeding and cultivar development, breeding methods for self-pollinated, cross-pollinated and clonal crops. (Typically Offered: Fall)

HORT 4240: Sustainable and Environmental Horticulture Systems

(Dual-listed with HORT 5240). (Cross-listed with ENVS 4240).

Credits: 3. Contact Hours: Lecture 3.

Inquiry into ethical issues and environmental consequences of horticultural cropping systems, production practices and managed landscapes. Emphasis on systems that are resource efficient, environmentally sound, socially acceptable, and profitable. (Typically Offered: Spring)

HORT 4340: Floriculture Crop Production

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: HORT 3320

Principles and practices of flowering and ornamental greenhouse crop production. Emphasis is placed on production of flowering potted plants, cut flowers, and foliage crops produced in greenhouses and other controlled environments. An overnight class field trip outside scheduled class time is required. Offered odd-numbered years. (Typically Offered: Fall)

HORT 4350: Landscape Plant Production

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: HORT 3320

Principles and practices of producing herbaceous and woody landscape plants for gardens, landscapes, restoration and other outdoor uses. Emphasis is placed on the production of: seedling plugs and rooted cuttings; container grown herbaceous annual and perennials; tree, shrubs, and vines; and native plants. An overnight class field trip outside scheduled class time is required. Offered odd-numbered years. (Typically Offered: Spring)

HORT 4440: Landscape Construction Management

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Principles and practices of residential landscape construction.

Encompasses project management, landscape estimating and overview of common landscape materials. Laboratory work involves field trips and project installation. (Typically Offered: Fall)

HORT 4510: Professional Turfgrass Management

Credits: 2. Contact Hours: Lecture 2.

Prereq: HORT 3510

Turfgrass science including the study of (1) specific information on soil chemistry and soil modification as they relate to the development and maintenance of turfgrass areas, (2) specialized management practices used in athletic field care, professional lawn care, and golf course industries, and (3) construction methods for golf courses and sports fields. Offered odd-numbered years. (Typically Offered: Spring)

HORT 4520: Integrated Management of Diseases and Insect Pests of Turfgrasses

(Dual-listed with PLP 5520/ ENT 5520/ HORT 5520). (Cross-listed with ENT 4520/ PLP 4520).

Credits: 3. Contact Hours: Lecture 3.

Prereq: HORT 3510

Identification and biology of important diseases and insect pests of turfgrasses. Development of integrated pest management programs in various turfgrass environments. Offered even-numbered years. (Typically Offered: Spring)

HORT 4530: Sports Turf Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: HORT 3510

Management techniques for today's specialized athletic fields. The horticultural and budgetary aspects of football, soccer, baseball, and softball fields will be presented. Field trips and laboratory exercises will develop a practical understanding of actual principles in field development, construction, and management. Offered even-numbered years. (Typically Offered: Fall)

HORT 4540: Turf & Landscape Irrigation

Credits: 3. Contact Hours: Lecture 3.

Irrigation systems and principles for turf and landscape environments. Topics include design, installation, equipment, management, and troubleshooting of irrigation systems for golf, athletic fields, residential lawns and landscapes. Participation in practical exercises and local field trips to irrigation sites is required. Offered odd-numbered years. (Typically Offered: Fall)

HORT 4610: Fruit Crop Production and Management

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: HORT 2210

Principles and practices of small fruit; tree fruit, and nut culture and production. Morphology, physiology of growth and development, plant establishment, pest management, pruning, training, harvesting, storage, and marketing of commercial temperate fruit and nut crops. Emphasis on sustainable practices. Participation in practical exercises and local field trips is required. Offered odd-numbered years. (Typically Offered: Spring)

HORT 4710: Vegetable Production and Management

(Dual-listed with HORT 5710).

Credits: 2. Contact Hours: Lecture 2.

Prereq: HORT 2210

Principles of vegetable production with emphasis on sustainable production practices, market outlets, business aspects, and risk management. Topics will include crop classification and rotation; planting methods; crop climatic conditions, physiological growth & development; soil, water, and pest management; cover cropping; season extension strategies; harvest and postharvest management and marketing. Involves visits to growers fields to observe/experience their production enterprise. Offered even-numbered years. (Typically Offered: Spring)

HORT 4710L: Vegetable Production and Management Lab

(Dual-listed with HORT 5710L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Junior or Senior classification; concurrent enrollment in HORT 4710

Hands-on training in the area of vegetable crop production. Opportunity to grow a variety of vegetables in a heated greenhouse and also conduct greenhouse and lab experiments. The lab also involves visits to vegetable production sites in Iowa to observe/experience and learn from growers and other agricultural professionals. Offered even-numbered years. (Typically Offered: Spring)

HORT 4750: Urban Forestry

(Cross-listed with FOR 4750).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Junior or senior classification, 3 credits in BIOL

Discussion of establishment and management of woody perennials in community-owned urban greenspaces, consideration of urban site and soil characteristics, plant physiology, plant culture, urban forest valuation, inventory methods, species selection, and urban forest maintenance (health care and pest management). (Typically Offered: Fall)

HORT 4760: Horticultural Postharvest Technology

(Dual-listed with HORT 5760).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: HORT 2210

Study of pre- and post-harvest factors, procedures, and challenges that affect market quality of horticultural commodities. Emphasis on storage and handling technologies to preserve quality and extend storage life of edible and ornamental horticultural crops. Field trips outside scheduled class time required. Offered odd-numbered years. (Typically Offered: Fall)

HORT 4810: Advanced Garden Composition

Credits: 2. Contact Hours: Studio 4.

Prereq: HORT 2400 and HORT 3300 and HORT 3800 and HORT 3810

Priority given to Landscape Design Installation and Management option students. Development of residential landscapes using design principles and the design process. Projects encompass site analysis, concept development, preliminary design, final design, and graphic presentation techniques. Techniques will include hand and computer rendering. (Typically Offered: Fall)

HORT 4840: Organic Agricultural Theory and Practice

(Dual-listed with AGRON 5840/ HORT 5840/ SUSAG 5840). (Cross-listed with AGRON 4840).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 9 credits in biological or physical sciences

Understanding of the historical origins and ecological theories underpinning the practices involved in organic agriculture. Interdisciplinary examination of crop and livestock production and socio-economic processes and policies in organic agriculture from researcher and producer perspectives. Offered odd-numbered years. (Typically Offered: Spring)

HORT 4900A: Independent Study: Greenhouse Crops

Credits: 1-30. Repeatable, maximum of 4 credits.

Prereq: Junior or Senior classification in HORT; Permission of Instructor; Membership in the University Honors Program

Investigation of topic holding special interest to the student.

Comprehensive report required. Election of course and topic must be approved by department head. Graduation Restriction: A maximum of 4 credits of HORT 4900 and an additional 2 credits of 4900 from outside Horticulture may be used toward the total of 129 credits required for graduation.

HORT 4900B: Independent Study: Nursery Crops

Credits: 1-30. Repeatable, maximum of 4 credits.

Prereq: Junior or Senior classification in HORT; Permission of Instructor; Membership in the University Honors Program

Investigation of topic holding special interest to the student.

Comprehensive report required. Election of course and topic must be approved by department head. Graduation Restriction: A maximum of 4 credits of HORT 4900 and an additional 2 credits of 4900 from outside Horticulture may be used toward the total of 129 credits required for graduation.

HORT 4900C: Independent Study: Turfgrass

Credits: 1-30. Repeatable, maximum of 4 credits.

Prereq: Junior or Senior classification in HORT; Permission of Instructor; Membership in the University Honors Program

Investigation of topic holding special interest to the student.

Comprehensive report required. Election of course and topic must be approved by department head. Graduation Restriction: A maximum of 4 credits of HORT 4900 and an additional 2 credits of 4900 from outside Horticulture may be used toward the total of 129 credits required for graduation.

HORT 4900D: Independent Study: Fruit Crops

Credits: 1-30. Repeatable, maximum of 4 credits.

Prereq: Junior or Senior classification in HORT; Permission of Instructor; Membership in the University Honors Program

Investigation of topic holding special interest to the student.

Comprehensive report required. Election of course and topic must be approved by department head. Graduation Restriction: A maximum of 4 credits of HORT 4900 and an additional 2 credits of 4900 from outside Horticulture may be used toward the total of 129 credits required for graduation.

HORT 4900E: Independent Study: Vegetable Crops

Credits: 1-30. Repeatable, maximum of 4 credits.

Prereq: Junior or Senior classification in HORT; Permission of Instructor; Membership in the University Honors Program

Investigation of topic holding special interest to the student.

Comprehensive report required. Election of course and topic must be approved by department head. Graduation Restriction: A maximum of 4 credits of HORT 4900 and an additional 2 credits of 4900 from outside Horticulture may be used toward the total of 129 credits required for graduation.

HORT 4900F: Independent Study: Cross-Commodity

Credits: 1-30. Repeatable, maximum of 4 credits.

Prereq: Junior or Senior classification in HORT; Permission of Instructor; Membership in the University Honors Program

Investigation of topic holding special interest to the student.

Comprehensive report required. Election of course and topic must be approved by department head. Graduation Restriction: A maximum of 4 credits of HORT 4900 and an additional 2 credits of 4900 from outside Horticulture may be used toward the total of 129 credits required for graduation.

HORT 4900G: Independent Study: Landscape Horticulture

Credits: 1-30. Repeatable, maximum of 4 credits.

Prereq: Junior or Senior classification in HORT; Permission of Instructor; Membership in the University Honors Program

Investigation of topic holding special interest to the student.

Comprehensive report required. Election of course and topic must be approved by department head. Graduation Restriction: A maximum of 4 credits of HORT 4900 and an additional 2 credits of 4900 from outside Horticulture may be used toward the total of 129 credits required for graduation.

HORT 4900H: Independent Study: Honors

Credits: 1-30. Repeatable, maximum of 4 credits.

Prereq: Junior or Senior classification in HORT; Permission of Instructor; Membership in the University Honors Program

Investigation of topic holding special interest to the student.

Comprehensive report required. Election of course and topic must be approved by department head. Graduation Restriction: A maximum of 4 credits of HORT 4900 and an additional 2 credits of 4900 from outside Horticulture may be used toward the total of 129 credits required for graduation.

HORT 4900I: Independent Study: International Study

Credits: 1-30. Repeatable, maximum of 4 credits.

Prereq: Junior or Senior classification in HORT; Permission of Instructor; Membership in the University Honors Program

Investigation of topic holding special interest to the student.

Comprehensive report required. Election of course and topic must be approved by department head. Graduation Restriction: A maximum of 4 credits of HORT 4900 and an additional 2 credits of 4900 from outside Horticulture may be used toward the total of 129 credits required for graduation.

HORT 4900J: Independent Study: Entrepreneurship

Credits: 1-30. Repeatable, maximum of 4 credits.

Prereq: Junior or Senior classification in HORT; Permission of Instructor; Membership in the University Honors Program

Investigation of topic holding special interest to the student.

Comprehensive report required. Election of course and topic must be approved by department head. Graduation Restriction: A maximum of 4 credits of HORT 4900 and an additional 2 credits of 4900 from outside Horticulture may be used toward the total of 129 credits required for graduation.

HORT 4910: Seed Science Internship Experience

(Cross-listed with AGRON 4910).

Credits: 1-2. Repeatable, maximum of 2 credits.

Prereq: AGRON 3380; Permission of Instructor

A professional work experience and creative project for seed science secondary majors. The project requires the prior approval and participation of the employer and instructor. The student must submit a written report. Advanced approval and participation of employer and instructor required. (Typically Offered: Fall, Spring, Summer)

HORT 4930: Workshop in Horticulture

Credits: 1-30. Repeatable.

Off campus. Offered as demand warrants. Workshops in horticulture.

HORT 4940A: Service Learning: International

Credits: 1-30. Repeatable, maximum of 12 credits.

Prereq: Instructor Permission for Course

Selected projects that result in outcomes benefiting a non-Iowa State University entity while instilling professional ethics and accomplishing student learning goals. Course expenses paid by student. Assessed service-learning component. Graduation Restriction: A maximum of 4 credits of HORT 4940 may be used toward the Horticulture credits required for graduation. (Typically Offered: Fall, Spring, Summer)

HORT 4940B: Service Learning: Domestic

Credits: 1-30. Repeatable, maximum of 12 credits.

Prereq: Instructor Permission for Course

Selected projects that result in outcomes benefiting a non-Iowa State University entity while instilling professional ethics and accomplishing student learning goals. Course expenses paid by student. Assessed service-learning component. Graduation Restriction: A maximum of 4 credits of HORT 4940 may be used toward the Horticulture credits required for graduation. (Typically Offered: Fall, Spring, Summer)

HORT 4950: Horticulture Travel Course Preparation

Credits: Required. Contact Hours: Lecture 1.

Repeatable.

Prereq: Instructor Permission for Course

Limited enrollment. Students enrolled in this course also intend to register for Hort 496 the following term. Topics include preparation for safe international travel, the horticultural/agricultural industries, climate, crops, economics, geography, history, marketing, soils, culture, traditions, and horticultural/agricultural development of the country to be visited. Students enroll in this course the term immediately before travel to the foreign country. (Typically Offered: Fall, Spring, Summer)

HORT 4960: Horticulture Travel Course

Credits: 1-4. Repeatable.

Prereq: Instructor Permission for Course

Limited enrollment. Study and tour of production methods in major horticultural regions of the world. Influence of climate, economics, geography, soils, landscapes, markets, cultures, and history of horticultural crops. Location and duration of tours will vary. Tour expenses paid by students. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

HORT 4970X: Domestic Horticulture Travel Course

Credits: 1-4. Contact Hours: Lecture 4.

Repeatable.

Study and tour of production methods in major horticultural regions of the US. Influence of climate, economics, geography, soils, landscapes, markets, cultures, and history of horticultural crops. Location and duration of tours will vary. Tour expenses paid by students. Limited enrollment. (Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

HORT 5060: Crop Genetics

(Cross-listed with AGRON 5060).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to plant reproductive systems, gene segregation and linkage analysis, molecular nature of genes and how genes confer phenotypes, mutation and biotechnology, quantitative inheritance and population genetics to prepare students for subsequent courses in crop improvement. Enrollment is restricted to off-campus MS in Plant Breeding students. (Typically Offered: Fall)

HORT 5110: Integrated Management of Tropical Crops

(Cross-listed with ENT 5110/ PLP 5110).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (ENT 3700 or ENT 3760 or HORT 2210 or PLP 4080 or PLP 4160) or Graduate Classification

Applications of Integrated Crop management principles (including plant pathology, entomology, and horticulture) to tropical cropping systems. Familiarization with a variety of tropical agroecosystems and Costa Rican culture is followed by a 10-day tour of Costa Rican agriculture during spring break, then writeup of individual projects. Offered odd-numbered years. Meets International Perspectives Requirement. (Typically Offered: Spring)

HORT 5240: Sustainable and Environmental Horticulture Systems

(Dual-listed with ENVS 4240/ HORT 4240).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Inquiry into ethical issues and environmental consequences of horticultural cropping systems, production practices and managed landscapes. Emphasis on systems that are resource efficient, environmentally sound, socially acceptable, and profitable. (Typically Offered: Spring)

HORT 5300: Research Orientation

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Instruction in scientific methods and communication skills. (Typically Offered: Fall)

HORT 5380: Seed Physiology and the Environment

(Cross-listed with AGRON 5380).

Credits: 2. Contact Hours: Lecture 2.

Prereq: AGRON 3160; CHEM 2310 or CHEM 3310 or graduate standing

Physiological aspects of seed development, maturation, longevity, dormancy, and germination of agronomic and horticultural crops and their interactions with field and storage environments. Emphasis on current literature and advanced methodology. Offered even-numbered years. (Typically Offered: Fall)

HORT 5420A: Introduction to Molecular Biology Techniques: DNA Techniques

(Cross-listed with BMS 5420A/ EEOB 5420A/ FSHN 5420A/ GDCB 5420A/ BBMB 5420A/ NREM 5420A/ NUTRS 5420A/ VDPAM 5420A/ VMPM 5420A).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes genetic engineering procedures, sequencing, PCR, and genotyping. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

HORT 5420B: Introduction to Molecular Biology Techniques: Protein

(Cross-listed with BMS 5420B/ EEOB 5420B/ FSHN 5420B/ GDCB 5420B/ BBMB 5420B/ NREM 5420B/ NUTRS 5420B/ VDPAM 5420B).

Credits: 1. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. Offered on a satisfactory-fail basis only. (Typically Offered: Spring, Summer)

HORT 5420C: Introduction to Molecular Biology Techniques: Cell Techniques

(Cross-listed with BMS 5420C/ EEOB 5420C/ FSHN 5420C/ GDCB 5420C/ BBMB 5420C/ NREM 5420C/ NUTRS 5420C/ VMPM 5420C/ VDPAM 5420C).

Credits: 1. Contact Hours: Laboratory 2.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. Includes biology techniques and related procedures. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

HORT 5420D: Introduction to Molecular Biology Techniques: Plant Transformation

(Cross-listed with BMS 5420D/ EEOB 5420D/ FSHN 5420D/ GDCB 5420D/ BBMB 5420D/ NREM 5420D/ NUTRS 5420D/ VMPM 5420D/ VDPAM 5420D).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: Agrobacterium and particle gun-mediated transformation of tobacco, Arabidopsis, and maize, and analysis of transformants. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

HORT 5420E: Introduction to Molecular Biology Techniques: Proteomics

(Cross-listed with BMS 5420E/ EEOB 5420E/ FSHN 5420E/ GDCB 5420E/ BBMB 5420E/ NREM 5420E/ NUTRS 5420E/ VMPM 5420E/ VDPAM 5420E).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.
Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: two-dimensional electrophoresis, laser scanning, mass spectrometry, and database searching. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

HORT 5420F: Introduction to Molecular Biology Techniques:

Metabolomics

(Cross-listed with BMS 5420F/ EEOB 5420F/ FSHN 5420F/ GDCB 5420F/ BBMB 5420F/ NREM 5420F/ NUTRS 5420F/ VMPM 5420F/ VDPAM 5420F).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.
Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: metabolomics and the techniques involved in metabolite profiling. For non-chemistry majoring students who are seeking analytical aspects into their biological research projects. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

HORT 5420G: Introduction to Molecular Biology Techniques: Genomic

(Cross-listed with BMS 5420G/ EEOB 5420G/ FSHN 5420G/ GDCB 5420G/ BBMB 5420G/ NREM 5420G/ NUTRS 5420G/ VMPM 5420G/ VDPAM 5420G).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.
Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

HORT 5430: Seed Physiology

(Cross-listed with STB 5430).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Admission to the Graduate Program in Seed Technology and Business or Permission of Instructor

Brief introduction to plant physiology. Physiological aspects of seed development, maturation, longevity, dormancy and germination. Links between physiology and seed quality. (Typically Offered: Fall)

HORT 5460: Strategies for Diversified Food and Farming Systems

(Cross-listed with AGRON 5460/ SUSAG 5460).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Project-focused engagement in food and farming systems using tools and perspectives drawn from multiple disciplines. Includes a field component. Offered odd-numbered years. (Typically Offered: Spring)

HORT 5510: Growth and Development of Perennial Grasses

(Cross-listed with AGRON 5510).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Selected topics onatomy, morphology, and physiology relative to growth and development of perennial grasses. Emphasis on growth and development characteristics peculiar to grasses and variations of such characteristics under natural and managed conditions. Offered even-numbered years. (Typically Offered: Spring)

HORT 5520: Integrated Management of Diseases and Insect Pests of Turfgrasses

(Dual-listed with PLP 4520/ ENT 4520/ HORT 4520). (Cross-listed with ENT 5520/ PLP 5520).

Credits: 3. Contact Hours: Lecture 3.

Prereq: HORT 3510 or Graduate Classification

Identification and biology of important diseases and insect pests of turfgrasses. Development of integrated pest management programs in various turfgrass environments. Offered even-numbered years. (Typically Offered: Spring)

HORT 5710: Vegetable Production and Management

(Dual-listed with HORT 4710).

Credits: 2. Contact Hours: Lecture 2.

Prereq: HORT 221 or Graduate Classification

Principles of vegetable production with emphasis on sustainable production practices, market outlets, business aspects, and risk management. Topics will include crop classification and rotation; planting methods; crop climatic conditions, physiological growth & development; soil, water, and pest management; cover cropping; season extension strategies; harvest and postharvest management and marketing. Involves visits to growers fields to observe/experience their production enterprise. Offered even-numbered years. (Typically Offered: Spring)

HORT 5710L: Vegetable Production and Management Lab

(Dual-listed with HORT 4710L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Hands-on training in the area of vegetable crop production. Opportunity to grow a variety of vegetables in a heated greenhouse and also conduct greenhouse and lab experiments. The lab also involves visits to vegetable production sites in Iowa to observe/experience and learn from growers and other agricultural professionals. Offered even-numbered years. (Typically Offered: Spring)

HORT 5760: Horticultural Postharvest Technology

(Dual-listed with HORT 4760).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: HORT 2210

Study of pre- and post-harvest factors, procedures, and challenges that affect market quality of horticultural commodities. Emphasis on storage and handling technologies to preserve quality and extend storage life of edible and ornamental horticultural crops. Field trips outside scheduled class time required. Offered odd-numbered years. (Typically Offered: Fall)

HORT 5810: Experience in Plant Science Extension and Outreach

(Cross-listed with AGRON 5810/ ENT 5810/ PLP 5810).

Credits: 1.

Prereq: Graduate Standing or Permission of Instructor

A supervised learning experience in several extension delivery methods used in the plant sciences. Participation in Iowa State University-based extension programs that may include field crops horticulture, or Master Gardener programming. Offered odd-numbered years. (Typically Offered: Summer)

HORT 5840: Organic Agricultural Theory and Practice

(Dual-listed with AGRON 4840/ HORT 4840/ SUSAG 4840). (Cross-listed with AGRON 5840/ SUSAG 5840).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Understanding of the historical origins and ecological theories underpinning the practices involved in organic agriculture. Interdisciplinary examination of crop and livestock production and socio-economic processes and policies in organic agriculture from researcher and producer perspectives. Offered odd-numbered years. (Typically Offered: Spring)

HORT 5900: Special Topics

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

HORT 5930A: Workshop in Horticulture: Greenhouse Crops

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Workshops in horticulture, with emphasis on off-campus instruction.

HORT 5930B: Workshop in Horticulture: Nursery Crops

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Workshops in horticulture, with emphasis on off-campus instruction.

HORT 5930C: Workshop in Horticulture: Turfgrass

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Workshops in horticulture, with emphasis on off-campus instruction.

HORT 5930D: Workshop in Horticulture: Fruit Crops

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Workshops in horticulture, with emphasis on off-campus instruction.

HORT 5930E: Workshop in Horticulture: Vegetable Crops

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Workshops in horticulture, with emphasis on off-campus instruction.

HORT 5930F: Workshop in Horticulture: Cross-Commodity

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Workshops in horticulture, with emphasis on off-campus instruction.

HORT 5930G: Workshop in Horticulture: Landscape Horticulture

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Workshops in horticulture, with emphasis on off-campus instruction.

HORT 5990: Creative Component

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Courses for graduate students:**HORT 6100: Graduate Seminar**

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

HORT 6900: Advanced Topics

Credits: 1-30. Repeatable.

HORT 6960: Research Seminar

(Cross-listed with AGRON 6960/ BBMB 6960/ FOR 6960/ GDCB 6960/ PLBIO 6960).

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Research seminars by faculty and graduate students. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

HORT 6980: Horticulture Teaching Practicum

Credits: 1. Contact Hours: Lecture 1.

Discussions are intended to foster the development of graduate students as teaching assistants and future horticulture/plant science teachers. Topics include establishing a classroom presence, improving lectures, motivating students, dealing with difficult or disruptive students, and developing a teaching philosophy. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

HORT 6990A: Thesis and Dissertation Research: Greenhouse Crops

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

HORT 6990B: Thesis and Dissertation Research: Nursery Crops

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

HORT 6990C: Thesis and Dissertation Research: Turfgrass

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

HORT 6990D: Thesis and Dissertation Research: Fruit Crops

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

HORT 6990E: Thesis and Dissertation Research: Vegetable Crops

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

HORT 6990F: Thesis and Dissertation Research: Cross-Commodity

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

HORT 6990G: Thesis and Dissertation Research: Landscape Horticulture

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

HORT 6990I: Thesis and Dissertation Research: Biotechnology

Credits: 1-30. Repeatable.

Hospitality Management (HSPM)

Courses primarily for undergraduates:

HSPM 1010: Introduction to the Hospitality Industry

Credits: 3. Contact Hours: Lecture 3.

Introduction to the foodservice, lodging, and tourism components of the hospitality industry. Background information, current issues, and future challenges in various segments of the industry. (Typically Offered: Fall, Spring)

HSPM 1330: Food Safety Certification

Credits: 1. Contact Hours: Lecture 1.

Introduction to safety and sanitation principles in foodservice operations. Characteristics of food, supplies, and equipment as related to quality, sanitation, and safety are discussed. Application of sanitation principles in restaurants are covered as well. Students must pass a National Sanitation Certification Examination to receive credit. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

HSPM 2010: Casino Management I

Credits: 3. Contact Hours: Lecture 3.

An overview of the casino gaming industry. Emphasis will be placed on examination of the history and development of gaming, casino operations, casino games, marketing of the core gaming products, and social and economic impacts of the gaming industry. (Typically Offered: Fall)

HSPM 2250: Introduction to Food Service Operations

Credits: 3. Contact Hours: Lecture 3.

Introduction to food service operations within the hospitality and event industry. Management concepts, distinct features, sustainability, current issues, and trends. (Typically Offered: Spring)

HSPM 2300: Introduction to Hospitality Performance Analysis

Credits: 3. Contact Hours: Lecture 3.

Introduction to Uniform Systems of Accounts for hospitality industry, profitability, income statements, budgeting, managing cash, accounts receivable and payable, costs control, pricing, and evaluation related to restaurant, lodging, and club industry. Preparation for a hospitality accounting certification exam. (Typically Offered: Fall, Spring)

HSPM 2330: Hospitality Sanitation and Safety

Credits: 3. Contact Hours: Lecture 3.

Sanitation and safety principles in hospitality operations. Issues impacting consumers and operators. (Typically Offered: Fall, Spring)

HSPM 2480: Introduction to Senior Living Management

Credits: 3. Contact Hours: Lecture 3.

Survey course provides a comprehensive overview of the history, current issues, and future trends of the senior living industry. Basics about major aspects of senior living management. (Typically Offered: Fall)

HSPM 2600: Global Tourism Management

Credits: 3. Contact Hours: Lecture 3.

Overview of the global tourism industry: hospitality and related services, destination/ attractions, tourist behaviors, and destination marketing. Introduction to destination mix, socio-economic and cultural impacts of tourism, destination organizations, tourist motivations, destination image, marketing, promotions, tourism distribution system, and the future of tourism. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

HSPM 2800: Non-Alcoholic Beverages and Cafe Operations

Credits: 3. Contact Hours: Lecture 3.

Advanced knowledge, preparation, and service of non-alcoholic beverages applied for cafe operations. (Typically Offered: Fall, Spring)

HSPM 2890: Contemporary Club Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: HSPM 1010

Organization and management of private clubs including city, country, and other recreational and social clubs. Field trip may be required. (Typically Offered: Spring)

HSPM 2900: Independent Study

Credits: 1-2. Repeatable, maximum of 4 credits.

Prereq: Freshman or Sophomore Classification. Permission of instructor, advisor, and department chair.

Independent study on topics of special interest to the student, facilitated by approved faculty member. Graduation Restriction: Maximum of 9 credits combined of HSPM 2900 and HSPM 4900 can be applied to graduation. (Typically Offered: Fall, Spring, Summer)

HSPM 3010: Hospitality Revenue Management

Credits: 3. Contact Hours: Lecture 3.

An overview of the revenue management in the lodging and food service industry will be provided. Emphasis will be placed on the application of analytical and forecasting techniques to formulate and implement pricing strategies in responses to daily operation complexities. (Typically Offered: Fall)

HSPM 3150: Hospitality Law

Credits: 3. Contact Hours: Lecture 3.

Laws relating to ownership and operation of hospitality organizations. The duties and rights of both hospitality business operators and customers. Legal implications of various managerial decisions. (Typically Offered: Spring)

HSPM 3200: Attractions and Amusement Park Administration

Credits: 3. Contact Hours: Lecture 3.

Prereq: HSPM 1010 or permission of instructor

Examination of current issues in the attractions and amusement park industry. Emphasis will be placed on development and design along with the functional departments of modern amusement parks and themed attractions. (Typically Offered: Spring)

HSPM 3330: Hospitality Operations Cost Controls

Credits: 3. Contact Hours: Lecture 3.

Introduction to revenue and cost systems in the hospitality industry. Application of principles related to procurement, production, and inventory controls. (Typically Offered: Fall)

HSPM 3520: Lodging Operations Management I

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or concurrent enrollment in HSPM 1010

Introduction to functional department activities and current issues of lodging organizations with emphasis on front office operations and guest services including reservation activities, forecasting, and auditing exercises. (Typically Offered: Fall)

HSPM 3580: Economics for Senior Living Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: HSPM 2480

Overview of supply and demand, product/service development, consumption, and financials of the senior living industry from a management perspective. (Typically Offered: Fall)

HSPM 3800: Food Production Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: HSPM 1330 or 2 cr MICRO; FSHN 1010, FSHN 1110 or FSHN 2140; FSHN 1150 or FSHN 2150; at least junior classification; enrollment in HSPM 3800L

Principles of and procedures used in food production management including menu planning, costing, work methods, food production systems, quality control, and service. (Typically Offered: Fall, Spring)

HSPM 3800L: Food Production Management Experience

Credits: 3.

Prereq: HSPM 1330 or 2 cr MICRO; FSHN 1110 or FSHN 1010 or FSHN 2140; FSHN 1150 or FSHN 2150; at least junior classification; enrollment in HSPM 3800

Application of food production and service management principles and procedures in the program's foodservice operation. Field trip. (Typically Offered: Fall, Spring)

HSPM 3830: Wine and Spirits in Hospitality Management

Credits: 2. Contact Hours: Lecture 2.

Prereq: Must Be 21 Years or Older on First Day of Class

Introduction to history and methods of production for a variety of wines and spirits. Beverage tasting and sensory analysis; product knowledge; service techniques; sales; and alcohol service related to the hospitality industry. Field trip. Must be age 21 or older by first day of class. . (Typically Offered: Fall, Spring)

HSPM 3830L: Wine, Spirits, and Mixology Laboratory in Hospitality Management

Credits: 2. Contact Hours: Lecture 1, Laboratory 2.

Prereq: Must Be 21 Years or Older on First Day of Class

The application of the management principles and procedures related to the sale and service of alcohol, specialty beverages, and cocktails served in the beverage and hospitality industry. Beverage tasting and sensory analysis of products commonly served in the beverage industry. Field trip. Must be age 21 or older by first day of class. . (Typically Offered: Fall, Spring)

HSPM 3850: Beer and Brewed Beverages in Hospitality Management

Credits: 1. Contact Hours: Lecture 2.

Prereq: Must Be 21 Years or Older on First Day of Class

Introduction to history and methods of production for a variety of beer, cider, perry, mead, sake and other brewed alcoholic beverages. Beverage tasting and sensory analysis; product knowledge; and service techniques related to the beverage and hospitality industry. Field trip. 8-week course. Must be age 21 or older by first day of class. . (Typically Offered: Fall, Spring)

HSPM 3910: Foodservice Systems Management I

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or concurrent enrollment in HSPM 3800 and HSPM 3800L

Principles and techniques related to basic management, leadership, and human resource management of foodservices in health care and other on-site foodservice settings. Food safety and sanitation for on-site foodservice operations. Graduation Restriction: Credit for either HSPM 3910 or AESHM 2870 and AESHM 4380 may count toward graduation. Not accepted for credit toward a major in Hospitality Management. (Typically Offered: Fall)

HSPM 3920: Foodservice Systems Management II

Credits: 3. Contact Hours: Lecture 3.

Prereq: HSPM 3910

Introduction to cost control in foodservice operations: procedures for controlling food and labor variable costs. Application of principles related to food product selection, specification, purchase, and storage in health care and other onsite operations. Interpretation and application of financial records. Graduation Restriction: Credit for either HSPM 3920 or HSPM 2330 and HSPM 3330 may count toward graduation. Not accepted for credit toward a major in Hospitality Management. (Typically Offered: Spring)

HSPM 3930AX: Workshop: Confectionary Art

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Repeatable.

Intensive 2-to-8-week workshop exploration. Topics vary each time offered. Graduation Restriction: Maximum of 6 credits of HSPM 393 can be applied toward graduation.

HSPM 3930B: Hospitality Management Industry Workshop: Baking and Pastry Art

Credits: 3. Repeatable.

Introduces students with practical experience working in a realistic bakeshop situation to restaurant kitchens and bakeries. Students will become familiar with producing a variety of baked goods as well as setting up "Mise En Place", different baking techniques, and dessert plating techniques for the dining room and banquet situations. Focus on weights, measurements, formulas, general baking classifications, handling, and storage of ingredients, safety and handling, production of yeast raised dough products, cakes, cookies, batters, bread, biscuits, muffins, pies, and special dessert preparation. Introduction to various ingredients and how they affect the finished product by giving a tender crumbed and a well-developed crust. The essential basic functions of ingredients and the techniques of scaling, pan preparation, and sifting. (Typically Offered: Fall, Spring, Summer)

HSPM 3930M: Hospitality Management Industry Workshop: Molecular Gastronomy

Credits: 3. Repeatable.

Introduction to molecular gastronomy as a type of modern and innovative cuisine through both sweet and savory culinary applications. Develop and apply basic and advanced culinary skills. Basic principles of chemistry, biology, and physics and how they can be used in combination with culinary arts techniques to create unique culinary experiences. (Typically Offered: Fall, Spring, Summer)

HSPM 4200: Fairs, Festivals, and Events Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: HSPM 3200

Examine current issues within fairs and festivals. Emphasis placed on the evolution of exhibitions to modern day fairs and festivals, along with the processes necessary for operating fairs and festivals. (Typically Offered: Fall)

HSPM 4330: Hospitality Financial Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: ACCT 2840; ECON 1010; HSPM 3330; credit or concurrent enrollment in STAT 1010 or STAT 1040

Fundamental concepts and issues in hospitality finance and investment. Application of financial statement analysis, accounting ratio analysis, and financial instruments in management decision-making. (Typically Offered: Spring)

HSPM 4370: Hospitality Technology Applications

Credits: 3. Contact Hours: Lecture 3.

Prereq: HSPM 1010

Introduction to hospitality technology. Emphasis will be placed on basic computer software and hardware components, property managements, point-of-sales systems; customer relationship management, selecting and purchasing computer systems, electronic distribution systems, and communication networks. (Typically Offered: Fall)

HSPM 4390: Advanced Hospitality Human Resource Management

Credits: 3. Contact Hours: Lecture 3.

Emphasis on development of management personnel in hospitality organizations. Case studies. (Typically Offered: Fall)

HSPM 4520: Lodging Operations Management II

Credits: 3. Contact Hours: Lecture 3.

Prereq: HSPM 3520

Development of business plan and evaluation of business performance in a simulated environment. Operational decision making practices by applying concepts of management, operations, marketing, and finance for a computer-mediated environment. (Typically Offered: Spring)

HSPM 4550: Strategic Management in Hospitality

Credits: 3. Contact Hours: Lecture 3.

Prereq: AESHM 2380 and AESHM 3400; credit or concurrent enrollment in HSPM 4330

Introduction to strategic management principles and practices with an application of human resources, operations, marketing, and financial management concepts. Case studies. (Typically Offered: Spring)

HSPM 4700: Supervised Professional Internship

Credits: 3. Repeatable.

Supervised work experience with a cooperating firm or organization, documentation of experience, and completion of an internship project. Coursework includes weekly self-reflection and topics related to current issues and career advancement. Employer/experience should be different than employer/experience used for AESHM 1700 and AESHM 2700. Graduation Restriction: No more than 12 credits from AESHM 1700, AESHM 2700, or HSPM 4700 may be applied toward graduation. (Typically Offered: Fall, Spring, Summer)

HSPM 4870: Fine Dining Management

(Dual-listed with HSPM 5870).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: HSPM 3800, HSPM 3800L, and HSPM 1330, or ServSafe® Certification

Exploration of the historical and cultural development of the world food table. Creative experiences with U.S. regional and international foods. Application of management and financial principles in food preparation and service in fine dining settings. Meets International Perspectives Requirement. (Typically Offered: Fall)

HSPM 4900B: Independent Study: Hospitality Management

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Independent Study in Hospitality Management. (Typically Offered: Fall, Spring, Summer)

HSPM 4900D: Independent Study: Lodging Operations

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

HSPM 4900E: Independent Study: Foodservice Operations

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

HSPM 4900H: Independent Study: Honors

Credits: 1-30. Repeatable.

Prereq: Permission of Instructor; Membership in the University Honors Program

(Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

HSPM 5050: Hospitality Management Scholarship and Applications

Credits: 1-3. Contact Hours: Laboratory 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Focus on teaching and research scholarship involving the hospitality industry. (Typically Offered: Fall, Summer)

HSPM 5060: Research Seminar in Hospitality Management

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Focus on current research in hospitality industry. Discuss research designs and methods commonly used in hospitality management research; Introduce research proposal development procedures. (Typically Offered: Spring)

HSPM 5070X: Teaching, Career Planning & Professional Development

Credits: 1. Contact Hours: Lecture 1.

Prereq: Graduate Standing or Permission of Instructor

Seminar course focused on developing teaching skill, planning career, and practicing professionalism for graduate students in hospitality and tourism management. Introduces and discusses a number of topics regarding the high-impact instructional methods and teaching techniques needs for the future hospitality educators at the college level. Discussion of career planning and professional development for graduate students encompasses the activities and resources that can help students sharpen a skill set to secure their future career as a hospitality educator in the higher education. (Typically Offered: Fall)

HSPM 5330: Financial Decision Making in Hospitality Organizations

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Concepts of financial management applied to strategic decision making. Offered odd-numbered years. (Typically Offered: Spring)

HSPM 5380: Human Resources Development in Hospitality Organizations

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Theories of human resources management. Practices and principles related to development of management personnel. Offered odd-numbered years. (Typically Offered: Fall)

HSPM 5400: Strategic Marketing

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Application of marketing principles in developing effective marketing strategies for hospitality, apparel, and retail organizations. Evaluation of multi-dimensional marketing functions in hospitality organizations. Offered even-numbered years. (Typically Offered: Fall)

HSPM 5550: Strategic Management in Hospitality Organizations

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Strategic management process as a planning and decision-making framework; integration of human resources, operations, marketing, and financial management concepts. Offered even-numbered years. (Typically Offered: Spring)

HSPM 5600: Tourism Management and Tourist Behavior

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Tourism theories and research. Overview of tourism industry, tourism theories, methods, and current issues in destination marketing and management and travel behavior. Evaluation of tourism and destination research. (Typically Offered: Spring)

HSPM 5870: Fine Dining Management

(Dual-listed with HSPM 4870).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Exploration of the historical and cultural development of the world food table. Creative experiences with U.S. regional and international foods. Application of management and financial principles in food preparation and service in fine dining settings. Meets International Perspectives Requirement. (Typically Offered: Fall)

HSPM 5900B: Special Topics: Hospitality Management

Credits: 1-30. Repeatable, maximum of 3 credits.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

HSPM 5900C: Special Topics: Tourism

Credits: 1-30. Repeatable, maximum of 3 credits.

Prereq: Graduate Standing or Permission of Instructor

Special topics in tourism. (Typically Offered: Fall, Spring, Summer)

HSPM 5900D: Special Topics: Lodging Operations

Credits: 1-30. Repeatable, maximum of 3 credits.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

HSPM 5900E: Special Topics: Commercial/Retail Foodservice Operations

Credits: 1-30. Repeatable, maximum of 3 credits.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

HSPM 5900F: Special Topics: Onsite Foodservice Operations

Credits: 1-30. Repeatable, maximum of 3 credits.

Prereq: Graduate Standing or Permission of Instructor

(Typically Offered: Fall, Spring, Summer)

HSPM 5900G: Special Topics: Event Management

Credits: 1-30. Repeatable, maximum of 6 credits.

Prereq: Graduate Standing or Permission of Instructor

Special Topics in Event Management. Graduation Restriction: Only 6 credits of HSPM 5900G can be applied toward graduation. (Typically Offered: Fall, Spring, Summer)

HSPM 5990: Creative Component

Credits: 1-30.

Prereq: Instructor Permission for Course

Creative component as arranged with instructor. (Typically Offered: Fall, Spring, Summer)

Courses for graduate students:**HSPM 6040: Professional Writing**

Credits: 2. Contact Hours: Lecture 2.

Development of professional written communication with emphasis on abstracts, proposals, and manuscripts. (Typically Offered: Spring, Summer)

HSPM 6080: Administrative Problems

Credits: 1-4. Contact Hours: Lecture 4.

Repeatable, maximum of 4 credits.

Advanced administrative problems; case studies in foodservice and lodging organizations. (Typically Offered: Fall, Spring, Summer)

HSPM 6330: Advanced Hospitality Financial Management

Credits: 3. Contact Hours: Lecture 3.

Theories and research in financial management with emphasis on financial performance and financing decisions. (Typically Offered: Fall, Summer)

HSPM 6380: Advanced Human Resources Management in Hospitality Organizations

Credits: 3. Contact Hours: Lecture 3.

Research in human resources management with an emphasis on organization or unit administration. (Typically Offered: Fall, Summer)

HSPM 6400: Seminar on Marketing Thoughts

Credits: 3. Contact Hours: Lecture 3.

Conceptual and theoretical development of marketing strategies. Analytical and critical review of marketing research and industry practices. (Typically Offered: Fall, Summer)

HSPM 6520: Advanced Lodging Operations

Credits: 3. Contact Hours: Lecture 3.

Analysis and applications of concepts and theories of operations research for lodging operations. (Typically Offered: Spring, Summer)

HSPM 6600: Research Seminar in Tourism Management

Credits: 3. Contact Hours: Lecture 3.

Advanced graduate course on tourism and destination theories and research. Analysis and application of theories, research findings, and research methods in tourism and destination management. Offered odd-numbered years. (Typically Offered: Spring)

HSPM 6800: Analysis of Research in Foodservice Operations

Credits: 3. Contact Hours: Lecture 3.

Analysis and application of theories, research, and research methods in foodservice operations. Offered even-numbered years. (Typically Offered: Spring)

HSPM 6900B: Advanced Topics: Hospitality Management

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable, maximum of 30 credits.

Prereq: Instructor Permission for Course

Advanced study of current topics in hospitality management. (Typically Offered: Fall, Spring, Summer)

HSPM 6900C: Advanced Topics: Tourism

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable, maximum of 30 credits.

Prereq: Instructor Permission for Course

Advanced study of current topics in hospitality management. (Typically Offered: Fall, Spring, Summer)

HSPM 6900D: Advanced Topics: Lodging Operations

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable, maximum of 30 credits.

Prereq: Instructor Permission for Course

Advanced study of current topics in hospitality management. (Typically Offered: Fall, Spring, Summer)

HSPM 6900E: Advanced Topics: Commercial/Retail Foodservice Operations

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable, maximum of 30 credits.

Advanced study of current topics in hospitality management. (Typically Offered: Fall, Spring, Summer)

HSPM 6900F: Advanced Topics: Onsite Foodservice Operations

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable, maximum of 30 credits.

Advanced study of current topics in hospitality management. (Typically Offered: Fall, Spring, Summer)

HSPM 6900G: Advanced Topics: Event Management

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable, maximum of 30 credits.

Advanced study of current topics in event management and hospitality management. (Typically Offered: Fall, Spring, Summer)

HSPM 6990: Research

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Research. (Typically Offered: Fall, Spring, Summer)

Human Computer Interaction (HCI)

Courses primarily for undergraduates:

HCI 4250: Optimization Methods for Complex Designs

(Dual-listed with ME 5250/ HCI 5250). (Cross-listed with ME 4250).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 2650; ME 1600

Optimization involves finding the 'best' according to specified criteria. Review of a range of optimization methods from traditional nonlinear to modern evolutionary methods such as Genetic algorithms. Examination of how these methods can be used to solve a wide variety of design problems across disciplines, including mechanical systems design, biomedical device design, biomedical imaging, and interaction with digital medical data. Students will gain knowledge of numerical optimization algorithms and sufficient understanding of the strengths and weaknesses of these algorithms to apply them appropriately in engineering design. Experience includes code writing and off-the-shelf routines. Numerous case-studies of real-world situations in which problems were modeled and solved using advanced optimization techniques. (Typically Offered: Fall)

Courses primarily for graduate students, open to qualified undergraduates:

HCI 5040: Evaluating Technology-based Learning Environments

(Cross-listed with EDUC 5040).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Principles and procedures to plan, design, and conduct effective evaluation studies (formative, summative, usability) in different settings are studied. Opportunities to engage in real or simulated evaluation projects of substantial scope are provided. Course activities include: create evaluation instruments, develop methods with which to evaluate a product or program, conduct try-outs or usability sessions, analyze the data, report the findings, and recommendations.

HCI 5100: Foundations of Game-based Learning

(Cross-listed with EDUC 5100).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 12 graduate credits

Theories, principles and best practices of utilizing games in educational environments. Topics include the theoretical foundations of learning games and game play, identity development in online environments, and assessment of learning in and out of games.

HCI 5150: Statistical Natural Language Processing

(Cross-listed with ENGL 5150/ LING 5150).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to computational techniques involving human language and speech in applications such as information retrieval and extraction, automatic text categorization, word prediction, intelligent Web searching, spelling and grammar checking, speech recognition and synthesis, statistical machine translation, n-grams, POS-tagging, word-sense disambiguation, on-line lexicons and thesauri, markup languages, corpus analysis, and Python programming language.

HCI 5200: Computational Analysis of English

(Cross-listed with ENGL 5200/ LING 5200).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Concepts and practices for analysis of English by computer with emphasis on the applications of computational analysis to problems in applied linguistics such as corpus analysis and recognition of learner language in computer-assisted learning and language assessment.

HCI 5210: Cognitive Psychology of Human Computer Interaction

(Cross-listed with PSYCH 5210).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate classification

Biological, behavioral, perceptual, cognitive and social issues relevant to human computer interactions.

HCI 5220: Scientific Methods in Human Computer Interaction

(Cross-listed with PSYCH 5220).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate classification

Basics of hypothesis testing, experimental design, analysis and interpretation of data, and the ethical principles of human research as they apply to research in human computer interaction. Offered odd-numbered years. (Typically Offered: Spring)

HCI 5230X: Qualitative Research Methods in HCI

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Introduction to qualitative research methods specific to human computer interaction and user experience research, both from an academic perspective and applied industry perspective. Conduct, write, and critique qualitative research. Examples and projects will be drawn from human computer interaction domains, e.g., mobile apps, web applications, automated vehicle, self-checkout stations, etc. Methods include focus groups, interviews, surveys, and many others. (Typically Offered: Fall)

HCI 5250: Optimization Methods for Complex Designs

(Dual-listed with ME 4250). (Cross-listed with ME 5250).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior, Senior, or Graduate Standing

Optimization involves finding the 'best' according to specified criteria. Review of a range of optimization methods from traditional nonlinear to modern evolutionary methods such as Genetic algorithms. Examination of how these methods can be used to solve a wide variety of design problems across disciplines, including mechanical systems design, biomedical device design, biomedical imaging, and interaction with digital medical data. Students will gain knowledge of numerical optimization algorithms and sufficient understanding of the strengths and weaknesses of these algorithms to apply them appropriately in engineering design. Experience includes code writing and off-the-shelf routines. Numerous case-studies of real-world situations in which problems were modeled and solved using advanced optimization techniques. (Typically Offered: Fall)

HCI 5260: Design Ethnography

(Cross-listed with ANTHR 5260).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

A hands-on introduction to ethnographic methods with a focus on their application in design, human computer interaction, user research, and other applied domains. Assumes no background in cross-cultural study or social science. Trains students to use ethnographic methods to conceptualize, design, build, and evaluate interactive systems and other design-oriented projects (e.g., architecture). (Typically Offered: Fall)

HCI 5300X: Perspectives in HCI

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

An exploration of different perspectives in HCI that covers: inclusive and humane design; the intersection of technology and race, gender, age, and class; technology around the world; the impact of technology on democracy; social engineering and cybersecurity; and other relevant topics students would like to explore. (Typically Offered: Summer)

HCI 5710: Augmented Reality

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Fundamental technologies enabling augmented reality (AR) application development. Assessment and integration of the hardware and software systems necessary for AR including, tracking, image processing and rendering. Programming skills in C++ and GPU-based optimization are developed to enable evaluation of interaction devices and modalities afforded by AR.

HCI 5740: Computational Implementation and Prototyping in HCI

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Fundamental concepts of software programming and the practical use of the Python programming language. Assignments include user interaction and interface design, information visualization, as well as other computational HCI tools. Intended for graduate students without prior background in software development. Requires programming during class lectures. (Typically Offered: Spring)

HCI 5750: Computational Perception

(Cross-listed with COMS 5750/ CPRE 5750).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

This class covers statistical and algorithmic methods for sensing, recognizing, and interpreting the activities of people by a computer. This semester we will focus on machine perception techniques that facilitate and augment human-computer interaction. The main goal of the class is to introduce computational perception on both theoretical and practical levels. Participation in small groups to design, implement, and evaluate a prototype of a human-computer interaction system that uses one or more of the techniques covered in the lectures. (Typically Offered: Spring)

HCI 5790X: Methods for Interdisciplinary Research

(Cross-listed with ARCH 5790X).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to qualitative, quantitative, and experimental methods for interdisciplinary research. Themes drawn from architectural history, design fields, human computer interaction, and applied social sciences; guest speakers attend to present their research methodologies. Students develop a research paper on a topic of their choice.

HCI 5800: Virtual Environments, Virtual Worlds, and Application

(Cross-listed with ME 5800).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

A systematic introduction to the underpinnings of Virtual Environments (VE), Virtual Worlds, advanced displays and immersive technologies; and an overview of some of the applications areas particularly virtual engineering. Offered even-numbered years. (Typically Offered: Spring)

HCI 5840: Python Application Development in HCI

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Department Permission for Course

Implement Python code and write design documents ("specs") and complement their code with sufficiently detailed documentation in development of a large Python project of the student's choosing. Typical development process: idea, specification, prototyping and implementation (including debugging, testing, refactoring) and documentation and result in a demo-able final product. Fulfills the implementation requirement of the HCI program. Offered even-numbered years. (Typically Offered: Fall, Summer)

HCI 5850: Developmental Robotics

(Cross-listed with CPRE 5850).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

An introduction to the emerging interdisciplinary field of Developmental Robotics, which crosses the boundaries between robotics, artificial intelligence, developmental psychology, and philosophy. The main goal of this field is to create autonomous robots that are more intelligent, more adaptable, and more useful than the robots of today, which can only function in very limited domains and situations. Offered odd-numbered years. (Typically Offered: Spring)

HCI 5870: Models and Theories in Human Computer Interaction

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Survey of the multidisciplinary models and theories that form the foundation of the science of Human Computer Interaction. Application of the scientific method to solve practical problems by using analyses or approaches from the behavioral and social sciences, and information and computer technology.

HCI 5890: Design and Ethics

(Cross-listed with ARTGR 5890).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Issues in ethics and decision-making as they relate to technology, design, design research, HCI, and the design industry. (Typically Offered: Fall, Spring)

HCI 5900: Special Topics

Credits: 1-30. Repeatable, maximum of 30 credits.

Prereq: Department Permission for Course

Investigation of problems of special interest in human computer interaction.

HCI 5910: Seminar in Human Computer Interaction

Credits: 1-3. Contact Hours: Lecture 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

HCI 5950: Visual Design of HCI

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Human interaction design as it applies to HCI. Aspects of audience analysis, design methodologies for creating concepts and solutions, techniques of concept prototyping, and the fundamentals of visual design such as color, type, symbolism, and grid structure. Class discussions, tutorials, and hands-on projects. (Typically Offered: Summer)

HCI 5960: Emerging Practices in Human-Computer Interaction

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Innovative or newly emerging ideas within the HCI research field or applied industry practice, e.g., based on changing cultures or attitudes, new technologies, and new economic forces. (Typically Offered: Summer)

HCI 5990: Creative Component

Credits: 3.

Prereq: Department Permission for Course

Creative component for nonthesis option of Master of Science degree.

Courses for graduate students:

HCI 6030: Advanced Learning Environments Design

(Cross-listed with EDUC 6030).

Credits: 3. Contact Hours: Lecture 3.

Exploration of advanced aspects of the learning environments design process. Application of analysis, design, development and production, evaluation, implementation, and project management principles. Theory and research in educational technology provides the foundation for design decisions. Focus on current trends in learning environment design and the production and use of educational technology.

HCI 6080: Social Media and Education

(Cross-listed with EDUC 6080).

Credits: 3. Contact Hours: Lecture 3.

Increase understanding of how social media is changing traditional concepts of identity, literacy, citizenship and more. Develop an online social presence through active social media participation.

HCI 6550: Organizational and Social Implications of Human Computer Interaction

(Cross-listed with MIS 6550).

Credits: 3. Contact Hours: Lecture 3.

Examine opportunities and implications of information technologies and human computer interaction on social and organizational systems. Explore ethical and social issues appurtenant to human computer interaction, both from a proscriptive and prescriptive perspective. Develop informed perspective on human computer interaction. Implications on research and development programs.

HCI 6810: Cognitive Engineering

(Cross-listed with IE 6810).

Credits: 3. Contact Hours: Lecture 3.

Provides an overview of human cognitive capabilities and limitations in the design of products, workplaces, and large systems. Contexts vary broadly and could range from simple use of mobile devices to an air-traffic control or nuclear plant command center. Course focuses on what we can infer about users' thoughts and feelings based on what we can measure about their performance and physiological state. Covers the challenge of designing automated systems.

HCI 6970: HCI Internship

Credits: Required. Repeatable.

*Prereq: Instructor Permission for Course***HCI 6990: Research**

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Human Development and Family Studies (HDFS)

Courses primarily for undergraduates:**HDFS 1020: Human Development**

Credits: 3. Contact Hours: Lecture 3.

Overview of life-span developmental tasks (physical, cognitive, language, social, emotional) examined from various theoretical perspectives. Discussion of topics related to family diversity, individual/family health and well-being and reciprocal relationships as affected by external factors. (Typically Offered: Fall, Spring, Summer)

HDFS 1100: Freshman Learning Community Orientation

Credits: 1. Contact Hours: Lecture 1.

Introduction to the Department of Human Development and Family Studies including academic requirements and opportunities, strategies for transitioning to college, learning and study strategies, reading and reflection, and career awareness. (Typically Offered: Fall)

HDFS 1110: New Transfer Student Seminar

Credits: 1. Contact Hours: Lecture 1.

Prereq: HDFS, ECE, FCEDS, or FCP major

Introduction to HDFS curricula and faculty for students in HDFS, FCEDS, ECE, or FCP. Department and University policies and procedures, degree audits, and registration. Exploration of campus resources and strategies for student success. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

HDFS 1830: Financial Literacy for Life

Credits: 1. Contact Hours: Lecture 1.

Introduction to basic concepts and budgeting practices for management of resources and prevention of financial problems commonly associated with college, including credit and student loans. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

HDFS 2080: Foundations of Early Childhood Professions

Credits: Required. Contact Hours: Lecture 2.

Prereq: Early Childhood Education Major or Instructor Permission

Introduction to historical foundations, delivery systems, ethical responsibilities, and professional practices. Focus on developmentally appropriate, equitable, and inclusive learning contexts as career preparation. (Typically Offered: Spring)

HDFS 2200: Introduction to Professional Practice

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Introduction to the human service field's historical context, delivery systems, ethics, and professional practices. Development of foundational career preparation. (Typically Offered: Fall, Spring)

HDFS 2230: Child Development and Health

Credits: 3. Contact Hours: Lecture 3.

Typical and atypical development of children prenatal through middle childhood. Examination of healthy development and potential impact of health issues in children. Discussion of influence of the family and society on development. Graduation Restriction: Either HDFS 2230 or HDFS 2240, but not both, may be applied toward graduation. (Typically Offered: Spring)

HDFS 2240: Child Development

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 2300 or HDFS 1020

Focus on child development from prenatal through age eight considering developmental stages, milestones and individual differences. Includes theories of child development with attention to physical, communication, cognitive, and social-emotional domains. Exploration of the impact of the family and society on development. (Typically Offered: Fall, Spring)

HDFS 2240L: Child Development Practicum

Credits: 1.

Prereq: HDFS 1020 OR PSYCH 2300; concurrent enrollment in HDFS 2240 or permission of instructor

Strategies for observing, recording, and interpreting children's development. Interactions within multiple learning environments for young children. (Typically Offered: Fall, Spring)

HDFS 2260: Development and Guidance in Middle Childhood

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 2300 or HDFS 1020

Physical, cognitive, socioemotional, and identity development from 5 to 12 years of age. Development within the contexts of family, school, peers, and society. Guidance of children in family and group settings. (Typically Offered: Fall)

HDFS 2270: Middle Childhood and Adolescence

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 2300 or HDFS 1020

Physical, cognitive, socioemotional, and psychosocial development in the contexts of family, schools, peers, relationships, and culture from 8 to 18 years of age. . (Typically Offered: Fall, Spring)

HDFS 2340: Young Adulthood Through Later Life

(Cross-listed with GERON 2340).

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 2300 or HDFS 1020

Exploration of the health, individual and social factors associated with adult development including emerging, younger, middle, and older adulthood. Information is presented from a biopsychosocial lens of change across the lifespan. . (Typically Offered: Spring)

HDFS 2390: Consumer Issues

Credits: 3. Contact Hours: Lecture 3.

Introduction to factors affecting consumer decisions of individuals and families, including housing, healthcare, and personal finances. Emphasis on accessibility and affordability, community contexts for families; and consumer protection, legislation and regulation, and consumer fraud. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall, Spring)

HDFS 2400: Children's Literature

Credits: 3. Contact Hours: Lecture 3.

Evaluation of literature for children with emphasis on diversity and inclusion. Role of literature in the development of children across contexts. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall, Spring)

HDFS 2490: Family Studies

Credits: 3. Contact Hours: Lecture 3.

Overview of family life, including the diversity of family structures and characteristics. Strengths-based approaches to supporting healthy family relationships including parenting and caregiving/partnering. (Typically Offered: Fall, Spring)

HDFS 2700: Family Communications and Relationships

Credits: 3. Contact Hours: Lecture 3.

Family communication and its function to develop, maintain, enrich and limit family relationships. Family theories related to communication and ethical considerations when working with families. Typically Offered: Fall (annually), Spring (annually), Summer (odd-numbered years). Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall, Spring, Summer)

HDFS 2760: Human Sexuality

Credits: 3. Contact Hours: Lecture 3.

Behavioral, biological, and psychological aspects of human sexuality within the social context of family, culture, and society. Role of sexuality in human development. Critical analysis of media and research. Communication and decision-making skills relating to sexuality issues and relationships. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall, Spring, Summer)

HDFS 2830: Personal Finance

Credits: 3. Contact Hours: Lecture 3.

Introduction to basic principles of personal and family finance. Budgeting, record keeping, checking and savings accounts, consumer credit, insurance, investments, and taxes. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall, Spring, Summer)

HDFS 2830H: Personal Finance: Honors

Credits: 3. Contact Hours: Lecture 3.

Prereq: Membership in the University Honors Program

Introduction to basic principles of personal and family finance.

Budgeting, record keeping, checking and savings accounts, consumer credit, insurance, investments, and taxes. Additional work required to meet Honors requirements. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall, Spring, Summer)

HDFS 3170B: Field Experiences: Human Development and Family Studies

Credits: 1-6. Repeatable.

Prereq: Instructor Permission for Course

Consult department office for procedure. Supervised field experience in human development and family studies programs. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

HDFS 3170G: Field Experiences: Financial Counseling and Planning

Credits: 1-6. Repeatable.

Prereq: Department Permission for Course

Consult department office for procedure. Supervised field experience in human development and family studies programs. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

HDFS 3170H: Field Experiences: Honors

Credits: 1-6. Repeatable.

Prereq: 9 credits in HDFS; Department Permission; Membership in the University Honors Program

Consult department office for procedure. Supervised field experience in human development and family studies programs. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

HDFS 3210: Happiness Across the Lifespan

Credits: 3. Contact Hours: Lecture 3.

Interdisciplinary and relational approach to happiness and well-being at every stage of life. Application of scientifically validated strategies for learning how to live a satisfying and fulfilling life, including how to respond to stress and adapt to life challenges. Emphasis on habit change and implementation for individual and career development. (Typically Offered: Fall, Spring)

HDFS 3400: Infant-Toddler Curriculum and Assessment

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Focus on curriculum, assessment, learning environments, teaching strategies, and routines for infant-toddler care and education. Using assessment information to plan, implement, and evaluate activities to promote child development and learning. Practicum. (Typically Offered: Fall)

HDFS 3410: Income Tax Planning

Credits: 3. Contact Hours: Lecture 3.

Practice and planning to minimize tax liability and maximize after-tax returns for individuals and families. Addresses components of the US personal income tax system including tax forms, filing status, income, exemptions, exclusions, deductions, adjustments, credits, penalties, and tax rates. The case-problem approach prepares students to plan for themselves and to advise others. (Typically Offered: Fall)

HDFS 3420: Social-Emotional Development and Guidance

Credits: 3. Contact Hours: Lecture 2.

Prereq: HDFS 2240

Working knowledge of social and emotional development of young children. Examines the influence of relationships, trauma, and positive guidance on children's development and learning across contexts. (Typically Offered: Fall, Spring)

HDFS 3430: Preschool Curriculum and Assessment

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: HDFS 2240; HDFS 2400; admission to Educator Preparation program

Application of curriculum, teaching, and assessment strategies for inclusive preschool settings. Plan, implement, and evaluate learning activities to promote holistic development. Practicum. (Typically Offered: Spring)

HDFS 3440: Programming for Children in Early Care and Education

Credits: 4. Contact Hours: Lecture 3.

Prereq: HDFS 2240

Programming in inclusive child care centers and family child care homes, including those with special needs, aged birth through 8 years. Developing, implementing, and evaluating learning environments; activities and materials; behavioral guidance and classroom management practices; health and nutritional practices; and schedules to ensure developmental, individual, and cultural appropriateness. Monitoring children's development and behavior to promote physical, motor, cognitive, communication, and social emotional development. Learning to collaborate effectively with parents and staff. Practicum. (Typically Offered: Fall, Spring)

HDFS 3450: Inclusive Teaching and Interaction Strategies

Credits: 3. Contact Hours: Lecture 3.

Prereq: (HDFS 2240; SPED 2500) or Permission of Instructor

Strategies to use with young children with special needs. Focus on meeting the needs of all learners ages birth through 8 years old through Individualized Education Plans. (Typically Offered: Spring)

HDFS 3600: Housing and Services for Families and Children

Credits: 3. Contact Hours: Lecture 3.

Prereq: 6 credits from the following courses: AESHM 4210; AFAM 3300; AMD 1650, 3620, 4670; AMIN 3100, 2150, 3220; ANTHR (except 2020); CJ (except 2200, 3320); ECON; FSHN 3420; INTST 2350; LING 2190, 2750, 4710; POLS; PSYCH (except 1310); SOC; WGS 2010, 2030, 3010, 3200, 3270, 3280, 3460, 3500, 3850

Approaches to and assessment of housing and services that assist those with special needs including those with disabilities, low-income, children at risk, single-parents, and the homeless. Emphasis on community settings; e.g., residential facilities, group housing, shelters and transitional housing. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall)

HDFS 3670: Family Stress, Abuse, and Resilience

Credits: 3. Contact Hours: Lecture 3.

Prereq: 3 credits from the following courses: AESHM 4210; AFAM 3300; AMD 1650, 3620, 4670; AMIN 3100, 2150, 3220; ANTHR (except 2020); CJ (except 2200, 3320); ECON; FSHN 3420; INTST 2350; LING 2190, 2750, 4710; POLS; PSYCH (except 1310); SOC; WGS 2010, 2030, 3010, 3200, 3270, 3280, 3460, 3500, 3850

Causes and consequences of family stressors across the lifespan including physical, psychological, and sexual abuse; substance abuse; intergenerational transmission of violence; and resilience to family stress. Community and legal response to family violence. . (Typically Offered: Fall, Spring)

HDFS 3690: Research Methods in Human Development and Family Studies

Credits: 3. Contact Hours: Lecture 3, Laboratory 1.

Prereq: (HDFS 1020 or PSYCH 2300); Junior or Senior classification
Understanding and evaluating research. Use of primary and secondary data to identify and study problems related to human development and family issues. An introduction to statistical concepts and data analysis. Computer laboratory experience. (Typically Offered: Fall, Spring)

HDFS 3730: Death as a Part of Living

(Cross-listed with GERON 3730).

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 2300 or HDFS 1020

Consideration of death in the life span of the individual and the family with opportunity for exploration of personal and societal attitudes. (Typically Offered: Fall, Spring, Summer)

HDFS 3770: Aging and the Family

(Cross-listed with GERON 3770).

Credits: 3. Contact Hours: Lecture 3.

Interchanges of older adults and their families. Emphasis on role changes, social interaction, and independence as influenced by health, finances, lifestyles, and community support. (Typically Offered: Fall, Summer)

HDFS 3780: Retirement Planning and Employee Benefits

(Cross-listed with GERON 3780).

Credits: 3. Contact Hours: Lecture 3.

Financial needs analysis for retirement, characteristics of employer-sponsored and individual retirement plans, tax implications of retirement plans, Social Security funding and benefits, strategies for meeting varying retirement needs in a diverse society, financial counseling and planning practice, and overview of employee benefits. (Typically Offered: Spring)

HDFS 3830: Fundamentals of Financial Planning

Credits: 3. Contact Hours: Lecture 3.

Fundamental principles of the financial planning process, client/planner interactions, time value of money applications as well as analyses of ethics review, financial statements, cash flow and debt management, education planning, retirement planning, tax planning, and estate planning needs of families. (Typically Offered: Spring)

HDFS 3840: Insurance Planning

Credits: 3. Contact Hours: Lecture 3.

Prereq: HDFS 2830

Strategies for managing family financial risk with insurance. Emphasis on communication and planning process and the use of risk mitigation and insurance within families. Risk analysis and management within the comprehensive family financial planning process. (Typically Offered: Spring)

HDFS 3860: Human Services Management I

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior or Senior Classification

Foundational understanding of administration and leadership within human services organizations, with a focus on operations, policies, staffing, and program design and evaluation. Key leadership and financial management principles for effective service delivery will be introduced. (Typically Offered: Fall)

HDFS 3870: Trauma-Informed Practice

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior or Senior Classification

The application of strengths-based and resiliency-focused approaches for individuals and families. Practice skills such as relationship building and motivational interviewing through role plays and experiential activities. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall, Spring)

HDFS 3950: Children, Families, and Public Policy

Credits: 3. Contact Hours: Lecture 3.

Prereq: HDFS 3690 or PSYCH 3010 or Permission of Instructor

Public policy and public service programs as they affect children and families. Examination of how individuals and groups influence policy. Investigation of current issues and programs influencing the well-being and welfare of children and families. (Typically Offered: Spring)

HDFS 4110X: Family Communication Dynamics

(Dual-listed with COMST 5110X/HDFS 5110X). (Cross-listed with COMST 4110X).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMST 1010 or HDFS 2700

Examine theory and research on communication dynamics across a variety of family relationships and structures. Topics include storytelling, affection, conflict, privacy, socialization, stress, and resilience. Students will gain an understanding of the communication behaviors that improve (or detract from) family functioning. (Typically Offered: Fall, Spring)

HDFS 4160: Human Development and Family Studies Seminar

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

Prereq: 8 credits in HDFS

Intensive study of a selected topic in human development and family studies. (Typically Offered: Fall, Spring, Summer)

HDFS 4170: Supervised Student Teaching: Early Childhood Special Education

Credits: 8. Repeatable.

Teaching experience in inclusive settings, ages 0-5
4170-1 Inside Central Iowa, first 8 weeks
4170-2 Outside Central Iowa, first 8 weeks
4170-3 Inside Central Iowa, second 8 weeks
4170-4 Outside Central Iowa, second 8 weeks. (Typically Offered: Spring)

HDFS 4180: Reflective Supervision

Credits: 0.5.

Prereq: Concurrent enrollment in HDFS 4170C

Reflective supervision and feedback of student teaching field experience. Offered on a satisfactory-fail basis only.
5 Credit 4180-1 first 8 weeks
4180-2 second 8 weeks. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

HDFS 4200: Advanced Professional Practice

Credits: 3. Contact Hours: Lecture 3.

Prereq: HDFS 2200 AND junior or senior classification

Essential skills for internship preparation and practice. Topics include career planning, resume writing, interview techniques, and strategic career management. (Typically Offered: Fall, Spring)

HDFS 4550: Curriculum and Interventions: Ages 3 through 6 Years

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: HDFS 3430, HDFS 3450, SPED 4050 and SPED 4580

Assessment and intervention strategies for preschool in educational settings with an emphasis on diverse populations. Practical experience in using assessment approaches to inform teaching, engage in collaborative teaming, and communicating assessment findings. Practicum. (Typically Offered: Fall)

HDFS 4560: Family Partnerships in Early Childhood

Credits: 3. Contact Hours: Lecture 3.

Prereq: HDFS 3400 or HDFS 3440 or Permission of Instructor

Understanding and applying family systems theory and family centered principals with a focus on early childhood and special education. Experiences with families. (Typically Offered: Fall)

HDFS 4790: Families Through a Social and Cultural Lens

Credits: 3. Contact Hours: Lecture 3.

Prereq: HDFS 1020 OR PSYCH 2300; HDFS 3690 OR PSYCH 3010 OR permission of instructor; junior or senior classification

Exploration of social and cultural factors that influence families. Examination of how social and cultural contexts impact work within chosen careers. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall, Spring)

HDFS 4820: Investment Planning

Credits: 3. Contact Hours: Lecture 3.

Prereq: HDFS 3830, ECON 1010; STAT 1010

Management of family financial resources; emphasis on savings and the investment planning process; issues facing financial planners who manage family assets. Identification of investment options including common stocks, fixed income securities, convertible securities, and related choices. (Typically Offered: Fall)

HDFS 4840: Estate Planning

Credits: 3. Contact Hours: Lecture 3.

Prereq: HDFS 2830 or FIN 3010

Study of estate planning focusing on efficient conservation and transfer of wealth, consistent with client's goals. Legal, tax, financial and non-financial aspects of estate planning process; trusts, wills, probate, advanced directives, charitable giving, wealth transfers and related taxes. (Typically Offered: Spring)

HDFS 4850: Case Studies in Financial Counseling and Planning

Credits: 3. Contact Hours: Lecture 3.

Prereq: (FIN 3610 or HDFS 3840); HDFS 3410; HDFS 3780; HDFS 3830; (FIN 3200 or HDFS 4820)

Capstone experience in comprehensive financial counseling and planning. Create a written financial plan, role play client delivery. Utilization of skills obtained in financial counseling and planning major to create financial planning narratives. (Typically Offered: Spring)

HDFS 4860: Human Services Management II

Credits: 3. Contact Hours: Lecture 3.

Prereq: HDFS 3860

Advanced leadership principles tailored for complex human service organizations, focusing on client-oriented program implementation and effective funding strategies. In-depth application of financial management techniques and strategic planning frameworks to meet organizational needs. (Typically Offered: Spring)

HDFS 4890: Financial Counseling

(Dual-listed with HDFS 5890).

Credits: 2. Contact Hours: Lecture 2.

Prereq: HDFS 2830

Financial counseling and planning education is the integrative, multidisciplinary field of social science that studies personal finance and helps individuals and families make effective financial decisions. Learn how a client's psychology, such as their socialization, money beliefs, and past financial experiences and behaviors impact their objectives, goals, understanding, decision-making and actions. (Typically Offered: Fall)

HDFS 4890L: Financial Counseling Laboratory

(Dual-listed with HDFS 5890L).

Credits: 1. Contact Hours: Laboratory 2.

Repeatable, maximum of 2 credits.

Prereq: HDFS 2830

Hands-on financial counseling experience using preventative, remedial, and productive strategies in one-on-one and/or group situations. Students work with clients to develop diverse and inclusive decision-making and problem-solving methods to achieve goals or to remove barriers. (Typically Offered: Fall)

HDFS 4900: Independent Study

Credits: 1-30. Repeatable.

Prereq: 6 credits in HDFS; Permission of Instructor

Consult department office for procedure.

HDFS 4900H: Independent Study: Honors

Credits: 1-30. Repeatable.

Prereq: 6 credits in HDFS; Permission of Instructor; Membership in the University Honors Program

Consult department office for procedure.

HDFS 4900I: Independent Study: Human Development and Family Studies

Credits: 1-30. Repeatable.

Prereq: 6 credits in HDFS; Permission of Instructor

Consult department office for procedure.

HDFS 4910: Internship

Credits: 4-9. Repeatable, maximum of 9 credits.

Prereq: Instructor Permission for Course

Supervised work experience related to the student's curriculum. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

HDFS 4930: Workshop

(Dual-listed with HDFS 5930).

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

Workshop in HDFS. (Typically Offered: Fall, Spring, Summer)

HDFS 4990: Research

Credits: 1-6. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

Supervised research experience. (Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

HDFS 5010: Graduate Studies, Research, and Ethics in HDFS

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Overview of graduate study, research, ethics, and professional development in the field of human development and family studies. Curriculum, programs of study, portfolios, faculty research interests, dissemination of research, career planning, and teaching discussed. (Typically Offered: Fall)

HDFS 5020: Professional Development in Human Development and Family Studies

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Overview of professional skills, portfolio building, preparation for academic and nonacademic jobs, leadership fundamentals and project management training, time management, work balance issues, and professional ethics. Opportunities for graduate students to work on their professional development tailored to individual needs of students. Develop an individual professional portfolio. Offered even-numbered years. (Typically Offered: Spring). (Typically Offered: Spring)

HDFS 5030: Introduction to Research Design

Credits: 4. Contact Hours: Lecture 4.

Prereq: Graduate Standing or Permission of Instructor

Basic research skills including developing research questions, posing testable hypotheses, determining appropriate data collection and analyses, and identifying the benefits and limitations of various sampling strategies. Measurement theory, observational assessments, survey research, experimental and quasi-experimental designs, analysis of secondary data, and qualitative research methods. (Typically Offered: Fall)

HDFS 5040: Qualitative Research Methods

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to qualitative research methodology. Application of fieldwork methods, analysis, interpretation, and writing through individual qualitative research projects. (Typically Offered: Spring)

HDFS 5050: Application of Quantitative Research Methods

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Descriptive and inferential statistics, hypothesis testing, scales of measurement, comparisons of proportions, correlations between variables, the t distribution, analysis of variance, and multiple regression. (Typically Offered: Spring)

HDFS 5100: Theories of Human Development

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Theoretical approaches and current research in child, adolescent, and adult development. Individual life span perspectives. Implications for research, policy and practice. (Summer course offering is on-line). (Typically Offered: Fall, Summer)

HDFS 5110: Family Theory

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Theoretical approaches and current research in family development. Review the nature and value of theory to the study of the family and evaluate the use of theory in empirical research. Implications for research, policy and practice. (Typically Offered: Spring)

HDFS 5110X: Family Communication Dynamics

(Dual-listed with COMST 4110X/ HDFS 4110X). (Cross-listed with COMST 5110X).

Credits: 3. Contact Hours: Lecture 3.

Examine theory and research on communication dynamics across a variety of family relationships and structures. Topics include storytelling, affection, conflict, privacy, socialization, stress, and resilience. Students will gain an understanding of the communication behaviors that improve (or detract from) family functioning. (Typically Offered: Fall, Spring)

HDFS 5300: Perspectives in Gerontology

(Cross-listed with GERON 5300).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Overview of current aging issues including theory and research, critical social and political issues in aging, the interdisciplinary focus of gerontology, career opportunities, and aging in the future. (Typically Offered: Fall)

HDFS 5340: Adult Development

(Cross-listed with GERON 5340).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Exploration of the biological, psychological and social factors associated with aging. Although the focus is on the later years, information is presented from a life-span developmental framework. Empirical studies are reviewed and their strengths, limitations and implications for normative and optimal functioning are discussed. (Typically Offered: Spring)

HDFS 5380: Developmental Disabilities

(Cross-listed with PSYCH 5380).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Theories, research, and current issues regarding the intersection of development and disabilities. Investigation of interventions with individuals and families (Online course offering via Distance Education). Offered odd-numbered years. (Typically Offered: Fall)

HDFS 5410: Housing and Real Estate in Family Financial Planning

(Cross-listed with FFP 5410).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

The role of housing and real estate in the family financial planning process, including taxation, mortgages, financial calculations, legal concerns, and ethical issues related to home ownership and real estate investments. Emphasis on emerging issues in the context of housing and real estate. Offered even-numbered years. (Typically Offered: Summer)

HDFS 5450: Economics, Public Policy, and Aging

(Cross-listed with GERON 5450).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Policy development in the context of the economic status of the older adult population. Retirement planning and the retirement decisions; social security and public transfer programs; intra-family transfers to/from the aged; private pensions; financing medical care; prospects and issues for the future. (Typically Offered: Fall)

HDFS 5550: Current Issues and Research in Early Childhood Services

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Analysis of contemporary and historical early childhood/early intervention/early childhood special education model programs and services. Examination of relationships among service systems and implementation, program quality, teacher effectiveness, and outcomes for children with and without disabilities (Online course offering via Distance Education). Offered even-numbered years. (Typically Offered: Fall)

HDFS 5630: Environments for the Aging

(Dual-listed with HDFS 4630/ GERON 4630). (Cross-listed with GERON 5630).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Emphasis on independent living within residential settings including specialized shelter, supportive services and housing management. Application of criteria appropriate for accessibility and functional performance of activities; universal design principles. Creative project provides service learning opportunities. (Typically Offered: Spring)

HDFS 5660: Family Policy

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

An introduction to policy for family researchers and practitioners. Examination of relevant policies through a family lens via discussion of theory and student interests in current and enduring family policies and programs. Descriptions of work roles in family policy and the interaction of family researchers and policymakers. Offered even-numbered years. (Typically Offered: Fall)

HDFS 5670: Family Stress, Abuse, and Illness

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Explores research related to family stress within romantic, parent-child, and sibling relationships. Examines contemporary theory and research on the nature, causes, and consequences of family stressors. These stressors include but are not limited to economic distress; physical and emotional abuse; substance abuse; and mental and physical illness across the life span (Online course offering via Distance Education). Offered even-numbered years. (Typically Offered: Fall)

HDFS 5680: Individual and Family Assessment

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Use of interviews, observational assessments, direct tests with individuals and families for research and intervention. Opportunities to practice assessments. Offered even-numbered years. (Typically Offered: Spring)

HDFS 5750: Cross-cultural Perspectives about Families and Children

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Review of current research regarding family diversity including an examination of cultural and structural influences on the development and well-being of families and children. Discussion of the impact on human rights and social justice (Online course offering via Distance Education). Offered even-numbered years. (Typically Offered: Spring)

HDFS 5770: Aging in the Family Setting

(Cross-listed with GERON 5770).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Theories and research related to personal and family adjustments in later life affecting older persons and their intergenerational relationships. Related issues including demographics also are examined through the use of current literature. (Typically Offered: Spring)

HDFS 5790: Family Well-being Across the Lifespan

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Review of current research to provide a theoretical and practical understanding of the economic, social, and psychological factors that influence interpersonal relationships and individual well-being within the institution of the family system. Economic and policy effects considered (Online course offering via Distance Education). Offered odd-numbered years. (Typically Offered: Spring)

HDFS 5810A: International Study in HDFS: Practicum

Credits: 1-12. Repeatable, maximum of 12 credits.

Prereq: Graduate Standing or Permission of Instructor

Limited enrollment. Supervised international study experiences in Human Development and Family Studies. Countries vary. (Typically Offered: Fall, Spring, Summer)

HDFS 5810B: International Study in HDFS: Exchange

Credits: 1-12. Repeatable, maximum of 12 credits.

Prereq: Graduate Standing or Permission of Instructor

Limited enrollment. Supervised international study experiences in Human Development and Family Studies. Countries vary. (Typically Offered: Fall, Spring, Summer)

HDFS 5810C: International Study in HDFS: Group Study

Credits: 1-12. Repeatable, maximum of 12 credits.

Prereq: Graduate Standing or Permission of Instructor

Limited enrollment. Supervised international study experiences in Human Development and Family Studies. Countries vary. (Typically Offered: Fall, Spring, Summer)

HDFS 5830: Investing for the Family's Future

(Cross-listed with FFP 5830).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Evaluation of investment markets for the household. Analysis of how families choose where to put their savings. Emphasis is on using the family's overall financial and economic goals to help inform investment choices. (Typically Offered: Fall)

HDFS 5840: Program Evaluation and Research Methods in Gerontology

(Cross-listed with GERON 5840).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Overview of program evaluation, research methods, and grant writing in gerontology. Includes application of quantitative and qualitative methods in professional settings. (Typically Offered: Spring)

HDFS 5850: Program Evaluation

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Theoretical and practical issues related to design and implementation of program evaluation in social sciences. Includes theory, design, implementation, analysis and proposal writing to assist programs to be successful in meeting program goals. Offered odd-numbered years. (Typically Offered: Spring)

HDFS 5880: Family, Income, and the Economy

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Analysis of family income, wealth, and economic well-being. Emphasis on effects of family behavior and public policies on the adequacy and security of income across the family life cycle. Implications of resource allocation within the family for adult and child well-being. Offered odd-numbered years. (Typically Offered: Fall)

HDFS 5890: Financial Counseling

(Dual-listed with HDFS 4890).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Financial counseling and planning education is the integrative, multidisciplinary field of social science that studies personal finance and helps individuals and families make effective financial decisions. Learn how a client's psychology, such as their socialization, money beliefs, and past financial experiences and behaviors impact their objectives, goals, understanding, decision-making and actions. (Typically Offered: Fall)

HDFS 5890L: Financial Counseling Laboratory

(Dual-listed with HDFS 4890L).

Credits: 1. Contact Hours: Laboratory 2.

Repeatable, maximum of 2 credits.

Prereq: Graduate Standing or Permission of Instructor

Hands-on financial counseling experience using preventative, remedial, and productive strategies in one-on-one and/or group situations. Students work with clients to develop diverse and inclusive decision-making and problem-solving methods to achieve goals or to remove barriers. (Typically Offered: Fall)

HDFS 5900I: Special Topics: Human Development and Family Studies

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Consult department office on procedure for filing a written plan of study.

HDFS 5900R: Special Topics

Credits: 1-30. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Consult department office on procedure for filing a written plan of study. (Typically Offered: Fall, Spring, Summer)

HDFS 5910I: Internship: Human Development and Family Studies

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Supervised experience in an area of human development and family studies. (Typically Offered: Fall, Spring, Summer)

HDFS 5930: Workshop

(Dual-listed with HDFS 4930).

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Workshop in HDFS. (Typically Offered: Fall, Spring, Summer)

HDFS 5940: Professional Seminar in Gerontology

(Cross-listed with GERON 5940).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

An integrative experience for gerontology students designed to be taken near the end of the degree program. By applying knowledge gained in earlier coursework, students will strengthen skills in ethical decision-making behavior, applying these skills in gerontology-related areas such as advocacy, professionalism, family and workplace issues. Students from a variety of professions will bring their unique perspectives to bear on topics of common interest. (Typically Offered: Summer)

HDFS 5990: Creative Component

Credits: 1-30.

Prereq: Instructor Permission for Course

Nonthesis creative component (e.g., a special report, capstone course, integrated field experience, annotated bibliography, research project, design, or other creative endeavor). (Typically Offered: Fall, Spring, Summer)

Courses for graduate students:

HDFS 6030: Advanced Quantitative Methods

Credits: 3. Contact Hours: Lecture 3.

Methodological and analytical issues in research in human development and family studies. Advanced research design and measurement, selection of statistical techniques, and issues in the interpretation of findings. (Typically Offered: Fall)

HDFS 6040: Advanced Qualitative Methods

Credits: 3. Contact Hours: Lecture 3.

Research methodologies including phenomenology, grounded theory, ethnography, and case studies. Methods of data collection and analysis procedures. Issues of ethics and interpretation of findings (Online course offering via Distance Education). Offered even-numbered years. (Typically Offered: Spring)

HDFS 6050: Multi-level Modeling

(Cross-listed with PSYCH 6050).

Credits: 3. Contact Hours: Lecture 3.

Rationale for and interpretation of random coefficient models. Strategies for the analysis of multi-level and panel data including models for random intercepts, random slopes, and growth curves. Offered odd-numbered years. (Typically Offered: Spring)

HDFS 6060: Advanced Structural Equation and Longitudinal Modeling

Credits: 3. Contact Hours: Lecture 3.

Rationale for and interpretation of advanced structural equation modeling for the analysis of longitudinal data. Emphasis will be placed on developing a working familiarity with some of the common statistical procedures, coupled with their application through the use of statistical software. Offered even-numbered years. (Typically Offered: Spring)

HDFS 6070: Mixed Methods

Credits: 3. Contact Hours: Lecture 3.

Foundations of mixed methods research, controversies, and philosophical concerns. Rationale for and interpretation of mixed methods designs. Research design, sampling, data collection, data analysis, results, and interpretation (Online course offering via Distance Education). Offered odd-numbered years. (Typically Offered: Spring)

HDFS 6080: Grant Writing for Research

Credits: 3. Contact Hours: Lecture 3.

Understand how to identify funding sources as well as the fundamental components of a federal research grant proposal such as the abstract or summary, background and significance, specific aims/goals and objectives, project design and methods, sustainability, assessment, broader impacts, dissemination, budget, budget justification, and cover letter. (Typically Offered: Fall)

HDFS 6160: Seminar

Credits: 1-30. Contact Hours: Lecture 30.

May be repeated. F.S.SS.

HDFS 6310: Child Health and Development

Credits: 3. Contact Hours: Lecture 3.

Young children's cognitive, physical, communication, and social-emotional health and development will be examined. Both typical and atypical trajectories will be explored. Research on current trends in the field will be emphasized (Online course offering via Distance Education). Offered even-numbered years. (Typically Offered: Fall)

HDFS 6320: Behavioral Interventions in Early Childhood

Credits: 3. Contact Hours: Lecture 3.

Issues related to behavioral development and needs of children ages 3-8. Design and implementation of group and individual behavioral interventions. Discussion of coaching strategies to improve intervention implementation (Online course offering via Distance Education). Offered odd-numbered years. (Typically Offered: Spring)

HDFS 6330: Infant Mental Health

Credits: 3. Contact Hours: Lecture 3.

Examination of the individual, interpersonal, and familial factors that influence infant (birth through age 3) mental health. Analysis of the risk and protective factors that influence these systems and their potential effects on social-emotional development. Current issues relating to effective programs for improving parent-infant interactions and additional supports available to families (Online course offering via Distance Education). Offered even-numbered years. (Typically Offered: Spring)

HDFS 6340: Adolescent and Emerging Adult Health and Development

Credits: 3. Contact Hours: Lecture 3.

Theory and research on biopsychosocial, cognitive, physical and sexual health and development from early adolescence to emerging adulthood. Contexts of development including families, peers, schools, neighborhoods, romantic relationships, economics and public policies are considered (Online course offering via Distance Education). Offered even-numbered years. (Typically Offered: Spring)

HDFS 6350: Adult Development, Aging, and Health

(Cross-listed with GERON 6350).

Credits: 3. Contact Hours: Lecture 3.

Review of the impact of the growing older adult population as well as individual development and aging on individuals, families, and society. Exploration of theoretical perspectives applied to adult development and aging and distinction of normative and non-normative changes in adulthood. Discussion of methods to assess development across adulthood and consideration of the role of individual and environmental factors impacting efforts to optimize adult development. Offered odd-numbered years. (Typically Offered: Fall)

HDFS 6400: Biomarkers and Family Research

Credits: 3. Contact Hours: Lecture 3.

Research on the biological underpinnings of human development and the biobehavioral health of the family. Exposure to interdisciplinary research and practice on biomarkers in the family, with particular emphasis on health-and wellbeing-related measures. Application of biomarker collection, measurement, analysis and dissemination. Offered odd-numbered years. (Typically Offered: Spring)

HDFS 6900I: Advanced Topics: Human Development and Family Studies

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

HDFS 6910A: Internship: College Teaching

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Supervised practice and experience in college-level teaching. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

HDFS 6910B: Internship: Research

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Supervised practice and experience in conducting research. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

HDFS 6910D: Internship: Professional Experience

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Supervised practice and experience in relevant professional experiences. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

HDFS 6990I: Research: Human Development and Family Studies

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Thesis and dissertation research. Offered on a satisfactory-fail basis only.

Immunobiology (IMBIO)

Courses for graduate students:

IMBIO 6020: Current Topics Workshop in Immunology

Credits: 1. Contact Hours: Lecture 3.

Repeatable.

Lectures provided by off-campus experts. Students are required to participate in discussion sessions with lecturers. (Typically Offered: Fall)

IMBIO 6040: Seminar in Immunobiology

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Student and faculty presentation. (Typically Offered: Spring)

IMBIO 6610: Comparative Immunology and Infectious Disease

(Cross-listed with VPTH 6610).

Credits: 2. Contact Hours: Lecture 2.

Discuss and define similarities and differences of varied host responses to infectious challenge. Learning will focus on comparative aspects of the host response and the unique aspects of immunity from different organisms, while highlighting molecular and mechanistic similarities of pathogen recognition, response and resolution. Offered odd-numbered years. (Typically Offered: Spring)

IMBIO 6900: Special Topics

Credits: 1-30. Repeatable.

Advanced study of specific topics in specialized field of immunobiology.

IMBIO 6970: Graduate Research Rotation

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

Graduate research projects performed under the supervision of selected faculty members in the Interdepartmental Immunobiology major.

IMBIO 6990: Research

Credits: 1-30. Repeatable.

Prereq: Department Permission for Course

Industrial Design (INDD)

Courses primarily for undergraduates:

INDD 2010: Industrial Design Studio I

Credits: 6. Contact Hours: Studio 12.

Prereq: Enrollment in INDD major

This is the first studio in the program introducing students to the industrial design process by focusing on the fundamentals of problem solving, critical thinking, basic market research and subsequent idea generation, emphasizing on sketching, experimentation, model making, visual and physical communication, and presentation. (Typically Offered: Fall)

INDD 2020: Industrial Design Studio II

Credits: 6. Contact Hours: Studio 12.

Prereq: Enrollment in INDD major; INDD 2010

Through a series of exercises, the second studio in the program advances students' skills in sketching, modeling and visual, physical and communication skills required for industrial design practice. Students will be implementing the use of new technologies in digital drawing, computer aided design (CAD) and analog and digital fabrication. (Typically Offered: Spring)

INDD 2100: Fundamentals of Industrial Design

Credits: 3. Contact Hours: Lecture 3.

Introduction to the discipline of Industrial Design: its definition, scope and basic principles of the profession as a whole. Overview of technical, artistic and social context of the profession.

INDD 2200: Concepts of Sketching and Making I

Credits: 3.

Introduction to basic tools and techniques used in different phases of the industrial design process. This course is the first in a series of two addressing key aspects of analog and digital communication tools and fundamentals of prototyping from different modes of sketching to physical sketch models.

INDD 2400: Digital Tools For Industrial Design

Credits: 3. Contact Hours: Lecture 3.

Introduction of digital applications and workflows through the lens specific to industrial design tasks and professional practices.

INDD 2500: Activity-Centered Industrial Design

Credits: 3. Contact Hours: Lecture 3.

Introduction to design for complex and dynamic situations that include people, products, activities and environments. Emphasizes the relationship between internal and external factors that impact pleasure and performance in these systems. Includes an overview of human diversity and examines the role of the industrial designer in developing the artifacts of daily activity.

INDD 2600: Design Engineering: From Thought to Thing

Credits: 3. Contact Hours: Lecture 3.

What is making, building, constructing, engineering and technology and their roles for industrial design? Investigation of making techniques, engineering methods and technological advancements through case studies of everyday objects. Exploration of questions about the impact of materials choice and technologies of fabrication. Modeling, prototyping capabilities, and constructing a par with the engineering realm. Application of construction methods to industrial design in an inclusive 'makers-lab' environment.

INDD 2800: History of Industrial Design

Credits: 3. Contact Hours: Lecture 3.

Introduction to contemporary and historic factors influencing industrial design craft and practice. Discussion of social, political, cultural and technological context for industrial design.

INDD 3010: Industrial Design Studio III

Credits: 6. Contact Hours: Studio 12.

Prereq: Enrollment in INDD major; INDD 2020

Emphasis in a research-based refined design process. Hands-on experience in navigating technology, manufacturing processes, and market strategy while addressing environmental, societal, and consumer needs. Projects will focus on innovation, technical proficiency, and the production of high-quality design documentation to meet professional standards. (Typically Offered: Fall)

INDD 3020: Industrial Design Studio IV

Credits: 6. Contact Hours: Studio 12.

Prereq: (Enrollment in INDD major; INDD 3010) OR Permission of Instructor

Exploration of commercial factors in industrial design. Meets Industrial Design Experiential Learning Requirements.

INDD 3200: Design Research Methods

Credits: 3. Contact Hours: Lecture 3.

Design Research Methods offers a comprehensive exploration of established industrial design research methodologies, theories, and practices. Through practical and academic training, student engage in observation, behavioral analysis, and the interpretation of user data to inform the development of innovative products.

INDD 3300: Creative Thinking in Design

Credits: 3. Contact Hours: Lecture 3.

Human-centered design (HCD) methodology that integrates scientific principles and data analysis for solving complex design problems. Investigation of creative thinking strategies, facilitation techniques, and problem-solving processes. Emphasis on the cognitive science of creativity and its application in diverse design contexts.

INDD 3400: Digital Design Technologies

Credits: 3. Contact Hours: Studio 6.

Emphasis on computer-aided visualization techniques for 3D rendering and digital fabrication. Exploration and practice of several computer modeling applications as digitization tools for industrial design.

INDD 3450X: Sketchnoting

Credits: 1-3.

Focus on student learning engagement and knowledge retention through visual note-taking. Introduction to sketchnoting as a creative and non-traditional visual note-taking methodology fostering active listening and synthesis. Learn to create visual libraries as they pertain to select subjects and practice visual notetaking through live lectures and study note development. Reflection sketchnotes will provide students an opportunity to discover their own learning progress and connections across courses. (Typically Offered: Fall)

INDD 3500: Applied Human Factors Lab

Credits: 1. Contact Hours: Laboratory 1.

Theory and application of human factors issues in the industrial design field, specifically their impact on the relationship of the user, the product, the product systems, and environment.

INDD 3600: Materials and Processes for Industrial Design

Credits: 3. Contact Hours: Lecture 3.

Introduction to materials and manufacturing methods for mass production and distribution of products including design for assembly and disassembly.

INDD 3700: STEM literacy: How Things Work

Credits: 3. Contact Hours: Lecture 3.

Dismantling mysteries surrounding science and technology. Identifying key concepts from applied science, engineering and technology to obtain better understanding on how things work. Review and explanation of the principles behind the technologies that define our modern way of life. Common everyday technology such as building electronic gadgets, interface hardware with computers, writing applications, systems applications and making functional electronics units, are some of the examples illustrating scientific knowledge and applications.

INDD 3800: History and Culture of Objects

Credits: 3. Contact Hours: Lecture 3.

Critical examination of meanings of objects from the perspectives of history, design, material culture, philosophy and cultural studies. Discussion of social, political, cultural and technological context for industrial design.

INDD 3810X: Exploration of Design and Artisanry throughout Europe

Credits: 2. Repeatable.

Academic and cultural visits to major landmarks, production facilities, companies, museums in Germany, France, Belgium and the Netherlands that provide context for understanding more about the traditions and practice of design and craftsmanship. (Typically Offered: Summer)

INDD 3970: Industrial Design Internship

Credits: 1-6. Repeatable, maximum of 12 credits.

Prereq: Enrollment in INDD major; INDD 2020; 18 credits in INDD; Permission of Instructor

Professional industrial design, off-campus experience. Meets Industrial Design Experiential Learning Requirements.

INDD 4010: Industrial Design Studio V: Commercial Practices

Credits: 6. Contact Hours: Studio 12.

Repeatable, maximum of 18 credits.

Prereq: Enrollment in INDD major; INDD 3010

Advanced topics focused on industrial design applications in commercial industries. Topics vary each time offered. Meets Industrial Design Experiential Learning Credits.

INDD 4020: Industrial Design Studio: Design for Social Impact

Credits: 6. Contact Hours: Studio 12.

Repeatable.

Prereq: Enrollment in INDD major; INDD 3010

Advanced topics focused on industrial design applications in service-learning and community engagement projects. Topics vary each time offered. (Typically Offered: Fall, Spring, Summer)

INDD 4200X: AI-Assisted User-Centered Industrial Design

Credits: 3. Contact Hours: Lecture 3.

User-centered concept generation using AI tools focuses on leveraging artificial intelligence to create ideas, products, or solutions tailored specifically to the needs, preferences, and pain points of the end users. The course will look at the existing industrial design process that utilizes behavioral research concepts to develop design insights, design interventions, and user testing strategies before creating a proposal that is economically viable, creates a better user experience, and addresses the core factors responsible for the issue at hand. The course focuses on the traditional industrial design process while utilizing cutting edge, AI-based tools. (Typically Offered: Fall, Spring)

INDD 4300X: The Science of Aesthetic Intelligence: Applying Principles to Industrial Design and Branding

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 39 credits.

This course examines the critical role of aesthetic intelligence in creating human-centered products and brand identities. Exploration of the theory and practice of industrial design, focusing on how aesthetic elements can be strategically employed, evoke emotions, to differentiate brands, and drive consumer engagement. A series of lectures, workshops, self-reflections, and hands-on activities will develop a strong foundation in aesthetic intelligence and its application to industrial design. All aimed at creating visually compelling and emotionally resonant products that contribute to the success of brands. (Typically Offered: Fall)

INDD 4350: Strategic Design: Project Management

Credits: 3. Contact Hours: Lecture 3.

Review and development of executable strategies for entrepreneurial, commercial and business efforts. Focus on strategic thinking, economics of innovation, tactical approaches and effective measures in order to integrate a full cycle of product/service development. Advanced technical design processes, design management, decision-making and value proposition.

INDD 4400: Portfolio and Professional Practice

Credits: 3.

Prereq: Enrollment in INDD major; INDD 3010

Discussion of industrial design practices, job market and career roadmap planning. Development and preparation of personal promotional materials for a range of media, including professional websites, personal brand, resumes, cover letters, business cards, print and/or digital portfolios.

INDD 4600: Product Realization

Credits: 3. Contact Hours: Lecture 3.

Prereq: Enrollment in INDD major; INDD 2020

Advanced techniques of prototyping and model making for industrial design, using materials and manufacturing methods for product development. Exploration of the stages of design fabrication, systems-level implementation, testing, and constructing a par with the engineering realm. Use of typical prototyping materials, such as foam, wood, metal, plastic, plus new and emerging materials; CNC and 3D printing technologies will also be applied. Coupling the "makers-lab" movement with design entrepreneurship, development of advanced functional models and high-fidelity prototypes.

INDD 4650: Textiles for Soft Goods

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Provides a foundational understanding of textiles from a material science and engineering perspective, focusing on their application in industrial soft goods. Instructional methodology includes theory, application-oriented projects focused on the manufacture, acquisition, and utilization of textiles for product development and industrial uses.

INDD 4900A: Special Topics: Theory, Criticism, Methodology

Credits: 1-6. Repeatable, maximum of 18 credits.

Prereq: Instructor Permission for Course

Advanced topics focused on theory, criticism, and methodologies in industrial design applications. (Typically Offered: Fall, Spring, Summer)

INDD 4900B: Special Topics: Experimental Techniques

Credits: 1-6. Repeatable, maximum of 18 credits.

Prereq: Instructor Permission for Course

Advanced topics focused on industrial design applications. Topics vary each time offered. (Typically Offered: Fall, Spring, Summer)

INDD 4900C: Special Topics: Three-Dimensional Design

Credits: 1-6. Repeatable, maximum of 18 credits.

Prereq: Instructor Permission for Course

Advanced topics focused on distributed collaboration in industrial design applications. Topics vary each time offered. (Typically Offered: Fall, Spring, Summer)

INDD 4900D: Special Topics: Distributed Collaboration

Credits: 1-6. Repeatable, maximum of 18 credits.

Prereq: Instructor Permission for Course

Advanced topics focused on distributed collaboration in industrial design applications. Topics vary each time offered. (Typically Offered: Fall, Spring, Summer)

INDD 4900H: Honors Independent Study

Credits: 1-6. Repeatable, maximum of 9 times.

Prereq: Membership in the University Honors Program

Independent investigation. (Typically Offered: Fall, Spring)

INDD 4930X: Experiential Projects in Industrial Design

Credits: 1-12. Contact Hours: Studio 24.

Repeatable, maximum of 6 times.

Project-based topics related to user-based design, design with various internal and external stakeholders, experimental learning, three dimensional design, distributed collaboration that supports experiential learning. (Typically Offered: Fall, Spring, Summer)

INDD 4935X: Topics in Industrial Design

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable, maximum of 36 credits.

Advanced topics focused on industrial design applications. Topics include theory, criticism, methodology, experimental techniques, and three dimensional design. (Typically Offered: Fall, Spring, Summer, Winter Session)

INDD 4950: Study Abroad Option

Credits: 1-12. Contact Hours: Studio 12.

Repeatable, maximum of 12 credits.

Prereq: Enrollment in INDD major; INDD 2020; Permission of Instructor

Special topics in Industrial Design, design history, environmental design, historic and contemporary practice. Travel to relevant countries. General cultural and historical studies, topical projects, and individual inquiry. Courses may be taught by departmental faculty or faculty from approved Iowa State Study Abroad programs. See current offerings for detailed syllabus. Meetings industrial design experiential credit requirements. (Typically Offered: Fall, Spring, Summer)

INDD 4990: Senior Project

Credits: 6. Contact Hours: Studio 12.

Prereq: Enrollment in INDD major; (INDD 4010, INDD 3970, or INDD 4950);

Senior classification in INDD

In this capstone course, students will showcase their abilities as emerging design professionals. Drawing from their acquired skills and knowledge, they will undertake a research-driven, user-centered project aimed at creating innovative products or systems. Through the presentation of comprehensive documentation and prototypes, students will demonstrate the viability of their designs.

Courses primarily for graduate students, open to qualified undergraduates:

INDD 5010: Industrial Design Graduate Studio I

Credits: 6. Contact Hours: Studio 12.

Prereq: Graduate Standing or Permission of Instructor

Fundamental concepts, design processes, and techniques for industrial design. Emphasis on project-based application of design models and procedures for form development, structure, function and communication.

INDD 5020: Industrial Design Graduate Studio II

Credits: 6. Contact Hours: Studio 12.

Prereq: Graduate Standing or Permission of Instructor

Advanced project-based application of industrial design theories and techniques. Emphasis on service and systems design, and its implications for community and social innovation. Application of entrepreneurial factors and systematic design methodology of complex design problems and innovative solutions.

INDD 5050: MInD Lab I

Credits: 3. Contact Hours: Lecture 1, Studio 4.

Repeatable, maximum of 3 credits.

Prereq: Graduate Standing or Permission of Instructor

Workshop training sessions based on project-based themes of industrial design: weekly series of 'how-tos' and other practical demos regarding fundamentals, concepts and techniques of Design. Offerings vary with each term; check with department for available sections. Course contact hours can range from (2-0) to (3-0) depending on number of credits.

INDD 5070: Industrial Design Practicum

Credits: 6. Contact Hours: Studio 12.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Studio project focused on topics generated with external partners.

Topics vary. Meets Industrial Design Experiential Learning Requirements.

INDD 5100: MInD Lab II

Credits: 3. Contact Hours: Lecture 1, Studio 4.

Repeatable, maximum of 3 credits.

Prereq: Graduate Standing or Permission of Instructor

Advanced workshop training sessions on application of industrial design concepts and skills: emphasis on executive demos on design thinking, service and system design, and its implications for the community and industry outreach. Offerings vary with each term; check with department for available sections. Course contact hours can range from (2-0) to (3-0) depending on number of credits.

INDD 5150: Graduate Colloquium

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Presentation and discussion of creative practices carried out in various design disciplines and their relationship to industrial design. Seminar sessions focusing on exemplary pieces of: design research undertaken by faculty; design education and learning pedagogies in design; and/or cross-disciplinary graduate work in design-related fields.

INDD 5200: Design Theory Methodology

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Synthesis of methodological work in products of design. Theoretical framework that integrates in-depth concepts related to design activity, design science, research philosophies, cognitive models and cognitive biases, design processes from different fields, advanced creativity studies and problem reframing. User-centered research methods to examine the impact of design on humans, environments, and social contexts. Examination and critique of current research methods employed in industrial design, service design, design for interaction and user experience (UX) design.

INDD 5300: Design Thinking

Credits: 3. Contact Hours: Lecture 3.

Prereq: Senior or Graduate classification or Permission of Instructor

Exploration of design thinking process, toolkits, and mindsets as creative problem solving approaches for systems, products, and processes, across diverse contexts. Strategies for problem-framing, creative solutions and co-evolution process, with a focus on collaborative and interdisciplinary design to investigate real-world problems and opportunities.

INDD 5400: Design Communication

Credits: 3. Contact Hours: Studio 6.

Prereq: Graduate Standing or Permission of Instructor

Emphasis on design narratives and story-telling. Exploration of creative digital media and multiple visual communication techniques which help break down complex information. Added professional development techniques such as positioning, intrapreneurship, design manifesto, design statement, client rapport, persuasive communication methods and speculative design will be applied.

INDD 5500: Human Factors: User Experience Design

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Human factors issues and the study of relationships between the user, the product, and the human body and its physical functions. Advanced investigations of bio-mechanics, anthropometry, instrumental displays and control, and their measurement as they relate to the design process. Emphasis on experience design, user narratives, interactions and context mapping, mapping out issues of usability, design inclusivity, diversity and integrity.

INDD 5600: Change by Design: Disruptive Innovation

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Exploration and execution of applied projects on civic entrepreneurship, social innovation and design activism. Through the 3 lenses of strategic, systems and critical thinking, it addresses the importance of design for social impact when applied to cases of service-learning, community-engagement, design ethics and transitional design. Change theory and management are central to examine diffusions and disruptions of innovation. (Typically Offered: Fall)

INDD 5700: Systems Thinking in Design

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Emphasis on 21st Century Design Issues through systems thinking as language, problem-framing as pivoting process and transitional design as frame innovation model. Exploration of interconnected and dynamic 21st century global issues, where complexity and future industries play a key role. Issues such as societal transitions, loss of biodiversity and climate change, circular economy, eco-centric design, aging, equity, mobility, robotics, cybernetics, etc. are discussed and mapped out for industrial design applications. (Typically Offered: Fall)

INDD 5800: Material Culture and Values

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Examination of the meanings of objects from the perspectives of design, material culture, philosophy and cultural studies. Critically examine the role of objects in everyday life. Concepts include: value of things, semiotics, object fetishism, product semantics, consumer value and production labor. Case studies of historic and contemporary objects will be discussed to understand key theoretical concepts and to make meaningful connection between theory and everyday objects. (Typically Offered: Spring)

INDD 5900: Special Topics

Credits: 1-6. Contact Hours: Lecture 2.

Repeatable, maximum of 18 credits.

Prereq: Instructor Permission for Course

Advanced topics focused on industrial design applications. Topics include theory, criticism, methodology, experimental techniques, three dimensional design, distributed collaboration. Meets Industrial Design Experiential Learning Requirements. (Typically Offered: Fall, Spring, Summer)

INDD 5920: Special Projects

Credits: 1-30. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Planned projects in topics related to theory, criticism, methodology, experimental techniques, three dimensional design, distributed collaboration. (Typically Offered: Fall, Spring, Summer)

INDD 5930: Experiential Learning Special Projects

Credits: 1-30. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Project based topics related to theory, criticism, methodology, experiential learning, three dimensional design, distributed collaboration that supports experiential learning. (Typically Offered: Fall, Spring, Summer)

INDD 5950: Study Abroad Option

Credits: 6. Contact Hours: Studio 12.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

International study abroad program. Visits to design studios, showrooms, museums and manufacturing facilities. Meets Industrial Design Experiential Learning Requirements. (Typically Offered: Fall, Spring, Summer)

INDD 5970: Internship

Credits: 1-6. Repeatable, maximum of 18 credits.

Prereq: Graduate Standing or Permission of Instructor

Professional industrial design, off-campus experience. Meets Industrial Design Experiential Learning Requirements. (Typically Offered: Fall, Spring, Summer)

INDD 5990X: Creative Component

Credits: 1-6. Repeatable, maximum of 6 credits.

Prereq: Graduate Standing or Permission of Instructor

The creative component is a comprehensive and in-depth study and development of a focused project chosen by the student and approved by the major professor. The completed project will culminate in an oral defense, comprehensive documentation and produce an artifact. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

Courses for graduate students:**INDD 6010: Industrial Design Graduate Studio III**

Credits: 6. Contact Hours: Studio 12.

Advanced studio-based creative component in specialized area of focus within industrial design or cross-disciplinary field. Prepares for graduate design project, culminating in a development plan, project initiation document and supporting documented inquiry.

INDD 6020: MInD Graduate Project

Credits: 6. Contact Hours: Studio 12.

Graduate project's creative component in specialized area of focus within industrial design or cross-disciplinary field. Culminates in a physical or digital artifact and supporting documentation such as graduate defense presentation and design process book.

INDD 6300: Critical Reflections for Thesis Preparation

Credits: 3. Contact Hours: Lecture 3.

Through the lenses of STEM literacy and critical thinking, exploration of why philosophy of science, technological and engineering literacies are connected to social justice and are related areas. Reflections on the effects of design projects on human health, social structures, and the environment, and examination of improvements in economic growth and quality of life. Case studies on the effects of Design and STEM to prepare for the formulation of graduate thesis or project topics, with proposed plan of investigations. (Typically Offered: Spring)

INDD 6400: Advanced Digital Technologies

Credits: 3. Contact Hours: Lecture 1, Studio 4.

Exploration of interactive technologies and digital thinking industries. Advanced concepts in computer to machine interface for manufacture, digital materiality, conversational interfaces, gamification, congruence, mixed reality AR/VR, and critical media for future industries.

INDD 6990: MInD Graduate Thesis

Credits: 6. Repeatable.

Prereq: Instructor Permission for Course

Advanced research component in specialized area of focus within industrial design. Culminates in a thesis document.

Industrial Engineering (IE)

Courses primarily for undergraduates:

IE 1020: Industrial Engineering Profession

Credits: Required. Contact Hours: Lecture 1.

Introduce students to the industrial engineering profession, its scope, industrial engineering tools, and future trends. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

IE 1600: Information Engineering

Credits: 3.

Prereq: Credit or concurrent enrollment in MATH 1430

Solving engineering problems with information-driven solutions. Effective communication via technical writing and presentations. Elements of computer science including the software development process, algorithm structure, computational thinking, and the human-computer interface. Database structure. Graduation Restriction: Only one of ENGR 1600, ABE 1600, AERE 1600, BME 1600, CE 1600, CHE 1600, CPRE 1850, EE 1850, IE 1480, ME 1600, and SE 1850 may count towards graduation. (Typically Offered: Fall, Spring)

IE 2220: Design & Analysis Methods for System Improvements

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or enrollment in IE 2710

Study of system improvement methods and strategies. Specific areas of lean system improvements include continuous improvement, setup reduction, workplace organization, and inventory and waste reduction. Methods and strategies for productivity analysis to quantify the impact of changes. (Typically Offered: Spring)

IE 2480: Engineering System Design, Manufacturing Processes and Specifications

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: (MATH 1660 or MATH 1660H) AND (PHYS 2310 or PHYS 2310H) AND [Credit or concurrent enrollment in (IE 1010 AND MATE 2730)]

Introduction to metrology, engineering drawings and specifications. Engineering methods for designing and improving systems. Theory, applications, and quality issues related to machining processes. (Typically Offered: Fall)

IE 2710: Applied Ergonomics and Work Design

Credits: 3. Contact Hours: Lecture 3.

Prereq: PHYS 2310 and PHYS 2310L

Basic concepts of human factors, ergonomics, and work design. Their impact on worker and work place productivity, and cost. Investigations of work physiology, biomechanics, anthropometry, work sampling, work evaluation methods, and their measurement as they relate to the design of human-machine systems. (Typically Offered: Spring)

IE 3050: Engineering Economic Analysis

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 1660

Economic analysis of engineering decisions under uncertainty. Financial engineering basics including time value of money, cash flow estimation, and asset evaluation. Make versus buy decisions. Comparison of project alternatives accounting for taxation, depreciation, inflation, and risk. (Typically Offered: Fall, Spring, Summer)

IE 3120: Optimization

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or enrollment in MATH 2670

Concepts, optimization and analysis techniques, and applications of operations research. Formulation of mathematical models for systems, concepts, and methods of improving search, linear programming and sensitivity analysis, network models, and integer programming. (Typically Offered: Fall)

IE 3130X: Crisis Decision Making and Risk Management with Defense Applications

Credits: 3. Contact Hours: Lecture 3.

Focus on making good decisions and managing risk with a special emphasis on crisis situations and Navy and defense applications. Explore good techniques to structure a decision by thinking about the decision maker's preferences, alternatives, and information. Examine how to model and account for risk both in crisis and non-crisis situations. Students will also be exposed to the military decision making process as a structured way to analyze information, explore different alternatives, and make decisions. The application of risk management and decision making for crisis situations will emphasize how to think clearly and use analysis in time-pressured situations.

IE 3410: Production Systems

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or concurrent enrollment in IE 3120; STAT 2310

Introduction of key concepts in the design and analysis of production systems in a sustainable and socially responsible manner. Topics include inventory control, forecasting, material requirement planning, Kanban systems, project planning and scheduling including Critical Path Method (CPM) and Program Evaluation Review Technique (PERT), operations scheduling, and other production systems such as Just-In-Time (JIT), warehousing, and global supply chains. (Typically Offered: Fall)

IE 3480: Solidification Processes

(Cross-listed with MATE 3480).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: IE 2480 and MATE 2730, or MATE 2150

Theory and applications related to metal casting, welding, polymer processing, powder metallurgy, and composites manufacturing, and related rapid manufacturing processes. (Typically Offered: Spring)

IE 3610: Statistical Quality Assurance

(Cross-listed with STAT 3610).

Credits: 3. Contact Hours: Lecture 3.

Prereq: STAT 2310, STAT 3010, STAT 3260, or STAT 5870

Statistical methods for process improvement. Simple quality assurance principles and tools. Measurement system precision and accuracy assessment. Control charts. Process capability assessment. Experimental design and analysis for process improvement. Significant external project in process improvement. (Typically Offered: Fall, Spring)

IE 4030: Introduction to Sustainable Production Systems

(Dual-listed with IE 5030).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or enrollment IE 3410

Quantitative introduction of sustainability concepts in production planning and inventory control. Review of material recovery (recycling) and product/component recovery (remanufacturing) from productivity perspectives. Sustainability rubrics ranging from design and process to systems. Application to multi-echelon networks subject to forward/backward flow of material and information. Closed-loop supply chains. Comparative study of sustainable vs. traditional models for local and global production systems.

IE 4050: Advanced Engineering Economy for Complex Engineering Projects

(Dual-listed with IE 5050).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 2650, MATH 2670, STAT 2310 and I E 3050

Overview of engineering economic valuation and complex engineering projects. Stochastic dynamic programming for project valuation. Modeling and analysis of confounding factors of engineering projects. Integration and synthesis of valuation methodologies to complex projects. Applications to power plants, transmission networks, and satellites.

IE 4130: Stochastic Modeling, Analysis and Simulation

Credits: 4. Contact Hours: Lecture 3, Discussion 1.

Prereq: MATH 2650 and STAT 2310

Development of probabilistic and simulation models using a simulation language. Introduction to Markov processes and other queuing models. Application to various areas of manufacturing and service systems such as assembly, material handling, and customer queues. Fitting of statistical distributions to data. Utilization of model output towards effective and efficient decision-making. (Typically Offered: Fall)

IE 4200: Engineering Problem Solving with R

(Dual-listed with IE 5200).

Credits: 3. Contact Hours: Lecture 3.

Prereq: STAT 2310

Introduction to data analytics using R programming language. Data manipulation. Exploratory data analysis via basic graphics. Basic statistical analysis including statistical tests and linear regression. R Markdown. Simulation by replicating a calculation. Conditional expressions, loops, and functions. High level data visualizations using ggplot graphics. Data extraction from text. Optimization via R build-in functions. Logistic regression. High performance computing tools. Project required for graduate credits. (Typically Offered: Spring)

IE 4300: Entrepreneurial Product Engineering

(Cross-listed with ENGR 4300).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior classification

Process of innovative product development in both entrepreneurial and intra-preneurial settings. Define, prototype and validate a product concept based on competitive bench-marking, market positioning and customer requirement evaluation in a target market into a product design that is consistent with defined business goals and strategies. Combination of lecture, discussion, problem solving and case study review. (Typically Offered: Fall, Spring)

IE 4320: Industrial Automation

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: PHYS 2320; PHYS 2320L

Overview of electrical circuit theory and its relationship to industrial control systems. Theory and application of transducers in the form of sensors and actuators, with applications in manufacturing, distribution and mechanical systems. Arduino and Programmable Logic Controllers (PLC), their programming and use for automation solutions. Introduction of automated identification systems such as Radio Frequency Identification (RFID) and Bar Coding technologies, and an introduction to industrial robotics. . (Typically Offered: Fall)

IE 4340X: Entrepreneurial Product Engineering Design Project

(Cross-listed with ENGR 4340X).

Credits: 0-99. Contact Hours: Laboratory 4, Lecture 1. Repeatable.

Prereq: IE 4300 or ENGR 4300

Open-ended design project related to creating, validating and launching a new engineered product into the marketplace. Fundamentals related to launching new engineered products in an Entrepreneurial way. Students submit new product ideas or select from a list of company supplied ideas. Application of engineering design principles including product definition, competitive evaluation, requirements evaluation, product design, manufacturing design, manufacturing costing, prototype creation, field validation, user evaluation. (Typically Offered: Spring)

IE 4370: Reliability and Safety Engineering

(Dual-listed with IE 5370).

Credits: 3. Contact Hours: Lecture 3.

Prereq: STAT 2310 or STAT 3050 or STAT 5870

Mathematical basics for dealing with reliability data, theory, and analysis. Bayesian reliability analysis. Engineering ethics in safety evaluations. Case studies of accidents in large technological systems. Fault and event tree analysis.

IE 4410: Industrial Engineering Design

Credits: 3. Contact Hours: Lecture 1, Laboratory 6.

Prereq: IE 2480, IE 2710, IE 3610; (credit or enrollment in IE 3410, IE 4130, AND IE 4480)

A large, open-ended design project conducted for a real-world business. Application of engineering design principles including problem definition, analysis, synthesis, and evaluation. (Typically Offered: Fall, Spring)

IE 4440: Advanced Manufacturing and Materials Processing

(Dual-listed with IE 5440).

Credits: 3. Contact Hours: Lecture 3.

Introduction of physical theory, design, analysis, and characterization of advanced manufacturing and materials processing technologies, including micro/nano scale manufacturing, bulk deformation, sheet forming, and additive manufacturing. Focus on the fabrication/ manufacturing of important types of microstructures used in engineering components and devices, and the techniques and tools used to characterize them. Students are expected to finish a team project related to advanced manufacturing and materials processing technologies. . (Typically Offered: Fall)

IE 4450: Additive Manufacturing and Rapid Production Methods

(Dual-listed with IE 5450).

Credits: 3. Contact Hours: Lecture 3.

Introduction to additive manufacturing and other rapid prototyping and manufacturing methodologies. Operating principles and characteristics of current and developing processes. Use of rapid prototypes in product design, development, and service. Selection of rapid prototyping and manufacturing systems, from design to mass production. Hybrid manufacturing and other integration of rapid production methods.

IE 4460: Geometric Variability in Manufacturing

(Dual-listed with IE 5460).

Credits: 3. Contact Hours: Lecture 3.

Assessment, accommodation, and control of geometric variability in manufacturing processes, specifically composites, metalcasting, welding, machining, powder metallurgy and additive processing. Techniques include the design of the component, tooling, process plan and inspection methodology.

IE 4470: Biomedical Design and Manufacturing

(Dual-listed with IE 5470). (Cross-listed with BME 4470).

Credits: 3. Contact Hours: Lecture 3.

Exploration of biology, materials, body mechanics, manufacturing, quality control, and ethics and the intersection of these subjects as they relate to biomedical manufacturing. Study of medical data (CT, MRI, etc.) processing, biomedical design, 3D bioprinting and additive manufacturing concepts.

IE 4480: Manufacturing Systems Engineering

Credits: 3. Contact Hours: Lecture 3.

Prereq: IE 2480

Fixturing and tooling requirements for manufacturing process planning, geometric dimensioning and tolerancing, computer aided inspection, cellular and flexible manufacturing, facility layout and controlled flow production. (Typically Offered: Spring)

IE 4490: Computer Aided Design and Manufacturing

(Dual-listed with IE 5490).

Credits: 3. Contact Hours: Lecture 3.

Prereq: IE 2480, and MATH 2650

Representation and interpretation of curves, surfaces and solids. Parametric curves and surfaces and solid modeling. Use of CAD software and CAD/CAM integration. Computer numerical control, CNC programming languages, and process planning.

IE 4500: Technical Sales for Engineers

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or enrollment in IE 3050

Technical sales process methodology, tools and techniques. Customer relationship management (CRM) sales automation applications, prospecting and lead qualification, market analysis and industry segmentation. Responding to prospective requests for quotation and proposal (RFQs and RFPs) in written and verbal form. Technical needs analysis, business value proposition development, proposal creation and competitive positioning. Evaluating organizational decision-making processes and people, being a trusted advisor, and practicing sales closing strategies. (Typically Offered: Fall)

IE 4520: Introduction To Systems Engineering And Analysis

(Cross-listed with AERE 4520).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior classification in an Engineering major OR graduate standing

Principles of systems engineering to include problem statement formulation, stakeholder analysis, requirements definition, system architecture and concept generation, system integration and interface management, verification and validation, and system commissioning and decommissioning operations. Introduction to discrete event simulation processes. Students will work in groups to propose, research, and present findings for a systems engineering topic of current relevance. (Typically Offered: Summer)

IE 4530X: Engineering Problem Solving for Defense

Credits: 3.

Prereq: Sophomore classification or permission of instructor

The primary objective of IE 4530X is to obtain practice in comprehensive engineering and communication skills, while simultaneously honing personal effectiveness and entrepreneurial skills, through the development and completion of an engineering project sponsored by a Department of Defense (DOD) agency. Engineering expectations include applying both previously learned and newly acquired knowledge and skills to identify, formulate, and solve a complex engineering problem, which results in tangible deliverables for the DOD agency. The semester's projects will revolve around the theme of prototyping solutions for national security. Engineered solutions will consider extensive ramifications, including defense and security, political, ethical, environmental and energy, and global issues. Project developments will be communicated via the Lean Startup methodology made famous by Stanford University to iteratively cut through the complexity. Student teams will provide the DOD sponsor with a validated problem, a validated solution concept, and a prototyped Minimal Viable Product.

IE 4680: Large-Scale Complex Engineered Systems (LSCES)

(Dual-listed with AERE 5680/ IE 5680). (Cross-listed with AERE 4680).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Senior classification in an Engineering major or Permission of Instructor

Introduction to the theoretical foundation and methods associated with the design for large-scale complex engineered systems, including objective function formation, design reliability, value-driven design, product robustness, utility theory, economic factors for the formation of a value function and complexity science as a means of detecting unintended consequences in the product behavior. (Typically Offered: Spring)

IE 4700: Systems Engineering and Project Management

(Dual-listed with IE 5700).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or enrollment in IE 3050; Credit or enrollment in STAT 2310 or STAT 3010 or STAT 3050 or STAT 3260 or STAT 4010 or STAT 5870

Systems view of projects and the processes by which they are implemented. Focuses on qualitative and quantitative tools and techniques of project management. Topics will include organizational structure types; project selection methodologies; simulation and optimization; and earned value management. Case studies will be included, and a group project required.

IE 4720: Design and Evaluation of Human-Computer Interaction

(Dual-listed with IE 5720).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior classification

Human factors methods applied to interface requirements, design, prototyping, and evaluation. Concepts related to understanding user characteristics, design principles, usability analysis, methods and techniques for design and evaluation of the interface. The evaluation and design of the information presentation characteristics of a wide variety of interfaces: web sites (e-commerce), mobile applications, and information presentation systems (cockpits, instrumentation, etc.).

IE 4810: e-Commerce Systems Engineering

(Dual-listed with IE 5810).

Credits: 3. Contact Hours: Lecture 3.

Prereq: IE 1480.

Design, analysis, and implementation of e-commerce systems. Information infrastructure, enterprise models, enterprise processes, enterprise views. Data structures and algorithms used in e-commerce systems, SQL, exchange protocols, client/server model, web-based views.

IE 4830: Data Mining

(Dual-listed with IE 5830).

Credits: 3. Contact Hours: Lecture 3.

Prereq: IE 1480, IE 3120, STAT 2310

Foundations of classification, data clustering and association rule mining. Techniques for data mining, with focus on tree-based methods for classification (simple trees, random forest and boosted trees), ensemble learning, optimization algorithms and deep learning with neural networks. Performance metrics and resampling methods for evaluating model quality. A computing project in R is required.

IE 4870: Big Data Analytics and Optimization

(Dual-listed with IE 5870).

Credits: 3. Contact Hours: Lecture 3.

Prereq: IE 3120 and STAT 2310

Optimization and statistical learning related to big data problems. Modern modeling for data-driven optimization problems and their applications in big data analytics. Algorithms for optimization and statistical learning and their implementation. Applications in manufacturing sector and service sciences. (Typically Offered: Spring)

IE 4900: Independent Study

Credits: 1-5. Repeatable.

Prereq: Senior classification; Permission of Instructor

Independent study and work in the areas of industrial engineering design, practice, or research.

IE 4900H: Independent Study: Honors

Credits: 1-5. Repeatable.

Prereq: Senior classification; Permission of Instructor; Membership in the University Honors Program

Independent study and work in the areas of industrial engineering design, practice, or research.

Courses primarily for graduate students, open to qualified undergraduates:

IE 5010: IE Graduate Seminar

Credits: Required. Contact Hours: Lecture 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Principles and practices for research tasks at the M.S. level including proposal writing, presentations, paper preparation, and project management. Offered on a satisfactory-fail basis only.

IE 5030: Introduction to Sustainable Production Systems

(Dual-listed with IE 4030).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Classification or Permission of Department

Quantitative introduction of sustainability concepts in production planning and inventory control. Review of material recovery (recycling) and product/component recovery (remanufacturing) from productivity perspectives. Sustainability rubrics ranging from design and process to systems. Application to multi-echelon networks subject to forward/backward flow of material and information. Closed-loop supply chains. Comparative study of sustainable vs. traditional models for local and global production systems.

IE 5050: Advanced Engineering Economy for Complex Engineering Projects

(Dual-listed with IE 4050).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Overview of engineering economic valuation and complex engineering projects. Stochastic dynamic programming for project valuation. Modeling and analysis of confounding factors of engineering projects. Integration and synthesis of valuation methodologies to complex projects. Applications to power plants, transmission networks, and satellites.

IE 5080: Design and Analysis of Allocation Mechanisms

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Market-based allocation mechanisms from quantitative economic systems perspective. Pricing and costing models designed and analyzed with respect to decentralized decision processes, information requirements, and coordination. Financial Engineering Techniques. Case studies and examples from industries such as regulated utilities, semiconductor manufacturers, and financial engineering services.

IE 5100: Network Analysis

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Formulation and solution of deterministic network flow problems including shortest path, minimum cost flow, and maximum flow. Network and graph formulations of combinatorial problems including assignment, matching, and spanning trees. Solution algorithm design and analysis based on optimality conditions and duality.

IE 5130: Analysis of Stochastic Systems

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to modeling and analysis of manufacturing and service systems subject to uncertainty. Topics include the Poisson process, renewal processes, Markov chains, and Brownian motion. Applications to inventory systems, production system design, production scheduling, reliability, and capacity planning.

IE 5140: Production Scheduling

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to the theory of machine shop systems. Complexity results for various systems such as job, flow and open shops. Applications of linear programming, integer programming, network analysis. Enumerative methods for machine sequencing. Introduction to stochastic scheduling.

IE 5190: Simulation Modeling and Analysis

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Simulation of stochastic variables and processes. Discrete event simulation. Simulation-based data resampling and augmentation. Introduction of Bayesian computing and useful numerical methods. Probability and statistics related to simulation parameters including run length, metrics, inference, design of experiments, variance reduction, and stopping rules. A computing project in a programming language is required.

IE 5200: Engineering Problem Solving with R

(Dual-listed with IE 4200).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to data analytics using R programming language. Data manipulation. Exploratory data analysis via basic graphics. Basic statistical analysis including statistical tests and linear regression. R Markdown. Simulation by replicating a calculation. Conditional expressions, loops, and functions. High level data visualizations using ggplot graphics. Data extraction from text. Optimization via R build-in functions. Logistic regression. High performance computing tools. Project required for graduate credits. (Typically Offered: Spring)

IE 5310: Quality Control and Engineering Statistics

(Cross-listed with STAT 5310).

Credits: 3. Contact Hours: Lecture 3.

Prereq: STAT 5870 and STAT 5880

Statistical methods and theory applicable to problems of industrial process monitoring and improvement. Statistical issues in industrial measurement; Shewhart, CUSUM, and other control charts; feedback control; process characterization studies; estimation of product and process characteristics; acceptance sampling, continuous sampling and sequential sampling; economic and decision theoretic arguments in industrial statistics.

IE 5330: Reliability

(Cross-listed with STAT 5330).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Probabilistic modeling and inference in engineering reliability; lifetime models, product limit estimator, probability plotting, maximum likelihood estimation for censored data, Bayesian methods in reliability, system reliability models, competing risk analysis, acceleration models and analysis of accelerated test data; analysis of recurrent events and degradation data; planning studies to obtain reliability data. Offered even-numbered years. (Typically Offered: Spring)

IE 5340: Linear Programming

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Classification or Permission of Department

Formulation of optimization problems as mathematical models, such as linear programming, integer programming, and multi-objective optimization. Introduction to classic optimization algorithms, such as Simplex and cutting plane algorithms. Basic concepts of duality theory and sensitivity analysis. Using computer solvers to obtain optimal solutions to optimization models.

IE 5370: Reliability and Safety Engineering

(Dual-listed with IE 4370).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Mathematical basics for dealing with reliability data, theory, and analysis. Bayesian reliability analysis. Engineering ethics in safety evaluations. Case studies of accidents in large technological systems. Fault and event tree analysis.

IE 5410: Inventory Control and Production Planning

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Economic Order Quantity, dynamic lot sizing, newsboy, base stock, and (Q,r) models. Material Requirements Planning, Just-In-Time (JIT), variability in production systems, push and pull production systems, aggregate and workforce planning, and capacity management. Supply Chain Contracts.

IE 5440: Advanced Manufacturing and Materials Processing

(Dual-listed with IE 4440).

Credits: 3. Contact Hours: Lecture 3.

Prereq: IE 3480 or Graduate Classification

Introduction of physical theory, design, analysis, and characterization of advanced manufacturing and materials processing technologies, including micro/nano scale manufacturing, bulk deformation, sheet forming, and additive manufacturing. Focus on the fabrication/manufacturing of important types of microstructures used in engineering components and devices, and the techniques and tools used to characterize them. Students are expected to finish a team project related to advanced manufacturing and materials processing technologies. (Typically Offered: Fall)

IE 5450: Additive Manufacturing and Rapid Production Methods

(Dual-listed with IE 4450).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (IE 2480 and MATH 2650) or Graduate Classification

Introduction to additive manufacturing and other rapid prototyping and manufacturing methodologies. Operating principles and characteristics of current and developing processes. Use of rapid prototypes in product design, development, and service. Selection of rapid prototyping and manufacturing systems, from design to mass production. Hybrid manufacturing and other integration of rapid production methods.

IE 5460: Geometric Variability in Manufacturing

(Dual-listed with IE 4460).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (IE 3480 or MATE 2160 or ME 3240) or Graduate Classification

Assessment, accommodation, and control of geometric variability in manufacturing processes, specifically composites, metalcasting, welding, machining, powder metallurgy and additive processing. Techniques include the design of the component, tooling, process plan and inspection methodology.

IE 5470: Biomedical Design and Manufacturing

(Dual-listed with IE 4470/ BME 4470).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Exploration of biology, materials, body mechanics, manufacturing, quality control, and ethics and the intersection of these subjects as they relate to biomedical manufacturing. Study of medical data (CT, MRI, etc.) processing, biomedical design, 3D bioprinting and additive manufacturing concepts.

IE 5490: Computer Aided Design and Manufacturing

(Dual-listed with IE 4490).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Representation and interpretation of curves, surfaces and solids. Parametric curves and surfaces and solid modeling. Use of CAD software and CAD/CAM integration. Computer numerical control, CNC programming languages, and process planning.

IE 5600: Engineering Risk Analysis

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Overview of probabilistic risk analysis, modeling risks, and risk management. Topics include probability, influence diagrams, subjective probability assessment, fault tree analysis, decision making with uncertainty, risk perception, risk communication, and intelligent adversary. Use of Monte Carlo simulation to combine different sources of uncertainty and risk to generate probability distributions over an outcome. Application of probabilistic risk analysis to business investments, engineering systems, critical infrastructure, defense and security, and health systems.

IE 5610: Total Quality Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Classification or Permission of Department

Perspectives for how to analyze and implement total quality management in different organizations, to include manufacturing firms, service industries, the non-profit sector, and government agencies. Topics include the different viewpoints of quality (from the customer, workforce, and process perspective); aligning quality in an organization's goals; performance measurement; quality in supply chain management; and reliability. Some advanced statistical elements of quality control will also be discussed.

IE 5630: Engineering and Systems Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to engineering management concepts and examples relevant to the engineering manager today. Topics include decision trees and associated probabilities; personnel issues and challenges; working with management, client and the project team; personality types; and documents/forms that are useful for the engineering manager. Case studies, and a group project required.

IE 5640: Decision Analysis

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Classification or Permission of Department

Application of normative decision theory to problems with uncertainty and/or multiple objectives. The first decision framework will be a single-objective decision problem with uncertainty that takes into account a decision maker's attitude towards risk. The second decision framework will be a multi-criteria decision problem in which a decision maker has multiple objectives. Topics include utility theory, value of information, sensitivity analysis, value-focused thinking, cost-effectiveness analysis, influence diagrams, and behavioral decision making. Examples will be drawn from business, systems engineering and design, and government.

IE 5650: Systems Engineering and Analysis

(Cross-listed with AERE 5650/ EE 5650).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Classification or Permission of Department

Introduction to organized multidisciplinary approach to designing and developing systems. Concepts, principles, and practice of systems engineering as applied to large integrated systems. Life cycle costing, scheduling, risk management, functional analysis, conceptual and detail design, test and evaluation, and systems engineering planning and organization. Graduation Restrictions: Not available for degrees in industrial engineering.

IE 5660: Applied Systems Engineering

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Design for reliability, maintainability, usability, supportability, producibility, disposability, and life cycle costs in the context of the systems engineering process. Students will be required to apply the principles of systems engineering to a project including proposal, program plan, systems engineering management plan, and test and evaluation plan. Graduation Restriction: Not available for degrees in industrial engineering.

IE 5680: Large-Scale Complex Engineered Systems (LSCES)

(Dual-listed with AERE 4680/ IE 4680). (Cross-listed with AERE 5680).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to the theoretical foundation and methods associated with the design for large-scale complex engineered systems, including objective function formation, design reliability, value-driven design, product robustness, utility theory, economic factors for the formation of a value function and complexity science as a means of detecting unintended consequences in the product behavior. (Typically Offered: Spring)

IE 5700: Systems Engineering and Project Management

(Dual-listed with IE 4700).

Credits: 3. Contact Hours: Lecture 3.

Prereq: IE 3050 and (STAT 2310 or STAT 3050) and Junior classification or Graduate Classification

Systems view of projects and the processes by which they are implemented. Focuses on qualitative and quantitative tools and techniques of project management. Topics will include organizational structure types; project selection methodologies; simulation and optimization; and earned value management. Case studies will be included, and a group project required.

IE 5710: Occupational Biomechanics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Anatomical, physiological, and biomechanical bases of physical ergonomics. Anthropometry, body mechanics, strength of biomaterials, human motor control. Use of bioinstrumentation, passive industrial surveillance techniques and active risk assessment techniques. Acute injury and cumulative trauma disorders. Static and dynamic biomechanical modeling. Emphasis on low back, shoulder and hand/wrist biomechanics.

IE 5720: Design and Evaluation of Human-Computer Interaction

(Dual-listed with IE 4720).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Classification or Permission of Department

Human factors methods applied to interface requirements, design, prototyping, and evaluation. Concepts related to understanding user characteristics, design principles, usability analysis, methods and techniques for design and evaluation of the interface. The evaluation and design of the information presentation characteristics of a wide variety of interfaces: web sites (e-commerce), mobile applications, and information presentation systems (cockpits, instrumentation, etc.).

IE 5760: Human Factors in Product Design

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Investigation of the human interface to consumer and industrial systems and products, providing a basis for their design and evaluation. Discussions of human factors in the product design process: modeling the human during product use; usability; human factors methods in product design evaluation; user-device interface; safety, warnings, and instructions for products; considerations for human factors in the design of products for international use.

IE 5770: Human Factors

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Physical and psychological factors affecting human performance in systems. Signal detection theory, human reliability modeling, information theory, and performance shaping applied to safety, reliability, productivity, stress reduction, training, and human/equipment interface design. Laboratory assignments related to system design and operation.

IE 5800: Introduction of Project Management for Thesis Research

(Cross-listed with CHE 5800/ MSE 5800).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Tools and skills of Project Management (PM) adapted from industry to improve efficiency in thesis research. Project charter initiation for thesis, timeline and meeting scheduling tools, expectation management, and communication with advisors. Practice of the PM skills using student's own thesis. Presentation of a project charter. Demonstration of knowledge of related PM skills and the ability of utilizing these skills for thesis research. Sharing thesis ideas and learning experience in the Graduate for Advancing Professional Skills (GAPS) learning community. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

IE 5810: e-Commerce Systems Engineering

(Dual-listed with IE 4810).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Design, analysis, and implementation of e-commerce systems. Information infrastructure, enterprise models, enterprise processes, enterprise views. Data structures and algorithms used in e-commerce systems, SQL, exchange protocols, client/server model, web-based views.

IE 5820: Enterprise Modeling and Integration

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

The design and analysis of enterprise models to support information engineering of enterprise-wide systems. Representation of system behavior and structure including process modeling, information modeling, and conceptual modeling. Applications in enterprise application integration, enterprise resource planning systems, product data management systems, and manufacturing execution systems.

IE 5830: Data Mining

(Dual-listed with IE 4830).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Foundations of classification, data clustering and association rule mining. Techniques for data mining, with focus on tree-based methods for classification (simple trees, random forest and boosted trees), ensemble learning, optimization algorithms and deep learning with neural networks. Performance metrics and resampling methods for evaluating model quality. A computing project in R is required.

IE 5850: Requirements and Architecture Engineering

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Principles and practices for requirements engineering as part of the product development process with emphasis on software systems engineering. Problem definition, problem analysis, requirements analysis, requirements elicitation, validation, specifications. Case studies using requirements engineering methods and techniques.

IE 5870: Big Data Analytics and Optimization

(Dual-listed with IE 4870).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Optimization and statistical learning related to big data problems. Modern modeling for data-driven optimization problems and their applications in big data analytics. Algorithms for optimization and statistical learning and their implementation. Applications in manufacturing sector and service sciences. (Typically Offered: Spring)

IE 5880: Information Systems for Manufacturing

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Design and implementation of systems for the collection, maintenance, and usage of information needed for manufacturing operations, such as process control, quality, process definition, production definitions, inventory, and plant maintenance. Topics include interfacing with multiple data sources, methods to utilize the information to improve the process, system architectures, and maintaining adequate and accurate data for entities internal and external to the enterprise to achieve best manufacturing practices.

IE 5900: Special Topics

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Advanced study of a research topic in the field of industrial engineering.

IE 5990: Creative Component

Credits: 1-30.

Prereq: Instructor Permission for Course

Offered on a satisfactory-fail basis only.

Courses for graduate students:**IE 6130: Stochastic Production Systems**

Credits: 3. Contact Hours: Lecture 3.

Modeling techniques to evaluate performance and address issues in design, control, and operation of systems. Markov models of single-stage make-to-order and make-to-stock systems. Approximations for non-Markovian systems. Impact of variability on flow lines. Open and closed queuing networks.

IE 6310: Nonlinear Programming

Credits: 3. Contact Hours: Lecture 3.

Develop nonlinear models, convex sets and functions, optimality conditions, Lagrangian duality, unconstrained minimization techniques. Constrained minimization techniques covering penalty and barrier functions, sequential quadratic programming, the reduced gradient method, nonlinear control concepts.

IE 6320: Integer Programming

Credits: 3. Contact Hours: Lecture 3.

Integer programming including cutting planes, branch and bound, and Lagrangian relaxation. Introduction to complexity issues and search-based heuristics.

IE 6330: Stochastic Programming

Credits: 3. Contact Hours: Lecture 3.

Mathematical programming with uncertain parameters; modeling risk within optimization; multi-stage recourse and probabilistically constrained models; solution and approximation algorithms including Benders decomposition and progressive hedging; and applications to planning, allocation and design problems.

IE 6340: Computational Optimization

Credits: 3. Contact Hours: Lecture 3.

Theory, algorithm, and computer implementation of optimization models. Simplex, Benders decomposition, computational complexity, mixed integer linear program, linear program with complementarity constraints, inverse optimization, bilevel discrete optimization. Open source and commercial optimization solvers will be introduced and used.

IE 6420: Simultaneous Engineering in Manufacturing Systems

Credits: 3. Contact Hours: Lecture 3.

Current engineering methods for the product life cycle process. Feature-based design, computer-aided process planning, and data-driven product engineering.

IE 6450X: Laser-based Advanced Manufacturing

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: IE 5450 or IE 5490

Concepts and fundamentals of laser-matter interaction. Design, optimization and analysis of laser shock processing and laser heating-based manufacturing. Advanced manufacturing simulations. Literature review, data analysis, and academic writing/presentation of laser-based advanced manufacturing research. (Typically Offered: Spring)

IE 6710: Research Practicum in Human Factors and Ergonomics

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Research topic development, literature evaluation, experimental design, use of bioinstrumentation, data collection, basic data interpretation, statistical analysis, manuscript preparation.

IE 6720: Human Factors in Automation Design

Credits: 3. Contact Hours: Lecture 3.

Concepts in human-automation systems, including levels of automation, types of automation, and level of control. Implications of how adaptive automation affects error, trust, workload, situation awareness, and performance. Understand how human operators are affected by automation implementation in real-world systems. Apply human factors concepts to the design and evaluation of human-automation systems. Offered even-numbered years. (Typically Offered: Fall)

IE 6730: Spine Biomechanics

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 3 times.

Gross and fine anatomy of spine, mechanism of pain, epidemiology, in vitro testing, psychophysical studies, spine stability models, bioinstrumentation: intradiscal pressure, intra-abdominal pressure and electromyography. Biomechanics of lifting and twisting, effects of vibration, effects of posture/lifting style, lifting belts, physical models, optimization models, mathematical models, muscle models, finite element models, current trends in medical management and rehabilitation, chiropractic. Offered odd-numbered years. (Typically Offered: Fall)

IE 6810: Cognitive Engineering

(Cross-listed with HCI 6810).

Credits: 3. Contact Hours: Lecture 3.

Provides an overview of human cognitive capabilities and limitations in the design of products, workplaces, and large systems. Contexts vary broadly and could range from simple use of mobile devices to an air-traffic control or nuclear plant command center. Course focuses on what we can infer about users' thoughts and feelings based on what we can measure about their performance and physiological state. Covers the challenge of designing automated systems.

IE 6900: Advanced Topics

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Advanced topics related to Ph.D. research in industrial engineering under the direction of the instructor.

IE 6970: Engineering Internship

Credits: Required. Repeatable.

One Fall OR Spring semester combined with one summer, maximum per academic year. Excludes Fall/Spring combination. Professional work period. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

IE 6990: Research

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Offered on a satisfactory-fail basis only.

Interdisciplinary Graduate Studies (IGS)

Courses primarily for graduate students, open to qualified undergraduates:

IGS 5990: Creative Component

Credits: 1-30. Repeatable.

*Prereq: Graduate Standing or Permission of Instructor***Courses for graduate students:****IGS 6990: Thesis Research**

Credits: 1-30. Repeatable.

Interior Design (ARTID)

Courses primarily for undergraduates:**ARTID 2500: Fundamentals of Interior Design**

Credits: 2. Contact Hours: Lecture 2.

The profession, issues, and the role of interior design. (Typically Offered: Fall)

ARTID 2510: Human Factors in Interior Design

Credits: 3. Contact Hours: Lecture 3.

Overview of issues related to the human/built environment interface: introduction to health and safety factors, ergonomics, anthropometrics, sensory perception, psycho-behavioral response, physical performance, cultural factors and universal design. Emphasis on application of human factor methods to the analysis, solution, and evaluation of design problems. (Typically Offered: Spring)

ARTID 2550: Forces That Shape Interior Space

Credits: 3. Contact Hours: Lecture 3.

A survey of variables influencing the nature and function of 'interior' environments. Review of professional, geo-political, utilitarian, social-cultural, economic, humanistic, historical, technological, and other factors as generators of form and space. (Typically Offered: Fall, Spring)

ARTID 2610: Graphic Communication for Interior Design I

Credits: 3. Contact Hours: Lecture 3.

Prereq: Admission to the Interior Design BFA; ARTID 2650

Introduction to fundamental graphic principles of communication that contribute to the successful comprehension of interior design visual presentation techniques. (Typically Offered: Fall)

ARTID 2630: Graphic Communication for Interior Design II

Credits: 3. Contact Hours: Lecture 3.

Prereq: ARTID 2610 and Credit or concurrent enrollment in ARTID 2670

Computer visualization techniques and applications; projects employing computer graphic methods. (Typically Offered: Spring)

ARTID 2650: Interior Design Studio I

Credits: 4. Contact Hours: Lecture 1, Studio 6.

Prereq: Interior Design BFA students

Introduction to technical drawing conventions, and design drawings. Emphasis on drawing layout, line quality, and lettering. Use of various rendering media and techniques on 2D and 3D drawing. Overview of presentation techniques, both visual and verbal. Enhanced creative interior design problem solving. Emphasis on research, spatial composition theories and graphic ideation and communication as applied to the interior design of small-scale environments. Modeling and manual visualization techniques. (Typically Offered: Fall)

ARTID 2670: Interior Design Studio II

Credits: 4. Contact Hours: Lecture 1, Studio 6.

Prereq: ARTID 2650

Human factors issues including ergonomics, human behavior and the requirements of special groups. Color theories related to interior spaces. Residential interior design and medium scale projects. Detail drawings, and expansion of visualization techniques. (Typically Offered: Spring)

ARTID 3500: Interior Finish Materials

Credits: 3. Contact Hours: Lecture 3.

Prereq: Admission to a College of Design program

Exploration of concepts, materials, and assemblies associated with development of interior elements including floors, walls, ceiling, windows, and finishes. Fiber, plastic, sheet metal, and other surfacing materials. Attention to related human factors, testing, detailing, specifications writing and end-use application. To take this course, students must have drafting skills to complete scaled orthographic drawings. (Typically Offered: Spring)

ARTID 3510: Interior Regulations and Guidelines

Credits: 3. Contact Hours: Lecture 3.

Prereq: ARTID 2670 OR Permission of Instructor

Exploration of interior design concepts, materials, and assemblies as they contribute to the user, health, safety and general well-being. Wood, steel, masonry, and glass assemblies. Attention to related human factors, testing, codes, detailing, specifications writing and end-use application. (Typically Offered: Fall)

ARTID 3520: Interior Lighting & Building Systems

Credits: 3. Contact Hours: Lecture 3.

Exploration of concepts, materials, assemblies associated with building service systems. Overview of electrical, lighting, acoustical, mechanical, plumbing and other non-structural building features. Attention to related human factors, testing, codes, detailing, specifications writing and end-use application. (Typically Offered: Spring)

ARTID 3530: Interior Construction and Details

Credits: 3. Contact Hours: Lecture 3.

Exploration of building construction concepts, materials, and assemblies and their influence on interior design. Attention to human factors, codes, detailing, and other interior design issues related to buildings. (Typically Offered: Fall)

ARTID 3540X: Textiles for Interiors

Credits: 2.

Attention to fibers, yarn, weaves, construction, and finishes of textiles. Technical and practical considerations, such as pattern, performance, and appearance, for end-use textile application for a wide range of interior spaces. An overview on the selection, manufacturer, and specification of furniture. (Typically Offered: Fall)

ARTID 3550: Interior Design History/Theory/Criticism I

Credits: 3. Contact Hours: Lecture 3.

Theoretical approaches to evaluation of interior finishes, furnishings, and decorative arts in relation to parallel developments in art and architecture, from a critical, historical and multicultural perspective. Focus on pre-1850. Meets International Perspectives Requirement. (Typically Offered: Fall)

ARTID 3560: Interior Design History/Theory/Criticism II

Credits: 3. Contact Hours: Lecture 3.

Prereq: ARTID 3550 or Permission of Instructor

Advanced theoretical approaches to evaluation of interior finishes, furnishings, and decorative arts in relation to parallel developments in art and architecture from a critical, historical, and multicultural perspective. Focus on mid-nineteenth and twentieth century. Meets International Perspectives Requirement. (Typically Offered: Spring)

ARTID 3570: Made in Italy

Credits: 2. Contact Hours: Lecture 2.

An investigation of the 20th century roots of modern Italian design and its contemporary form. Lectures and seminar presentations highlight major Italian designers and internationally significant design in the 20th century. Focus is on innovative design that exhibits a synthesis of formal and social functions. Meets International Perspectives Requirement. (Typically Offered: Fall)

ARTID 3600: Interior Design Internship Seminar I

Credits: 1. Contact Hours: Lecture 1.

Prereq: ARTID 2670

Procedural and ethical concerns relating to interior design internship. Preparation of documents for internship search. Formulation of personal internship and career goals. (Typically Offered: Fall)

ARTID 3610: Interior Design Internship Seminar II

Credits: 1. Contact Hours: Lecture 1.

Prereq: ARTID 3600

Procedural and ethical concerns relating to interior design internship. Refinement of placement credentials and personal goals. Internship search process and agreements. (Typically Offered: Spring)

ARTID 3650: Interior Design Studio III

Credits: 4. Contact Hours: Lecture 1, Studio 6.

Prereq: ARTID 2630; ARTID 2670

Refined methods of problem identification design programming and problem solving, including theoretically-based concept development and refinement. Emphasis and compliance with codes and standards. Produce small and large scale projects. Alternative manual and computer-based visualization methods. Teamwork. Multi-cultural, study abroad option. (Typically Offered: Fall)

ARTID 3670: Interior Design Studio IV

Credits: 4. Contact Hours: Lecture 1, Studio 6.

Prereq: ARTID 3650

Emphasis on three-dimensional spatial development in large scale, multiple scale unit institutional projects. Inclusion of extensive design documentation. Expansion of alternative manual and computer-based visualization methods. Teamwork. (Typically Offered: Spring)

ARTID 3670H: Interior Design Studio IV: Honors

Credits: 4-5. Contact Hours: Lecture 1, Studio 9.

Prereq: ARTID 3650; Membership in the University Honors

Emphasis on three-dimensional spatial development in large scale, multiple scale unit institutional projects. Inclusion of extensive design documentation. Expansion of alternative manual and computer-based visualization methods. Teamwork. (Typically Offered: Spring)

ARTID 4600: Interior Design Internship Documentation

Credits: 1. Contact Hours: Lecture 1.

Prereq: ARTID 3500, ARTID 3600, and ARTID 3650

Documentation of professional interior design off-campus experience. (Typically Offered: Fall)

ARTID 4610: Interior Design Professional Practices

Credits: 2. Contact Hours: Lecture 2.

Prereq: ARTID 4600

Organization and general management of the interior design office: agreements, business procedures, and professional ethics. Professional interior design issues and concerns. (Typically Offered: Spring)

ARTID 4610H: Interior Design Professional Practices: Honors

Credits: 2. Contact Hours: Lecture 2.

Prereq: ARTID 4600; Membership in the University Honors Program

Organization and general management of the interior design office: agreements, business procedures, and professional ethics. Professional interior design issues and concerns. (Typically Offered: Spring)

ARTID 4630X: Artificial Intelligence Tools for Designed Environments

Credits: 3. Contact Hours: Lecture 10.

This course explores the integration of Artificial Intelligence (AI) within designed environments, focusing on tools and technologies that enhance the design process from ideation to post-production. In addition to mastering AI tools, students will engage in responsible design practices, including a written essay on the ethical use of AI in design. This course equips students with technical skills and the ability to communicate their design decisions critically. (Typically Offered: Spring, Summer, Winter Session)

ARTID 4650: Interior Design Studio V

(Dual-listed with ARTID 5650).

Credits: 4. Contact Hours: Lecture 1, Studio 6.

Design research and refined problem solving methods including functional analysis, programming and detailing. (Typically Offered: Fall)

ARTID 4670: Interior Design Studio VI

(Dual-listed with ARTID 5670).

Credits: 4. Contact Hours: Lecture 1, Studio 6.

Prereq: ARTID 4650

Refinement of technical, analytical and theoretical problem-solving methods and comprehensive design documentation. In-depth development of interior design projects. Current issues in interior design. (Typically Offered: Spring)

ARTID 4680: Interior Design in an Urban Setting

Credits: 3. Contact Hours: Lecture 3.

Prereq: ARTID 3650

Study of selected interior design projects and designers practicing in an urban setting. Studio project examining issues related to interior design in an urban context. (Typically Offered: Spring)

ARTID 4680H: Interior Design in an Urban Setting: Honors

Credits: 3-4. Contact Hours: Lecture 3.

Prereq: ARTID 3650; Membership in the University Honors

Study of selected interior design projects and designers practicing in an urban setting. Studio project examining issues related to interior design in an urban context. (Typically Offered: Spring)

ARTID 4900: Independent Study

Credits: 1-6. Repeatable.

Prereq: Department Permission for Course

Student must have completed related interior design coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis. (Typically Offered: Fall, Spring, Summer)

ARTID 4900H: Independent Study: Honors

Credits: 1-6. Repeatable.

Prereq: Department Permission for Course; Membership in the University Honors Program

Student must have completed related interior design coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis. (Typically Offered: Fall, Spring, Summer)

ARTID 4930: Workshop

Credits: 1-3. Contact Hours: Studio 6.

Repeatable, maximum of 3 credits.

Prereq: ARTID 3670

Intensive 2 to 4 week studio exploration. Topics vary each time offered. (Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

ARTID 5510A: Design Humanics: Sensory Perception & Ergonomic Factors

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Prereq: Graduate Standing or Permission of Instructor

Human factors related to the nature, performance and accommodation of the individuals and small groups, including sensation and perception, physical requirements, anthropometrics, safety and other issues connecting human needs and built environmental responses. Topics vary each time offered. (Typically Offered: Fall, Spring)

ARTID 5510B: Design Humanics: Environment & Behavior

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Prereq: Graduate Standing or Permission of Instructor

Human factors issues related to the nature, performance and accommodation of medium to large groups and settings. Emphasis on psychological, sociological, cultural, interpersonal safety, and related human needs and built environmental responses. Topics vary each time offered. (Typically Offered: Fall, Spring)

ARTID 5520A: Evidence-Based Design: Investigation Analysis

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 10 credits.

Prereq: Graduate Standing or Permission of Instructor

Methods of design research, analysis, programming and theory formulation. (Typically Offered: Fall, Spring)

ARTID 5520B: Evidence-Based Design: Synthesis

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 10 credits.

Prereq: Graduate Standing or Permission of Instructor

Methods of synthesizing design concepts and solutions. (Typically Offered: Fall, Spring)

ARTID 5520C: Evidence-Based Design: Communication

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 10 credits.

Prereq: Graduate Standing or Permission of Instructor

Methods of managing, translating, communicating and otherwise utilizing text, image, abstract and other forms of information. (Typically Offered: Fall, Spring)

ARTID 5520D: Evidence-Based Design: Procedural Alternatives

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 10 credits.

Prereq: Graduate Standing or Permission of Instructor

New and specialized methodological trends, including subject or setting-specific methods. (Typically Offered: Fall, Spring)

ARTID 5540: Interior Design Teaching Practicum

Credits: 3. Repeatable.

Prereq: Instructor Permission for Course

Supervised practical application of interior design theory, materials, and practice to the educational process. (Typically Offered: Fall, Spring, Summer)

ARTID 5590: Graduate Interior Design Field Study

Credits: 1-3. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Study and tours of places of interior design-related interest such as manufacturers, design studios, related professional offices, showrooms, museums, and historical sites.

ARTID 5650: Interior Design Studio V

(Dual-listed with ARTID 4650).

Credits: 4. Contact Hours: Lecture 1, Studio 6.

Prereq: Graduate Standing or Permission of Instructor

Design research and refined problem solving methods including functional analysis, programming and detailing. (Typically Offered: Fall)

ARTID 5670: Interior Design Studio VI

(Dual-listed with ARTID 4670).

Credits: 4. Contact Hours: Lecture 1, Studio 6.

Prereq: Graduate Standing or Permission of Instructor

Refinement of technical, analytical and theoretical problem-solving methods and comprehensive design documentation. In-depth development of interior design projects. Current issues in interior design. Open to non-majors. (Typically Offered: Spring)

ARTID 5680: Experimental Interior Design

Credits: 4. Contact Hours: Studio 8.

Repeatable, maximum of 16 credits.

Prereq: Graduate Standing or Permission of Instructor

Application of alternative design methods and sources of insight to the solution of human environmental design problems. Focus on the identification, formulation, refinement and application of theory to the design process. Emphasis on the pursuit of new discovery and innovative problem solving. Approaches, settings and scales vary each time offered. (Typically Offered: Fall, Spring)

ARTID 5690: Advanced Studies in Interior Design: Variable Topics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate classification and Permission of Instructor

Examination of special issues with emphasis on their translation into design application.

ARTID 5700X: Social Entrepreneurship in Aging

Credits: 3. Contact Hours: Discussion 1.5, Lecture 1.5.

Repeatable.

Examination of critical issues of older adults in our society with emphasis on human-environment interactions. Enhanced creative and innovative design solutions to address the complex issues. Produce a semester-long project and improve social entrepreneurial mindset.

ARTID 5710: Advanced Visualization in Interior Design

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Exploration of an advanced level of computer visualization techniques and applications with relevance to interior design. Introduction to the latest graphic communication software and technologies focuses on data visualization, hybrid digital perspective, 3D modeling & photo-realistic rendering, real-time video making, and Virtual Reality.

ARTID 5720: Preservation & Cultural Heritage

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Examination of special issues with emphasis on their translation into design application.

ARTID 5730: Advanced Color Theory

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Examination of special issues with emphasis on their translation into design application.

ARTID 5740: Inclusive Environments

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Examination of special issues with emphasis on their translation into design application.

ARTID 5900: Special Topics

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

ARTID 5930: Workshop

Credits: 1-3. Contact Hours: Studio 6.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Intensive 2 to 4 week studio exploration. Topics vary each time offered. (Typically Offered: Fall, Spring, Summer)

ARTID 5980: Research Forum

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable, maximum of 3 credits.

Prereq: Graduate Standing or Permission of Instructor

Presentation and discussion of cross-disciplinary design research theory, methods, and application. Focus on the investigation, application, and communication of types of design research. (Typically Offered: Fall, Spring)

ARTID 5990: Creative Component

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

Courses for graduate students:

ARTID 6600: Research Methods

Credits: 3. Contact Hours: Lecture 3.

Research strategies related to design. Application of selected methods to specific issues. Open to non-majors. (Typically Offered: Spring)

ARTID 6680: Advanced Experimental Interior Design

Credits: 4. Contact Hours: Lecture 1, Studio 6.

Repeatable, maximum of 16 credits.

Application of alternative design methods and sources of insight to the solution of human environmental design problems. Focus on the identification, formulation, refinement and application of theory to the design process. Emphasis on the pursuit of new discovery and innovative problem solving. Approaches, settings and scales vary each time offered. (Typically Offered: Fall, Spring)

ARTID 6900: Advanced Topics

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

ARTID 6970: Design Practicum

Credits: 1-9. Repeatable, maximum of 9 credits.

Applied, off campus, professional interior design-related experience.

(Typically Offered: Fall, Spring, Summer)

ARTID 6990A: Thesis

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

ARTID 6990B: Thesis-Exhibition

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

International Studies (INTST)

Courses primarily for undergraduates:

INTST 2350: Introduction to International Studies

Credits: 3. Contact Hours: Lecture 3.

Overview of international studies, emphasizing cultural, geographic, economic, and political characteristics of major world areas and nations. Meets International Perspectives Requirement. (Typically Offered: Fall, Summer)

INTST 2500: The World's Regions in a Global Context

Credits: 3. Contact Hours: Lecture 3.

Comparative study of the world's regions beyond North America (Africa, Asia, Europe, Latin America and the Caribbean, and the Middle East) within the context of globalization and regionalization. Framework for understanding how environmental, demographic, political and socio-cultural relationships in each region are affected by geographic connections. Exploration of how these relationships will shape future regional geographies. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

INTST 2950: International Experience Abroad

Credits: 1-8. Repeatable, maximum of 9 credits.

Supervised instruction in an international setting, augmented by practical living experience. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

INTST 3500: Topics in International Studies

Credits: 2-4. Contact Hours: Lecture 4.

Exploration of key topics and themes in International Studies. Topics vary each time offered. Meets International Perspectives Requirement.

INTST 3950A: Interdisciplinary Study Abroad: Pre-Departure Seminar

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Multi-faceted exploration of a selected world region directed at developing a comprehensive understanding of a selected culture's role in contemporary society.

INTST 3950B: Interdisciplinary Study Abroad: Humanities

Credits: 1-4. Repeatable.

Multi-faceted exploration of a selected world region directed at developing a comprehensive understanding of a selected culture's role in contemporary society.

INTST 3950C: Interdisciplinary Study Abroad: Communications

Credits: 1-4. Repeatable.

Multi-faceted exploration of a selected world region directed at developing a comprehensive understanding of a selected culture's role in contemporary society.

INTST 3950D: Interdisciplinary Study Abroad: Mathematics and Natural Science

Credits: 1-4. Repeatable.

Multi-faceted exploration of a selected world region directed at developing a comprehensive understanding of a selected culture's role in contemporary society.

INTST 3950E: Interdisciplinary Study Abroad: Social Sciences

Credits: 1-4. Repeatable.

Multi-faceted exploration of a selected world region directed at developing a comprehensive understanding of a selected culture's role in contemporary society.

INTST 4300: Seminar in International Studies

Credits: 3. Contact Hours: Lecture 3.

Prereq: INTST 2350; Junior classification or higher

Capstone seminar in international studies focused on economic development, women's issues, war and ethnic conflict, population, the environment, globalization, human rights, international trade and business and other issues. Students develop a project on a subject linked to their area of professional interest or academic specialization. Meets International Perspectives Requirement. (Typically Offered: Spring)

INTST 4900: Independent Study

Credits: 1-3. Repeatable, maximum of 9 credits.

Prereq: Permission of Instructor; Permission of International Studies Director

Designed to meet the needs of students who wish to study in areas other than those in which courses are offered or to integrate areas of study appropriate to special problems with international foci. Graduation Restriction: No more than 3 credits of INTST 4900 may be used in the International Studies major or minor.

INTST 4910: Experiences Abroad: Learning to Think Globally

(Cross-listed with WLC 4910).

Credits: 1. Contact Hours: Lecture 1.

Repeatable, maximum of 2 credits.

Prereq: Minimum of 3 credits of study abroad and/or internship abroad

Students returning from study abroad gain perspective on the personal, academic, and professional impact of their time spent abroad through readings and discussions. Students will be expected to make one presentation about the culture they experienced to an audience outside ISU. Offered on a satisfactory-fail basis only.

Iowa Lakeside Laboratory (IALL)

Courses primarily for undergraduates:

IALL 1010: Earth, Air, and Sky

Credits: 1-4.

Essentials of earth science, including astronomy, meteorology, geology, and paleontology; includes laboratory and fieldwork. Offered irregularly. (Typically Offered: Summer)

IALL 1030: Natural History Workshop

Credits: 1-2. Repeatable, maximum of 2 credits.

Offered as demand warrants. Five-day-long, nontechnical introductions to a specific aspect of the natural history of the Upper Midwest or techniques for studying natural history. (Typically Offered: Summer)

IALL 1040: Field Archaeology

Credits: 3-4.

Nature of cultural and environmental evidence in archaeology and how they are used to model past human behavior and land use; emphasis on Iowa prehistory; basic reconnaissance surveying and excavation techniques. Offered irregularly. (Typically Offered: Summer)

IALL 1045: Illustrating Nature II Photography

Credits: 1-2.

Beginning to intermediate technical and compositional aspects of color photography of natural areas and their plants and animals. Offered irregularly. (Typically Offered: Summer)

IALL 3100: Science Teaching Methods

Credits: 1-3. Repeatable.

Development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology, geology, and environmental courses; exercises built around common organisms and ecosystems in Iowa; animal biology, plant biology, fungi and lichens, aquatic ecology, prairie ecology, wetland ecology, limnology, animal behavior, insect ecology, biology of invertebrates, noninvasive use of living organisms, Project WET; field trips. Offered irregularly. (Typically Offered: Summer)

IALL 3106: Plant Taxonomy

Credits: 2-4.

Principles of classification and evolution of vascular plants; taxonomic tools and collection techniques; use of keys. Field and laboratory studies emphasizing identification of local flowering plants and recognition of major plant families. Offered irregularly. (Typically Offered: Summer)

IALL 3109: Ecology and Systematics of Algae

Credits: 4. Contact Hours: Lecture 4.

Biology, ecology, and taxonomy of cyanobacteria and eukaryotic freshwater algae based on field collected material. Samples collected from lakes, fens, streams, and rivers will be identified mostly to genus level with some common species identifications within each algal group. An ecological perspective is used to explore the diversity of photosynthetic microbes that form the energy base of freshwater ecosystems. Environmental and economic concerns caused by excessive algal growth will also be examined. Field collections will be used to identify the common phyla and genera of algae, to study their life histories, and to examine environmental factors that affect algal growth and distribution. A class project will investigate the algal ecology of Lake West Okoboji. (Typically Offered: Summer)

IALL 3110: Field Mycology

Credits: 2.

Identification and classification of the common fungi; techniques for identification, preservation, and culture practiced with members of the various fungi groups. Offered irregularly. (Typically Offered: Summer)

IALL 3113: Iowa Lakeside Laboratory

Credits: 1-4. Repeatable.

(Typically Offered: Summer)

IALL 3122: Prairie Ecology

Credits: 4.

Basic patterns and underlying physical and biotic causes of both regional and local distributions of plants and animals of North American prairies; field and laboratory analyses and projects. Requirements: familiarity with basic principles of biology and ecology. Offered irregularly. (Typically Offered: Summer)

IALL 3123: Prairie Ecology I

Credits: 2.

Basic patterns and underlying physical and biotic causes of both regional and local distributions of plants and animals of North American prairies; field and laboratory analyses and projects. (Typically Offered: Summer)

IALL 3125: Prairie Ecology II

Credits: 2.

Basic patterns and underlying physical and biotic causes of both regional and local distributions of plants and animals of North American prairies; field and laboratory analyses and projects. (Typically Offered: Summer)

IALL 3126: Ornithology

Credits: 2-4.

The biology, ecology, and behavior of birds with emphasis on field studies of local avifauna. Group projects stress techniques of population analysis and methodology for population studies. Offered irregularly. (Typically Offered: Summer)

IALL 3131: Ecology

Credits: 4.

An introduction to the principles of ecology at the population, community and ecosystem level. Field studies of local lakes, wetlands and prairies are used to examine factors controlling distributions, interactions, and roles of plants and animals in native ecosystems. Requirements: two semesters of introductory biology. Offered irregularly. (Typically Offered: Summer)

IALL 3140: Nature Based, Early Childhood Teaching Methods Using 'The Project Approach'

Credits: 3-4.

Examination of the value of young children's direct experiences in nature through inquiry-based learning; 'The Project Approach' builds on children's natural curiosity and enables them to interact, question, connect, problem solve, communicate, and reflect; students follow steps for implementing a nature-based project within their own classroom setting as they insure the needs of diverse learners are met for both social and academic learning; designed for early childhood teachers. Offered irregularly. (Typically Offered: Summer)

IALL 3150: Soil Formation and Landscape Relationships

Credits: 2-4.

Relationships between soil formation, geomorphology, environment; soil description, classification, geography, mapping, interpretation for land use. Offered irregularly. (Typically Offered: Summer)

IALL 3160: Animal Behavior

Credits: 2.

Examination of ecological and evolutionary theories of animal behavior through field studies of animal coloniality, courtship, territoriality, predator defense, habitat selection, foraging, mating systems, and parental care. Requirements: two biology courses. Offered irregularly. (Typically Offered: Summer)

IALL 3162: Restoration Ecology

Credits: 2.

Ecological principles for restoration of native ecosystems; establishment (site preparation, selection of seed mixes, planting techniques) and management (fire, mowing, weed control) of native vegetation; evaluation of restorations; emphasis on prairie restoration and wetland vegetation. Requirements: ecology courses. Offered irregularly. (Typically Offered: Summer)

IALL 3170: Glacial Geomorphology

Credits: 2-4.

Field-based introduction to glacial environments and processes including the origin of sediments, landforms, and landscapes produced in glacial and associated environments; aeolian (wind) processes, river and lacustrine systems, and mechanisms and chronologies of climate change. Offered irregularly. (Typically Offered: Summer)

IALL 3200: Introduction to Research and Inquiry

Credits: 1-3.

How data transforms to information and ultimately knowledge through scientific investigations; examinations and applications include steps formulating the scientific method using 21st-century data, conditions, and related challenges; deliverables include a thoroughly documented scientific experiment beginning with research questions and hypotheses, recommended methods, and concluding with anticipated results. Offered irregularly. (Typically Offered: Summer)

IALL 3340A: Topics in Ecology and Sustainability: Acoustic Ecology

Credits: 1-4. Repeatable.

Scientific introduction at intermediate level to ecology and evolution of important groups of organisms: algae to vertebrates, different ecological phenomena (e.g., fire and climate change), varying landforms, different ecosystems (e.g., prairies and aquatic systems); emphasis on sustainability with introduction to concepts, issues, and practices; ability to communicate environmental information through a variety of means. Requirements: one general biology course. Offered irregularly. (Typically Offered: Summer)

IALL 3340B: Topics in Ecology and Sustainability: Lichen Diversity

Credits: 1-4. Repeatable.

Scientific introduction at intermediate level to ecology and evolution of important groups of organisms: algae to vertebrates, different ecological phenomena (e.g., fire and climate change), varying landforms, different ecosystems (e.g., prairies and aquatic systems); emphasis on sustainability with introduction to concepts, issues, and practices; ability to communicate environmental information through a variety of means. Requirements: one general biology course. Offered irregularly. (Typically Offered: Summer)

IALL 3340D: Topics in Ecology and Sustainability: Biology Illustration

Credits: 1-4. Repeatable.

Scientific introduction at intermediate level to ecology and evolution of important groups of organisms: algae to vertebrates, different ecological phenomena (e.g., fire and climate change), varying landforms, different ecosystems (e.g., prairies and aquatic systems); emphasis on sustainability with introduction to concepts, issues, and practices; ability to communicate environmental information through a variety of means. Requirements: one general biology course. Offered irregularly. (Typically Offered: Summer)

IALL 3340F: Topics in Ecology and Sustainability: Herpetology

Credits: 1-4. Repeatable.

Scientific introduction at intermediate level to ecology and evolution of important groups of organisms: algae to vertebrates, different ecological phenomena (e.g., fire and climate change), varying landforms, different ecosystems (e.g., prairies and aquatic systems); emphasis on sustainability with introduction to concepts, issues, and practices; ability to communicate environmental information through a variety of means. Requirements: one general biology course. Offered irregularly. (Typically Offered: Summer)

IALL 3340G: Topics in Ecology and Sustainability: Ichthyology

Credits: 1-4. Repeatable.

Scientific introduction at intermediate level to ecology and evolution of important groups of organisms: algae to vertebrates, different ecological phenomena (e.g., fire and climate change), varying landforms, different ecosystems (e.g., prairies and aquatic systems); emphasis on sustainability with introduction to concepts, issues, and practices; ability to communicate environmental information through a variety of means. Requirements: one general biology course. Offered irregularly. (Typically Offered: Summer)

IALL 3340J: Topic in Ecology and Sustainability: Environmental Nonfiction

Credits: 2.

Learn the ways scientists can better communicate discoveries and ideas. Learn the importance of identifying your audience and how you can adapt your writing based upon your understanding of those varying audiences. (Typically Offered: Summer)

IALL 3340K: Topics in Ecology and Sustainability: Making Kin With(in) Place: Literature & Multispecies Kinship

Credits: 3.

Exploration of what it means to build kin with a place, while in a place—specifically, Lake Okoboji and the grounds of the Lakeside Laboratory. Consideration of the human impact on our planet and the inherent demand issued by climate change to abandon anthropocentrism and fundamentally alter human relationships with our environments, places, and the species therein. After discussing the cultural and human dimensions of climate change, we will consider multispecies kinship systems and how to build meaningful relationships with place. (Typically Offered: Summer)

IALL 3340M: Topics in Ecology and Sustainability: Introduction to Geographical Information Systems

Credits: 2.

History, purpose, functionality and basic uses of geographical information systems (GIS) as a tool for demonstrating information in relation to locations on the earth and moments in time. While map data may often serve as the basis for using or understanding geographical information, more complex data and systems may be analyzed using GIS tools to grow understanding of geographical phenomena. For the sake of consistency, ArcGIS tools will be used to familiarize students with the basic application and function of GIS technology in relation to data. (Typically Offered: Spring)

IALL 3340N: Topics in Ecology and Sustainability: Design Ecologies

Credits: 1-4. Repeatable.

Scientific introduction at intermediate level to ecology and evolution of important groups of organisms: algae to vertebrates, different ecological phenomena (e.g., fire and climate change), varying landforms, different ecosystems (e.g., prairies and aquatic systems); emphasis on sustainability with introduction to concepts, issues, and practices; ability to communicate environmental information through a variety of means. Requirements: one general biology course. (Typically Offered: Summer)

IALL 3410: Environmental Policy

Credits: 3. Repeatable.

Theory and practice of environmental policies, including the study of U.S. federal environmental policies with direct and indirect bearings on water issues; focus on policy history, implementation, and effectiveness; how policies interact with each other, how local stakeholders perceive their pros and cons, and linkages between local implementation efforts and regional and large-scale impacts. Offered irregularly. (Typically Offered: Summer)

IALL 4080: Aquatic Ecology

Credits: 2-4.

Analysis of aquatic ecosystems; emphasis on basic ecological principles; ecological theories tested in the field; identification of common plants and animals. Requirements: ecology, chemistry, and physics courses. (Typically Offered: Summer)

IALL 4800: Ecology and Systematics of Diatoms

Credits: 2-4.

Field and laboratory study of freshwater diatoms; techniques in collection, preparation, and identification of diatom samples; study of environmental factors affecting growth, distribution, taxonomic characters; project design and execution including construction of reference and voucher collections and data organization and analysis. Offered irregularly. (Typically Offered: Summer)

Courses primarily for graduate students, open to qualified undergraduates:

IALL 5160X: Animal Behavior

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Examination of ecological and evolutionary theories of animal behavior through field studies of animal coloniality, courtship, territoriality, predator defense, habitat selection, foraging, mating systems, and parental care. Requirements: two biology courses. (Typically Offered: Summer)

IALL 5210: Ecology and Systematics of Diatoms

Credits: 2-4.

Prereq: Graduate Standing or Permission of Instructor

(Typically Offered: Summer)

IALL 5213: Graduate Independent Study

Credits: 1-4. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

(Typically Offered: Summer)

IALL 5340K: Topics in Ecology and Sustainability: Making Kin With(in)

Place: Literature & Multispecies Kinship

Credits: 3.

Prereq: Graduate Standing or Permission of Instructor

Exploration of what it means to build kin with a place, while in a place—specifically, Lake Okoboji and the grounds of the Lakeside Laboratory. Consideration of the human impact on our planet and the inherent demand issued by climate change to abandon anthropocentrism and fundamentally alter human relationships with our environments, places, and the species therein. After discussing the cultural and human dimensions of climate change, we will consider multispecies kinship systems and how to build meaningful relationships with place. (Typically Offered: Summer)

Italian (ITAL)

Courses primarily for undergraduates:

ITAL 1070: Intensive Beginning Italian

Credits: 4. Contact Hours: Lecture 4.

A communicative approach to grammar and vocabulary within the context of Italian culture for students whose native language is not Italian. Taught in Italian. (Typically Offered: Fall, Spring)

Journalism and Mass Communication (JLMC)

Courses primarily for undergraduates:

JLMC 1010: Mass Media and Society

Credits: 3. Contact Hours: Lecture 3.

Communication theory models and their application to the mass media; the mass communication process; organization, characteristics and responsibilities of the mass media; media literacy process. (Typically Offered: Fall, Spring, Summer)

JLMC 1100: Orientation to Journalism and Communication

Credits: 1. Contact Hours: Lecture 1.

Orientation to curriculum requirements in the Greenlee School and introduction to careers related to Greenlee majors. Introduction to professional and preprofessional opportunities. Offered on a satisfactory/fail basis only. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

JLMC 1400: Identity, Diversity and the Media

Credits: 3. Contact Hours: Lecture 3.

Understand perspectives and biases within journalism, advertising and public relations content, including content shared through social-media platforms. Analyze content generated by others. Topics include media literacy, source evaluation, portrayals of diverse groups, identification of diverse sources and strategies for reducing bias in media work. Meets U.S. Cultures and Communities Requirement.

JLMC 2010: Reporting and Writing for the Mass Media

Credits: 3.

Prereq: (ADVRT, JLMC, or PR major; credit or enrollment in JLMC 1100) or Permission of Department

Gathering information and writing for Greenlee majors (ADVRT, JLMC, P R). Emphasis on analyzing and organizing information into written communication that is clear, concise, accurate and appropriate to platform. Developing skills in reporting, interviewing and research. Use of AP Style.

JLMC 2400: Principles of Journalism

Credits: 3. Contact Hours: Lecture 3.

Analysis of the journalism industry and specific audiences served by traditional media, including print and broadcast, as well as digital and emerging media. Introduction to core values of journalism in a democratic society and guiding principles that encompass a free press, media literacy, ethics, law, history, the economy and cultural and societal implications. (Typically Offered: Fall, Spring)

JLMC 2420: Visual Principles for Mass Communicators

Credits: 3. Contact Hours: Lecture 3.

Understanding and analysis of the visual message. Visual perception, visual communication theory, design syntax, design elements and how they are applied in mass communication. (Typically Offered: Fall, Spring)

JLMC 2600: Media Controversies in Science and Technology

Credits: 3. Contact Hours: Lecture 3.

Understanding science communication in the media. Exploring audience perceptions, media portrayals, underlying theories and social controversies related to communication of science and technology.

JLMC 3020: Intermediate Reporting and Writing for the Mass Media

Credits: 3.

Prereq: JLMC 1100 and Minimum of C+ in JLMC 2010

Researching, organizing and writing for newspapers, magazines and digital media. Enhancing and refining skills in developing sources and generating story ideas. Information-gathering techniques, reporting and writing.

JLMC 3030: Writing for Electronic Media

Credits: 3.

Prereq: JLMC 1100; minimum of C+ in JLMC 2010; ADVRT, JLMC, or PR major

Basic principles of written content creation across electronic media. Details the fundamental technical, conceptual, and stylistic issues related to writing non-fiction and fiction scripts for informational and entertainment purposes in electronic media. (Typically Offered: Fall, Spring)

JLMC 3060: Broadcast Media Production

Credits: 3.

Prereq: Minimum of C+ in JLMC 2010

Introduction to studio production using professional equipment. Course focus on visual concepts, maintenance and practical operation of studio equipment. (Typically Offered: Fall, Spring)

JLMC 3070: Fundamentals of Digital Video Production

Credits: 3.

Creation of video productions for use as communication tools in advertising, promotions, short documentaries and public relations. Technical and artistic fundamentals of video production including planning, scripting, shooting, lighting and digital editing.

JLMC 3080: Electronic Media Production

Credits: 3.

Prereq: Minimum of C+ in JLMC 2010

Multiplatform techniques in single-camera video production used to create and deliver visual stories. Details professional strategies and standards for visual content creators for a multitude of platforms.

JLMC 3100: Fundamentals of Photojournalism

Credits: 3.

Prereq: Minimum of C+ in JLMC 2010

Basic photojournalism techniques. Includes camera operation, lighting, composition and photo reproduction techniques for print or computer-mediated applications. Emphasis on using the camera as a reporting tool. Basic use of digital imaging and editing software. Ethical issues involving photojournalism. (Typically Offered: Fall, Spring)

JLMC 3110: Fundamentals of Mobile Photography

Credits: 3. Contact Hours: Lecture 3.

Basic photographic techniques for publication. Includes smartphone operation, lighting, composition and historical overview of photography and use in digital platforms. Basic use of image editing software. Ethical issues involving photo publication in media platforms. A smartphone camera is required.

JLMC 3120: Advanced Techniques in Photojournalism

Credits: 3.

Prereq: JLMC 3100 or Permission of Instructor

Advanced techniques and problem solving, both ethical and technical, for photographers who seek to be members of newsgathering teams. Photographic storytelling using a combination of audio and still photography techniques to report stories for print and web publications. Hands on experience with latest digital imaging technology. A digital SLR camera is required. Offered irregularly. (Typically Offered: Fall, Spring)

JLMC 3150: Digital Storytelling

Credits: 3.

Prereq: JLMC 3080 or JLMC 3100 or JLMC 3160

Identify and critically evaluate multimedia elements in journalistic storytelling. Produce audio, photographic and video story packages for a variety of outlets. Choose and work with appropriate digital tools. Learn economic, social and ethical issues that influence media today. Computer design proficiency recommended. (Typically Offered: Fall, Spring)

JLMC 3160: Visual Communication Design

Credits: 3.

Prereq: Minimum of C+ in JLMC 2010

Beginning techniques in layout, photo editing, and vector artwork. Application of visual principles and creative problem-solving to digital, social media, and print design projects. Use of industry-standard tools such as Adobe Photoshop, Illustrator, and InDesign. (Typically Offered: Fall, Spring)

JLMC 3170: Publishing for Mobile Devices

Credits: 3.

Prereq: JLMC 3160

Creating, designing and publishing content for mobile devices through use of industry-standard tools. Exposure to animation and HTML. Computer design proficiency recommended. (Typically Offered: Spring)

JLMC 3440: Feature Writing

Credits: 3.

Prereq: Minimum of C+ in JLMC 3020; (JLMC 3030 or PR 3210)

Reporting and writing short- and long-form feature stories for media across platforms. Focus on service journalism, personal essays, trend or conflict articles and personality profiles. Emphasis on immersion reporting. Majors may not apply both JLMC 3440 and ENGL 3030 toward graduation.

JLMC 3460: Public Affairs Reporting

Credits: 3.

Prereq: Minimum of C+ in JLMC 3020; (JLMC 3030 or PR 3210)

Reporting and writing about government, business, and other institutions; identification of and access to public records; investigative reporting techniques; developing major stories about government and nonprofit organizations; and ethical issues.

JLMC 3470: Science Communication

(Dual-listed with JLMC 5470).

Credits: 3.

Prereq: Junior or Senior Classification

Understanding and practicing science communication. Emphasis on building skills to report on science topics, telling science stories using different kinds of media, and understanding factors that impact how different audiences interpret scientific information. Explorations of science communication products relevant to health, natural resources, social science, and technology.

JLMC 3490: News and Feature Editing

Credits: 3.

Prereq: Minimum of C+ in JLMC 3020 OR JLMC 3030 OR PR 3210

Editing content for multiple platforms, including websites, magazines, newspapers, and newsletters. Adapting material for audiences, including selection and organization of text and visuals, grammar, punctuation, usage, logic and accuracy. Designing print and online layouts. Using search engine optimization and social media to promote content.

JLMC 3900: Professional Skills Development

(Cross-listed with ADVRT 3900/ PR 3900/ SMC 3900).

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: (Minimum of C+ in JLMC 2010; JLMC major or ADVRT major or PR major or SMC major)

Check with Greenlee School for course availability.No More Than 3 Credits In JLMC/ADVRT/PR 3900 May Be Applied Toward Major Requirements For Graduation. (Typically Offered: Fall, Spring)

JLMC 3910: Short Course Intensive

(Cross-listed with ADVRT 3910/ PR 3910/ SMC 3910).

Credits: 1. Contact Hours: Lecture 1.

Repeatable, maximum of 6 credits.

Focused short courses on timely concepts. Check with Greenlee School for course availability. Offered on a satisfactory-fail basis only.

JLMC 4010: Mass Communication Theory

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior classification

Theory and research in mass communication processes and effects; the scientific process; methods of measuring, evaluating and reporting mass communication research.

JLMC 4060: Media Management

(Dual-listed with JLMC 5060).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior classification

Decision-making functions of media. Basic media market analysis, media organization and management, circulation and audience development, technological developments affecting management decisions, and relationships with labor and regulatory agencies that affect media operations.

JLMC 4140: Digital Newsroom

Credits: 3.

Prereq: Minimum of C+ in JLMC 3020 or JLMC 3030

Developing in-depth reporting projects suitable for publication, using platforms appropriate to the projects.

JLMC 4600: Law of Mass Communication

Credits: 3. Contact Hours: Lecture 3.

Prereq: (JLMC 1100; minimum of C+ in JLMC 2010; Junior classification) or Permission of Instructor

First Amendment law, libel, privacy, obscenity, contempt, copyright, trademark, the Federal Communications Act; laws affecting advertising, legal publication, and other business activities of the media.

JLMC 4610: History of American Journalism

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior classification

Role of the mass media, including advertising and public relations, in shaping the social, economic and political history of America; impact of change in these areas on the development, traditions and philosophies of the media.

JLMC 4620: Media Ethics, Freedom, Responsibility

Credits: 3. Contact Hours: Lecture 3.

Prereq: JLMC 1100; minimum of C+ in JLMC 2010; ADVRT, JLMC, or PR major

Ethics and professionalism in the practice of journalism, public relations and advertising.

JLMC 4640: Journalism and Literature

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior classification

A study of journalism's impact on literary writing and literature's impact on journalism, as seen through the works of esteemed American author-journalists.

JLMC 4730: Social Media Strategy

(Cross-listed with ADVRT 4730/ PR 4730).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

The strategic use of social media, from both an advertising and public relationship standpoint, to the advantage of a client or organization. Examination and analysis of the social media space from a business perspective. Best practices in the areas of strategic planning, tactical execution, and measurement of social media platforms via online digital tools. (Typically Offered: Fall, Spring)

JLMC 4740: Communication Technology and Social Change

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior classification

Examination of historical and current communication technologies, including how they shape and are shaped by the cultural and social practices into which they are introduced. Meets International Perspectives Requirement.

JLMC 4760: World Communication Systems

(Dual-listed with JLMC 5760).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior classification

World communication systems and social, political, and economic factors determining flow, character, and volume of news. Impact of media information, advertising and public relations on nations and societies. Comparative analysis of role and impact of traditional modes of communication, the mass media and computer-mediated systems. Meets International Perspectives Requirement.

JLMC 4770: Diversity and the Media

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior classification

Portrayals of ethnic groups, gender, sexual orientation and social class in the media in news, advertising, information and entertainment; the effects of mass media on social issues and population groups. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall, Spring, Summer)

JLMC 4900: Independent Study in Media and Communication

(Cross-listed with ADVRT 4900/ PR 4900/ SMC 4900).

Credits: 1-30. Repeatable.

Prereq: Junior or Senior classification; Instructor Permission

Projects during which students may study problems associated with a medium, a professional specialization, a philosophical or practical concern, a reportorial method or writing technique, or a special topic in their field. Credit is not given for working on student or professional media without an accompanying research component. Graduation Restriction: No more than 3 credits of ADVRT/JLMC/PR/SMC 4900 may be used toward a degree in the Greenlee School.

JLMC 4970: Special Topics in Communication

(Cross-listed with ADVRT 4970/ PR 4970/ SMC 4970).

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: Junior classification

Seminars or one-time classes on topics of relevance to students in communication. See Schedule of Classes for topics.

JLMC 4990A: Professional Media Internship: Required

(Cross-listed with ADVRT 4990A/ PR 4990A/ SMC 4990A).

Credits: 3.

Prereq: ([JLMC major; JLMC 1100; minimum of C+ in JLMC 3020 or JLMC 3030] or [ADVRT major; JLMC 1100; ADVRT 3010 or PR 3010; minimum of C+ in JLMC 2010] or [PR major; JLMC 1100; ADVRT 3010 or PR 3010; minimum of C+ in PR 3210] or [SMC major; minimum of C+ in JLMC 2010; SMC 3040 or SMC 3510]); Advisor Approval

Initial, required internship. A 400-hour (for 3 credits) internship in the student's specialization. Assessment based on employer evaluations, student reports and faculty reviews. Available only to Greenlee School majors. Offered on a satisfactory-fail basis only.

JLMC 4990B: Professional Media Internship: Optional

(Cross-listed with ADVRT 4990B/ PR 4990B/ SMC 4990B).

Credits: 1-3. Repeatable.

Prereq: ([JLMC major; JLMC 1100; minimum of C+ in JLMC 3020 or JLMC 3030] or [ADVRT major; JLMC 1100; ADVRT 3010 or PR 3010; minimum of C+ in JLMC 2010] or [PR major; JLMC 1100; ADVRT 3010 or PR 3010; minimum of C+ in PR 3210] or [SMC major; minimum of C+ in JLMC 2010; SMC 3040 or SMC 3510]); Advisor Approval

Optional internship in the student's specialization. Assessment based on employer evaluations, student reports and faculty reviews. Available only to Greenlee School majors. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:**JLMC 5010: Theories of Mass Communication**

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Classification or Permission of Instructor

Historical overview of mass communication theories. Examination of major areas of research activity and theoretical development related to organization, functions, and effects of mass communication.

JLMC 5020: Fundamentals of Communication Research Methods

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Research methods in journalism and mass communication, including problem selection, sampling, hypothesis formulation, research design, data collection and analysis. Designing a research strategy appropriate for a variety of communication-related questions and assessing the appropriateness, validity, and generalizability of research results.

JLMC 5030: Advanced Communication Research Methods: Quantitative

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: JLMC 5020 or permission of instructor

In-depth examination of quantitative research methods in journalism and mass communication, including surveys, experiments and media content analyses. Data collection, data analysis and presentation of research findings. Application of quantitative research designs to journalism and mass communication cases.

JLMC 5040: Advanced Communication Research Methods: Qualitative

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: JLMC 5020 or permission of instructor

In-depth examination of qualitative methods in journalism and mass communication research. Social scientific and humanistic modes of inquiry. Discussions of critical-cultural theory, design and presentation of qualitative studies, and application of qualitative research methods in communication.

JLMC 5060: Media Management

(Dual-listed with JLMC 4060).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Decision-making functions of media. Basic media market analysis, media organization and management, circulation and audience development, technological developments affecting management decisions, and relationships with labor and regulatory agencies that affect media operations.

JLMC 5100: Strategies of Communication

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

The process of developing professional communication and persuasion strategies, with emphasis on problem definition, behavioral objectives, situation analysis, strategy formulation, and justification through application of communication theories and research.

JLMC 5200: Public Relations Theory and Methods

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Overview of dominant theories and research methods applied to the study and practice of public relations.

JLMC 5210: Theories of Visual Communication

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Explores the theoretical frameworks in visual communication, including concepts of perception, visual language, visual persuasion, and the social, political and cultural implications of the use of images. Understanding the function of images in changing knowledge, attitudes and behavior.

JLMC 5470: Science Communication

(Dual-listed with JLMC 3470).

Credits: 3.

Prereq: Graduate Standing or Permission of Instructor

Understanding and practicing science communication. Emphasis on building skills to report on science topics, telling science stories using different kinds of media, and understanding factors that impact how different audiences interpret scientific information. Explorations of science communication products relevant to health, natural resources, social science, and technology.

JLMC 5600: Risk Perception and Communication

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Study of risk communication principles, models and theories applicable to any risk communication situation. Emphasis on science, technology and risk issues, such as food, health, agriculture and the environment. Examines roles of scientists and communicators in cultivating a public informed about scientific and technological issues.

JLMC 5610: Media and Society: Interrelationships

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Media roles and functions in society including interrelationships between the media and a variety of social actors and forces. Theories and practices regarding social networking and communication via social media; influence of social media and social networking.

JLMC 5740: Communication Technologies and Social Change

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Personal, organizational, and social implications of the use of communication technologies. Includes theories and empirical research across the continuum of perspectives, from techno-utopianism through an anti-technology stance. Meets International Perspectives Requirement.

JLMC 5760: World Communication Systems

(Dual-listed with JLMC 4760).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

World communication systems and social, political, and economic factors determining flow, character, and volume of news. Impact of media information, advertising and public relations on nations and societies. Comparative analysis of role and impact of traditional modes of communication, the mass media and computer-mediated systems. Meets International Perspectives Requirement.

JLMC 5900A: Special Topics: Media Studies

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

JLMC 5900B: Special Topics: Professional Specialization

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

JLMC 5900C: Special Topics: Research Problems and Methods

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

JLMC 5900D: Special Topics: Technique and Style

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

JLMC 5900E: Special Topics: Specialized Communication

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

JLMC 5910: Professional Internship

Credits: 1-2.

Prereq: Instructor Permission for Course

Supervised internship experience. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

JLMC 5920: Introduction to Graduate Study in Journalism and Mass Communication

Credits: Required. Contact Hours: Lecture 1.

Prereq: Graduate Standing or Permission of Instructor

Overview of advanced study in journalism and mass communication with special emphasis on requirements for obtaining the master of science degree.

JLMC 5980A: Seminars in Mass Communication: Audiences and Effects

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

JLMC 5980B: Seminars in Mass Communication: Communication Technology

Credits: 1-3. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

JLMC 5980C: Seminars in Mass Communication: Professional Communication

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

JLMC 5980D: Seminars in Mass Communication: Development Communication

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

JLMC 5980E: Seminars in Mass Communication: Evaluation Methods

Credits: 1-3. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

JLMC 5980F: Seminars in Mass Communication: International Communication

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

JLMC 5980G: Seminars in Mass Communication: Mass Communication History

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

JLMC 5980H: Seminars in Mass Communication: Mass Communication Law

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

JLMC 5980I: Seminars in Mass Communication: Media Management

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

JLMC 5980J: Seminars in Mass Communication: Research Methods

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

JLMC 5980K: Seminars in Mass Communication: Society and Mass Communication

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

JLMC 5980L: Seminars in Mass Communication: Journalism and Mass Communication Education

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

JLMC 5980M: Seminars in Mass Communication: Visual Communication

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

JLMC 5980N: Seminars in Mass Communication: Broadcast Communication

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

JLMC 5980O: Seminars in Mass Communication: Communication Theory

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

JLMC 5980P: Seminars in Mass Communication: Computer Mediated Communication

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

JLMC 5980Q: Seminars in Mass Communication: Science, Technology and Risk Communication

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

JLMC 5990: Creative Component

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Offered on a satisfactory-fail basis only.

Courses for graduate students:

JLMC 6990: Thesis Research

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Offered on a satisfactory-fail basis only.

Kinesiology (KIN)

Courses primarily for undergraduates:

KIN 1010: Swimming I

Credits: 1. Contact Hours: Laboratory 3.

Basic course for nonswimmers. Emphasis on two fundamental strokes and personal water safety skills. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

KIN 1020: Swimming II

Credits: 1. Contact Hours: Laboratory 3.

Prereq: KIN 1010

Intermediate course. Emphasis on learning and improving five basic strokes and personal water safety skills. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

KIN 1080: Aquatic Fitness

Credits: 1. Contact Hours: Laboratory 3.

Prereq: KIN 1020 or Permission of Instructor

Water related exercises, activities, and swimming workouts to improve physical fitness. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

KIN 1220: Badminton

Credits: 1. Contact Hours: Laboratory 2.

Introduction to fundamental badminton skills and strategic game play. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

KIN 1230: Pickleball

Credits: 1. Contact Hours: Laboratory 3.

Introduction to pickleball and strategic game play. . Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

KIN 1290: Bowling

Credits: 1. Contact Hours: Laboratory 2.

Introduction to bowling skills and strategic game play. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

KIN 1350: Golf

Credits: 1. Contact Hours: Laboratory 2.

Introduction to fundamental golf skills and strategic game play. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

KIN 1440: Racquetball

Credits: 1. Contact Hours: Laboratory 2.

Introduction to fundamental racquetball skills and strategic game play. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

KIN 1530: Ice Skating

Credits: 1. Contact Hours: Laboratory 2.

Introduction to fundamental ice skating skills and strategic game play. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

KIN 1580: Tennis

Credits: 1. Contact Hours: Laboratory 2.

Introduction to basic skills (forehand, backhand, service) and basic knowledge of game play. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

KIN 1600: Team Sports

Credits: 1. Contact Hours: Laboratory 3.

Introduction to fundamental team sport skills and strategic game play.

Indoor and outdoor team sports provided. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

KIN 1630: Physical Fitness

Credits: 1. Contact Hours: Laboratory 3.

Evaluation of fitness status. Exercises, activities, and programs to improve physical fitness. Offered on a satisfactory-fail basis only.

(Typically Offered: Fall, Spring)

KIN 1640: Walking for Fitness

Credits: 1. Contact Hours: Laboratory 3.

Fitness walking as an activity to improve health and fitness; values of this type of activity as a lifetime endeavor with knowledge and usage of pedometers. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

KIN 1650: Running for Fitness

Credits: 1. Contact Hours: Laboratory 2.

Running as a physical activity to improve physical fitness and health. Promotion of this activity as a lifetime endeavor. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

KIN 1660: Weight Training

Credits: 1. Contact Hours: Laboratory 3.

Introduction to fundamental skills of weight training and strategic game play. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

KIN 1680: Judo

Credits: 1.

Fundamentals of self defense, focusing on throwing with the hands, hips and feet as well as applying pins, chokes and arm-bars. The physical skills will be taught focused on training through development of courtesy, integrity, perseverance, self control, & indomitable spirit. Emphasis on learning a way of life that promotes personal development, physical health and citizenship. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

KIN 1700: Tae Kwon Do/Karate I

Credits: 1. Contact Hours: Laboratory 2.

Teaches fundamentals of self-defense, focusing on hand and foot striking and blocking techniques. The physical skills will be taught focused on training through development of courtesy, integrity, perseverance, self-control and indomitable spirit. It will be emphasized that each student learns a way of life that promotes personal development, physical health and citizenship. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

KIN 1710: Tae Kwon Do/Karate II

Credits: 1. Contact Hours: Laboratory 2.

Teaches advanced application of self-defense focusing on hand and foot striking and blocking techniques. The physical skills will be taught focused on training through development of courtesy, integrity, perseverance, self-control and indomitable spirit. It will be emphasized that each student learns a way of life that promotes personal development, physical health and citizenship. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

KIN 1730: Hap Ki Do/Martial Self-Defense

Credits: 1. Contact Hours: Laboratory 2.

Teaches fundamentals of self-defense focusing on joint locks, pressure points and throwing techniques to escape from an attacker. The physical skills will be taught focused on training through development of courtesy, integrity, perseverance, self-control and indomitable spirit. It will be emphasized that each student learns a way of life that promotes personal development, physical health & citizenship. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

KIN 1820: Volleyball

Credits: 1. Contact Hours: Laboratory 2.

Introduction to fundamental volleyball skills and strategic game play. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

KIN 1850: Soccer

Credits: 1. Contact Hours: Laboratory 2.

Introduction to fundamental soccer skills and strategic game play. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

KIN 2100: Concepts of Fitness and Wellness

Credits: 2. Contact Hours: Lecture 2.

Coverage of behavioral skills needed to adopt and maintain lifestyles conducive to fitness and wellness. Provides students with knowledge and skills needed to adopt and maintain healthy lifestyles. Includes self-assessments and content on physical activity, nutrition, weight control, stress management and other lifestyle behaviors related to health. For non-kinesiology majors. (Typically Offered: Fall, Spring)

KIN 2310: Fundamentals of Tumbling and Gymnastics

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Physical Education Teacher Education Specialization

Fundamentals of tumbling and gymnastics apparatus. Skill enhancement, analysis, understanding practice and the development of progressions. (Typically Offered: Fall)

KIN 2320: Fundamentals of Team Sports

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Physical Education Teacher Education Specialization

Fundamentals of indoor and outdoor team sports, for example basketball, volleyball, flag football, and soccer. Skill enhancement, analysis, understanding practice and the development of progressions. (Typically Offered: Fall)

KIN 2360: Fundamentals of Individual Sports and Fitness

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Physical Education Teacher Education Specialization

Fundamentals of individual sports and fitness, for example disc golf, bowling, badminton, and weight training. Skill enhancement, analysis, understanding practice and the development of progressions. (Typically Offered: Spring)

KIN 2420: Planning for Success in a Health Career

Credits: 0.5. Contact Hours: Lecture 0.5.

Prereq: Pre-Health Professions Specialization; Sophomore classification

Reflection and discovery to better understand skills needed for admission to professional and graduate school. Facilitate preparation of relevant materials and develop professional school admission strategies. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

KIN 2520: Introduction to the Discipline of Kinesiology

Credits: 1. Contact Hours: Lecture 1.

Relevant societal issues and research within the discipline of Kinesiology (the study of movement) are addressed. (Typically Offered: Fall, Spring)

KIN 2530: Orientation and Learning Community in Kinesiology and Health

Credits: 1. Contact Hours: Lecture 1.

Overview of ISU policies and procedures, academic advising operations, degree requirements, program of study planning, and campus resources. Students will have out-of-class activities and work with faculty, staff and mentors to explore careers in Kinesiology and complete assignments related to identification & development of their skills and interests. Department of Kinesiology students only. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

KIN 2580: Principles of Physical Fitness and Conditioning

Credits: 2. Contact Hours: Lecture 1, Laboratory 3.

Introduction to five components of fitness: cardiorespiratory, muscular strength, muscular endurance, flexibility, and body composition. Students will be introduced to basic exercise prescription and evaluation principles, develop skills to assess each component of fitness, and learn different exercise modalities to enhance each component. (Typically Offered: Fall, Spring)

KIN 2590: Leadership Techniques for Fitness Programs

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: KIN 2580

Development of exercise leadership skills for a variety of activities. Includes planning, promotion, and teaching techniques for developing fitness in others using a variety of exercise modalities including group fitness and weight training. Kinesiology and health majors only. (Typically Offered: Fall, Spring)

KIN 2660: Strength Training and Conditioning

Credits: 2. Contact Hours: Lecture 1, Laboratory 2.

Prereq: KIN 2580; Kinesiology and Health Majors

This course is designed to enhance the student's current level of knowledge and expertise in the area of strength training and conditioning. The course will prepare students interested in taking the National Strength and Conditioning Association Certified Strength and Conditioning Specialist's exam. The course will focus on the assessment and implementation of training programs with strong emphasis on the areas of resistance training, metabolic training, flexibility, reaction time, speed, and agility. (Typically Offered: Fall, Spring)

KIN 2800: Directed Field Experience in Elementary Physical Education

Credits: 1.

Prereq: Physical Education Teacher Education Specialization

Observing, planning, and facilitating movement experiences of children in an elementary school setting. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

KIN 2810: Directed Field Experience in Secondary Physical Education

Credits: 1.

Prereq: Physical Education Teacher Education Specialization

Observing, planning, and facilitating movement experiences of students in a middle and/or high school setting. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

KIN 2820: Field Experience with Educational Outreach

Credits: 1.

Prereq: Admitted to the Educator Preparation Program

Planning and facilitating physical education experiences for children in a community outreach setting. Experiences take place on campus. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

KIN 2840: Elementary and Pre-school Movement Education

Credits: 3.

Prereq: 3 credits in HDFS

Approaches to teaching movement skills, health-related fitness and school-based physical activities (in the classroom, in PE, during recess) to pre-school and elementary school age children are covered. Emphasis is placed on planning and conducting developmentally appropriate movement experiences for preschool and elementary aged children throughout the school day based upon educational psychology, exercise psychology and motor development research. Practical experience is provided. (Typically Offered: Fall, Spring)

KIN 2850: Pre-Internship in Kinesiology and Health

(Cross-listed with HS 2850).

Credits: 1-2.

Prereq: Kinesiology and Health major; credit or concurrent enrollment in KIN 2580; Permission of Internship Coordinator

Pre-internship experience with a health organization based on option. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

KIN 2900: Independent Study

Credits: 1. Repeatable, maximum of 3 credits.

Prereq: 2nd semester Freshmen or Sophomore classification; Permission of Instructor

Study under supervision of faculty. (Typically Offered: Fall, Spring)

KIN 2940AX: Practicum in Adult Fitness Assessment: Techniques and Interpretation

Credits: 1-6.

Practicum in Adult Fitness Assessment: Techniques and Interpretation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

KIN 2940BX: Practicum in Adult Fitness Assessment: Supervised Experience

Credits: 1-2. Repeatable, maximum of 5 credits.

Conduct and interpret physical fitness assessments with adults. Protocols for assessing aerobic, muscular fitness, and flexibility, and will have opportunities to practice and refine these skills in supervised adult fitness settings. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

KIN 3120: Movement Education in Elementary School Physical Education

Credits: 3.

Prereq: Admitted to the Educator Preparation Program

Planning for management and instruction of developmentally appropriate physical education for children pre-school through grade six. Laboratory experience required. Graduation Restriction: Credit for only one of KIN 2840 or KIN 3120 may be applied toward graduation. (Typically Offered: Fall)

KIN 3130: Teaching Secondary Physical Education

Credits: 3. Contact Hours: Lecture 2, Laboratory 1.

Prereq: Admitted to the Educator Preparation Program

Current theory, practice and research on teaching focusing on management, instructional, and learning styles of students in secondary schools. (Typically Offered: Spring)

KIN 3150: Coaching Theory and Administrative Issues

Credits: 3. Contact Hours: Lecture 3.

Study in the theory, ethics, strategy, and mechanics of coaching various interscholastic and/or intercollegiate sports. Emphasis on formulating a philosophy, identifying goals and psychological aspects, teaching skills, and developing strategies. (Typically Offered: Fall, Spring, Summer)

KIN 3450: Management of Health-Fitness Programs and Facilities

Credits: 3. Contact Hours: Lecture 3.

Application of management concepts to the fitness industry, e.g., understanding customers, marketing, program management, financial management, legal issues, and evaluation and planning. (Typically Offered: Fall, Spring)

KIN 3550: Biomechanics

Credits: 3. Contact Hours: Lecture 3.

Prereq: PHYS 1150 or PHYS 1310

Mechanical basis of human performance; application of mechanical principles to exercise, sport and other physical activities. (Typically Offered: Fall, Spring, Summer)

KIN 3580: Exercise Physiology

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2550 and BIOL 2560

Physiological basis of human performance; effects of physical activity on body functions. (Typically Offered: Fall, Spring, Summer)

KIN 3590: Exercise Physiology Lab

Credits: 1. Contact Hours: Laboratory 2.

Prereq: Credit or concurrent enrollment in KIN 3580

Learning lab techniques in Exercise Physiology and engaging in the experimental process. (Typically Offered: Fall, Spring, Summer)

KIN 3600: Sociology of Physical Activity and Health

Credits: 3. Contact Hours: Lecture 3.

Prereq: SOC 1340

Provide an overview of sociology to enhance students understanding of societal forces influencing behavior; Provide insights about people, environments, organization and policies that impact Kinesiology professionals. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall, Spring)

KIN 3630: Basic Electrocardiography

Credits: 2. Contact Hours: Lecture 2.

Understanding of human electrocardiography, including normal and abnormal 12-lead ECGs and arrhythmia identification. Offered even-numbered years. (Typically Offered: Fall, Spring)

KIN 3650: Sport Psychology

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 1010 or PSYCH 2300

Psychological factors that influence performance in sport settings. The influence of personality, anxiety, motivation and social factors. Psychological skills training and strategic methods for improvement of athletic performance. (Typically Offered: Fall, Spring, Summer)

KIN 3660: Exercise Psychology

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 1010 or PSYCH 2300

Psychological theories for understanding and predicting health-oriented exercise behavior. Psychological and psychobiological responses to exercise. Psychological interventions for increasing exercise participation and adherence rates. (Typically Offered: Fall, Spring, Summer)

KIN 3720: Motor Control and Learning Across the Lifespan

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2550, BIOL 2560, (PSYCH 1010 or PSYCH 2300)

Introduction to major concepts of neuromotor control, behavioral motor control and motor learning in the child, adult and older adult, with emphasis on the adult system. (Typically Offered: Fall, Spring, Summer)

KIN 3730: Biomechanics and Motor Control Laboratory

Credits: 1. Contact Hours: Laboratory 2.

Prereq: Credit or concurrent enrollment in (KIN 3550; KIN 3720)

Introduction to lab techniques in Biomechanics and Motor Control by engaging in the experimental process. Reinforces and integrates concepts from KIN 3550 and KIN 3720. Performance of hands-on collection of biomechanical and motor control data and analysis and explanation of human movement from mechanical, behavioral, and neural perspectives.

KIN 3810A: Study Abroad Experience in Kinesiology: Preparing for the Experience

Credits: 1. Contact Hours: Lecture 1.

Prereq: KIN 2520; KIN 2530; major in ATR or KIN; Sophomore classification; minimum GPA of 2.5

Prepares student for a study abroad experience focused on the discipline of Kinesiology in another country. Precedes a multi-credit KIN 3810B course that is the actual study abroad experience. The prerequisite for this course is having been accepted to study abroad by the Program Director of your intended program. Offered even-numbered years. Meets International Perspectives Requirement. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

KIN 3810B: Study Abroad Experience In Kinesiology

Credits: 2.

Prereq: KIN 3810A; Permission of Instructor

First-person perspective into the discipline of Kinesiology in another country as well as provide enrichment experiences related to the history and culture of that country. Follows a 1 credit KIN 3810A course that was intended to prepare you for this study abroad experience. Offered even-numbered years. Meets International Perspectives Requirement. (Typically Offered: Summer)

KIN 3850: Preparation and Search Strategies for Kinesiology and Health Internships

(Cross-listed with HS 3850).

Credits: 0.5. Contact Hours: Lecture 0.5.

Prereq: Junior classification

Preparation of relevant material for a successful internship/career search. Specific internship timeline, process, procedures will be reviewed. Course needs to be taken a minimum of two semesters prior to required internship. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

KIN 3910: Service Learning Leadership Experience

Credits: 1-3. Repeatable, maximum of 6 credits.

Applied service learning experiences designed to provide students with opportunities to apply classroom knowledge to real world applications. Students will gain professional skills and programming experience while supporting health, education and wellness programming in school, work site or community settings. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

KIN 3950: Adapted Physical Education

(Dual-listed with KIN 5950).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Admitted to the Educator Preparation Program

Etiology, characteristics, needs, and movement experiences for individuals with disabilities. Designed to provide appropriate methods of physical education instruction for students including those with disabilities as identified by the Individuals with Disabilities Education Act and students who are talented and gifted. Assessments and strategies to differentiate instruction and to adapt activities for all exceptional learners will be addressed. Laboratory experience required. Graduation Restriction: KIN 5950 may not be taken by students who previously earned credit in KIN 3950. (Typically Offered: Fall)

KIN 3990: Recreational Sport Management

Credits: 3. Contact Hours: Lecture 3.

The role of sport in developing fitness, recreational opportunities, and tourism, with special emphasis on issues related to youth sport, volunteerism, and the marketing of sport events and facilities. (Typically Offered: Fall)

KIN 4170: Supervised Teaching in Physical Education in the Secondary School

Credits: 1-30.

Supervised teaching in the secondary schools. (Typically Offered: Fall, Spring)

KIN 4180: Supervised Teaching in Physical Education in the Elementary School

Credits: 8.

Supervised teaching in the elementary schools. (Typically Offered: Fall, Spring)

KIN 4580: Principles of Fitness Assessment and Exercise Prescription

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: Minimum of C- in KIN 3580

Principles of cardiac risk factor identification and modification; risk classification of potential exercise clients; fitness assessments; developing comprehensive exercise prescriptions for individuals. (Typically Offered: Fall, Spring)

KIN 4590: Internship in Exercise Leadership

Credits: 1. Contact Hours: Laboratory 3.

Observation and practice of exercise leadership techniques in an on-campus adult fitness program. (Typically Offered: Fall, Spring)

KIN 4610: Advanced Strength Training and Conditioning

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: KIN 2660; KIN 3580; Kinesiology & Health Majors only

Applied methods for developing and implementing short- and long-term strength and conditioning programs for performance-oriented clients. (Typically Offered: Spring)

KIN 4620: Medical Aspects of Exercise

Credits: 3. Contact Hours: Lecture 3.

Prereq: Minimum of C- in KIN 3580

The role of exercise in preventive medicine. Impact of exercise on various diseases, and the effect of various medical conditions on the ability to participate in vigorous exercise and competitive sports. Principles of exercise testing and prescription for individuals with these conditions. Environmental and nutritional aspects of exercise. (Typically Offered: Fall, Spring)

KIN 4660: Exercise for Mental Health

Credits: 3. Contact Hours: Lecture 3.

Prereq: KIN 3660 or Senior classification in Psychology or Permission of Instructor

Understand the state-of-the-knowledge of the mental health benefits of physical activity both in the prevention and in the treatment of clinical mental health and other psychological conditions. Focus on both the neurobiological bases of mental health disorders and the effects of exercise on these factors. Practical approach to encouraging changes in physical activity across populations suffering from psychological disturbances as part of treatment. (Typically Offered: Spring)

KIN 4670: Exercise and Health: Behavior Change

(Dual-listed with KIN 5670).

Credits: 3. Contact Hours: Lecture 3.

Prereq: KIN 3660 or Permission of Instructor

Advanced analysis of theoretical health behavior models and their application to physical activity behavior. Includes practical techniques, tools and interventions (e.g., counseling skills, motivational interviewing) to enhance exercise prescription and motivation, and considerations for working with special populations. (Typically Offered: Fall, Spring)

KIN 4710: Measurement in Physical Education

(Dual-listed with KIN 5710).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Admitted to the Educator Preparation Program

Current theory, practice and research on measurement and evaluation in physical education and youth physical activity settings. Statistics, grading, and specific assessments including fitness, motor skill, sport skill, physical activity, affective, and cognitive testing will be addressed. Graduation Restriction: KIN 5710 may not be taken by students who previously earned credit in KIN 4710. (Typically Offered: Spring)

KIN 4720: Neural Basis of Human Movement

(Dual-listed with KIN 5720).

Credits: 3. Contact Hours: Lecture 3.

Prereq: KIN 3720 or PSYCH 3100

Addresses the role of the central nervous system in the control of voluntary human movement, with the focus on the cerebral cortex, basal ganglia and cerebellum. Content organized around specific nervous system damage (such as stroke, apraxia, spasticity, or spinal cord damage) and functional movements (such as reaching and grasping, balance and gait). Converging evidence from human movement disorders, brain imaging, animal lesion and single cell studies provide the primary basis for the content. (Typically Offered: Fall, Spring)

KIN 4730: Physical Dimensions of Aging

Credits: 3. Contact Hours: Lecture 3.

Prereq: KIN 3550 or KIN 3580 or KIN 3720

Understanding the physiological, behavioral, and cognitive changes associated with aging with focus on the effects of physical activity on the aging human system. Discussions of what it means to become older, what a person can expect during the aging process, and what kind of control a person has over the aging process. (Typically Offered: Spring)

KIN 4740: Music and Neuroscience

(Cross-listed with MUSIC 4740).

Credits: 3. Contact Hours: Lecture 3.

Understanding how music is processed in the brain and the implications for healthy care and education. Online discussions about how music changes all aspects of the brain from neurotransmitters to cortical reorganization. (Typically Offered: Fall)

KIN 4750: Physical Education Curriculum Design and Program Organization

(Dual-listed with KIN 5750).

Credits: 3. Contact Hours: Lecture 3.

Current theory, practices and principles applied to curriculum development for programs in physical education, K-12. Organizing for teaching in a variety of school settings. (Typically Offered: Fall)

KIN 4800: Functional Anatomy

Credits: 3. Contact Hours: Lecture 3.

Prereq: (BIOL 1550 or BIOL 2550); BIOL 2560; KIN 3550

The structure and function of human muscular, skeletal and nervous systems. The relationship of these systems to efficient and safe human motion. (Typically Offered: Fall, Spring)

KIN 4810: Biomechanics Lab

Credits: 1. Contact Hours: Laboratory 2.

Learning lab techniques in Biomechanics and engaging in the experimental process.

KIN 4830: Exercise Psychology Lab

Credits: 1. Contact Hours: Laboratory 2.

Learning lab techniques in Exercise Psychology and engaging in the experimental process.

KIN 4840: Assessment and Control of Locomotion

Credits: 1. Contact Hours: Laboratory 2.

Learning lab techniques in Motor Control and engaging in the experimental process.

KIN 4850A: Internship in Exercise Science

Credits: 8-12. Repeatable.

Prereq: Senior classification; Exercise Science specialization; C- or better in (KIN 3550; KIN 3580; KIN 3590; KIN 3660; KIN 3720; KIN 4580; KIN 4590; KIN 4620; HS 3500); Cumulative GPA 2.0; Permission of Internship Coordinator

Observation and practice in selected exercise science agencies. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

KIN 4900A: Independent Study: Exercise and Sport Science

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

Independent study of problems of areas of interest in exercise and sport science and related areas. 6 credits from KIN advanced core recommended. (Typically Offered: Fall, Spring, Summer)

KIN 4900H: Independent Study

Credits: 1-2. Repeatable, maximum of 4 credits.

Prereq: Permission of Instructor; Membership in the University Honors Program

Independent study of problems of areas of interest in exercise and sport science and related areas. 6 credits from KIN advanced core recommended. (Typically Offered: Fall, Spring, Summer)

KIN 4910: Undergraduate Teaching Experience

Credits: 1-2. Repeatable, maximum of 6 credits.

Prereq: Permission of Instructor; Junior classification

Undergraduate teaching assistant opportunity in Kinesiology. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

KIN 4940A: Practicum in Motivational Interviewing for Health: Principles of Motivational Interviewing

Credits: 1. Contact Hours: Lecture 1.

Prereq: Permission of Instructor; Junior classification

Introduction to the principles of 'motivational interviewing' for behavior change and health coaching applications. Students interested in gaining practical experience in health coaching should enroll in the associated practicum course (KIN 4940B). Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

KIN 4940B: Practicum in Motivational Interviewing for Health: Supervised Experience

Credits: 1-2. Contact Hours: Laboratory 4.

Repeatable, maximum of 5 credits.

Prereq: KIN 4940A; Permission of Instructor

This supervised practicum course is designed for students interested in gaining experience in applying 'motivational interviewing' strategies in behavior change and health coaching applications. Students will have opportunities to practice motivational interviewing skills with adult clients and receive on-going support and assistance needed to refine their skills. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

KIN 4950: Special Topics in Kinesiology

Credits: 1-3. Contact Hours: Lecture 3.

Prereq: Junior classification or above

Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

KIN 5010: Research Methods in Physical Activity

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate classification

Methods and techniques used in the design and interpretation of research involving physical activity. Emphasis on styles of writing, library use, and computer applications.

KIN 5050: Research Laboratory Techniques in Exercise Physiology

Credits: 3. Contact Hours: Lecture 1, Laboratory 4.

Prereq: KIN 3580

Application and use of laboratory research equipment in exercise physiology, including operation, calibration, and use in selected situations.

KIN 5100: Advanced Medical Aspects of Exercise

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

The role of exercise in preventive medicine. Impact of exercise on various diseases, and the effect of various medical conditions on the ability to participate in vigorous exercise and competitive sports. Principles of exercise testing and prescription for individuals with these conditions.

KIN 5110: Physical Activity Strategies for Youth

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Provide adequate opportunities to develop a more in-depth understanding of (a) the challenges in youth physical activity (PA), (b) the relevant theoretical models that are popular in youth PA, (c) the strategies that can be implemented to promote PA in youth.

KIN 5120: Movement Education in Elementary School Physical Education

Credits: 3.

Prereq: Graduate Standing or Permission of Instructor

Planning for management and instruction of developmentally appropriate physical education for children pre-school through grade six. Laboratory experience required. Emphasis on evaluating published research on physical education and school-wide physical activity. (Typically Offered: Fall)

KIN 5150: Injury Biomechanics

Credits: 3. Contact Hours: Lecture 3.

Prereq: KIN 3550 or Permission of Instructor

Utilization of biomechanical principles to model injury mechanisms. Introduction to tissue mechanics of bone, articular cartilage, ligament, tendon, muscle, and nerve. Biomechanics of lower extremity, upper extremity, and head/neck/trunk injuries. Offered odd-numbered years. (Typically Offered: Fall)

KIN 5160: Quantitative Analysis of Human Movement

Credits: 3. Contact Hours: Lecture 3, Laboratory 1.

Prereq: KIN 3550

Application of the principles of mechanics to the analysis of human motion. Investigation of the effects of kinematics and kinetics on the human body with special emphasis on exercise and sport applications. Includes consideration of two-dimensional and three-dimensional imaging techniques and force measurements.

KIN 5170: Musculoskeletal Modeling

Credits: 3. Contact Hours: Lecture 3.

Prereq: KIN 3550 or Permission of Instructor

Systematic problem-solving approaches and design of computer programs for biomechanical analyses. Estimation of anthropometric parameters and mechanical properties of muscles, bones, and joints. Integration of anthropometrics, kinematics, EMG, and muscle mechanics into simulations of human movement. Offered even-numbered years. (Typically Offered: Fall)

KIN 5180: Student Teaching in Elementary Physical Education

Credits: 8.

Prereq: KIN 5120, KIN 5700, KIN 5750

Student teaching for 8 weeks in an elementary school. (Typically Offered: Fall, Spring)

KIN 5190: Student Teaching in Secondary Physical Education

Credits: 8.

Prereq: KIN 5120, KIN 5700, KIN 5750

Student teaching for 8 weeks in a middle or high school. (Typically Offered: Fall, Spring)

KIN 5210: Advanced Topics in Exercise and Sport Psychology

Credits: 3. Contact Hours: Lecture 3.

Prereq: KIN 3650 or KIN 3660, 3 courses in psychology; open to Kin majors only

Aspects of psychology which form a basis for understanding and explaining behavior in the context of exercise and sport. Emphasis on evaluating published research, particularly theory and research methodology. Student presentations.

KIN 5490: Advanced Vertebrate Physiology I

(Cross-listed with ANS 5490/ NUTRS 5490).

Credits: 4. Contact Hours: Lecture 4.

Prereq: Undergraduate course in Physiology and Biochemistry

Overview of mammalian physiology. Cell biology, endocrinology, cardiovascular, respiratory, immune, digestive, skeletal muscle and reproductive systems. (Typically Offered: Fall)

KIN 5500: Advanced Physiology of Exercise I

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: KIN 5050

Analysis of factors affecting work capacity and performance. Concepts and measurement of human energy metabolism and bioenergetic adaptations to training.

KIN 5510: Advanced Physiology of Exercise II

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: KIN 5050

Analysis of factors affecting cardiovascular and respiratory function in response to multiple stressors including exercise. Influence of environment will also be discussed.

KIN 5600: Principles of Neuromotor Control and Learning

Credits: 3. Contact Hours: Laboratory 3, Lecture 2.

Prereq: KIN 3720

Theoretical perspectives of neuromotor control and learning will be examined as well as factors that facilitate motor learning. Neuromotor control and learning will also be addressed by studying functional tasks such as reach-to-grasp and locomotion.

KIN 5610: Motor Development and Physical Activity

Credits: 2-3. Contact Hours: Lecture 2.

Prereq: PSYCH 2300

Addresses theories and underlying mechanisms of motor development and motor control applied to typically and atypically developing children. Developmental control of balance, locomotion, reach-to-grasp, and other functional skills will be discussed, as will the role of physical activity in a child's life.

KIN 5670: Exercise and Health: Behavior Change

(Dual-listed with KIN 4670).

Credits: 3. Contact Hours: Lecture 3.

Prereq: KIN 3660 or Permission of Instructor

Advanced analysis of theoretical health behavior models and their application to physical activity behavior. Includes practical techniques, tools and interventions (e.g., counseling skills, motivational interviewing) to enhance exercise prescription and motivation, and considerations for working with special populations. (Typically Offered: Fall, Spring)

KIN 5700: Physical Activity Assessment for Health Related Research

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

This course will cover the broad scope of research in physical activity and public health. Emphasis will be placed on the application of physical activity assessment techniques since accurate measures are needed to more accurately assess the health benefits from physical activity and to evaluate the effectiveness of behavioral interventions designed to promote physical activity.

KIN 5710: Measurement in Physical Education

(Dual-listed with KIN 4710).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Current theory, practice and research on measurement and evaluation in physical education and youth physical activity settings. Statistics, grading, and specific assessments including fitness, motor skill, sport skill, physical activity, affective, and cognitive testing will be addressed. Graduation Restriction: KIN 5710 may not be taken by students who previously earned credit in KIN 4710. (Typically Offered: Spring)

KIN 5720: Neural Basis of Human Movement

(Dual-listed with KIN 4720).

Credits: 3. Contact Hours: Lecture 3.

Prereq: KIN 3720 or PSYCH 3100

Addresses the role of the central nervous system in the control of voluntary human movement, with the focus on the cerebral cortex, basal ganglia and cerebellum. Content organized around specific nervous system damage (such as stroke, apraxia, spasticity, or spinal cord damage) and functional movements (such as reaching and grasping, balance and gait). Converging evidence from human movement disorders, brain imaging, animal lesion and single cell studies provide the primary basis for the content. (Typically Offered: Fall, Spring)

KIN 5730X: Impact of Physical Activity on Healthy Aging

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Issues of aging from multiple kinesiological perspectives, such as the role of physical activity on brain health, on muscle health, on bone health, and on emotional health. Presentation of research article by students, and discussion; or research articles. Guest professors will present within their area of expertise and lead the discussions. Each student will complete a major writing assignment and verbal presentation in which a review of literature on a related topic will be presented. Offered odd-numbered years. (Typically Offered: Fall)

KIN 5750: Physical Education Curriculum Design and Program Organization

(Dual-listed with KIN 4750).

Credits: 3. Contact Hours: Lecture 3.

Prereq: KIN 2800; KIN 2810; Admission to Educator Preparation Program

Current theory, practices and principles applied to curriculum development for programs in physical education, K-12. Organizing for teaching in a variety of school settings. (Typically Offered: Fall)

KIN 5900A: Special Topics: Physical Education

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

KIN 5900B: Special Topics: Health and Exercise Promotion

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

KIN 5900D: Special Topics: Exercise Physiology

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

KIN 5900E: Special Topics: Sport Sociology

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

KIN 5900F: Special Topics: Sport/Exercise Psychology

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

KIN 5900G: Special Topics: Motor Behavior

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

KIN 5900H: Special Topics: Biomechanics

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

KIN 5900I: Special Topics: Research Ethics

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

KIN 5910A: Supervised Field Experience: Physical Education

Credits: 1-6. Repeatable.

Prereq: Instructor Permission for Course

Supervised on-the-job field experience in special areas. (Typically Offered: Fall, Spring, Summer)

KIN 5910B: Supervised Field Experience: Health and Exercise Promotion

Credits: 1-6. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Supervised on-the-job field experience in special areas.

KIN 5910D: Supervised Field Experience: Exercise Physiology

Credits: 1-6. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Supervised on-the-job field experience in special areas.

KIN 5920: Practicum in College Teaching

Credits: 1-3. Repeatable, maximum of 3 credits.

Prereq: Instructor Permission for Course

Supervised experience with teaching an upper division, classroom-based course. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

KIN 5950: Adapted Physical Education

(Dual-listed with KIN 3950).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Junior classification or above

Etiology, characteristics, needs, and movement experiences for individuals with disabilities. Designed to provide appropriate methods of physical education instruction for students including those with disabilities as identified by the Individuals with Disabilities Education Act and students who are talented and gifted. Assessments and strategies to differentiate instruction and to adapt activities for all exceptional learners will be addressed. Laboratory experience required. Graduation Restriction: KIN 5950 may not be taken by students who previously earned credit in KIN 3950. (Typically Offered: Fall)

KIN 5990: Creative Component

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

Courses for graduate students:

KIN 6150: Seminar

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

(Typically Offered: Fall, Spring, Summer)

KIN 6200: Advance Research Methods in Physical Activity

Credits: 3. Contact Hours: Lecture 3.

Prereq: KIN 5010, STAT 4710 and STAT 5870. Doctoral students only

Culminating seminar designed to synthesize statistical and design courses with practical research issues using data from physical activity. (Typically Offered: Spring)

KIN 6610: Advanced Topics in Neuroscience

(Cross-listed with BBMB 6610/ GDCB 6610/ NEURO 6610).

Credits: 3. Contact Hours: Lecture 3.

Students will present three journal articles and two overview lectures on topics in neuroscience that are related but outside of their own research interest. Offered even-numbered years. (Typically Offered: Spring)

KIN 6700: Molecular Biology of Muscle

(Cross-listed with ANS 6700).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BBMB 4050, BBMB 4200

Ultrastructure of muscle; chemistry, structure, function, and molecular biology of muscle proteins. Molecular aspects of muscle contraction, development and turnover. Cytoskeletal proteins and dynamics. Offered odd-numbered years. (Typically Offered: Spring)

KIN 6990: Research

Credits: 1-6. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

Landscape Architecture (LA)

Courses primarily for undergraduates:

LA 2010: Studio: Landscape Interpretation and Representation

Credits: 6. Contact Hours: Studio 12.

Prereq: Landscape Architecture professional program

Reading and representing varied landscapes; development of aesthetic sensitivity to the geomorphology, vegetation, and cultural influences on these landscapes. Small-scale interventions and exploration of landscape phenomena and change. Emphasis on a variety of documentation and drawing techniques. (Typically Offered: Fall)

LA 2020: Studio: Site Design I

Credits: 6. Contact Hours: Studio 12.

Prereq: LA 2010

Fundamental issues of landscape planning and design at a site scale. Projects introduce a variety of (objective and subjective) site inquiry methods, space and place making, and sensitive integration of architecture and landscape for specific land uses. User needs, precedent study, programming, site engineering, planting design, and outdoor space design expressed through a variety of three-dimensional modeling, graphic, and written media. (Typically Offered: Spring)

LA 2110: Digital Design Methods for Landscape Architecture

(Cross-listed with CRP 2110).

Credits: 3. Contact Hours: Lecture 3.

Foundational knowledge and basic skills in 2D, 3D, and 4D computer applications used for design development and communication, with emphasis on 3D modeling and workflow interoperability. (Typically Offered: Spring)

LA 2210: Native Plants of the Savanna Ecotone

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Landscape Architecture professional program

Observation and study of the wetland, prairie, and woodland vegetation native to the savanna ecotone. Emphasis on plant communities, their distribution, structure, habitat and aesthetics. Plant identification and use in landscape design. Precedent and case studies of vegetation preservation, restoration and use in built works. (Typically Offered: Fall)

LA 2220: Introduced Plants of the Midwest

Credits: 3. Contact Hours: Lecture 2, Studio 3.

Prereq: LA 2210

Identification, observation, and study of plants introduced to cultivation in the Midwest region. Plant cultural requirements, including adaptations to climate changes, solar exposure, and soil conditions. Investigation of history of plant introduction and use in designed landscape, including consequent impacts of plant introduction such as plant invasion. Introduction to planting design at the site scale, including matching plant cultural requirements to site conditions, functional uses of plants and expressive composition using plant form, texture and color. (Typically Offered: Spring)

LA 2410: Developing Identity as a Landscape Architect

Credits: 1. Contact Hours: Lecture 1.

Prereq: Landscape Architecture professional program

Development of life skills for conflict resolution, effective interpersonal communication, and CPR/First Aid. Examination of personal values as they relate to the backgrounds, abilities, attitudes, and values of others; exploration of how these influence personal decision-making and group interaction. Reading, discussion, class activities, journal-keeping, writing. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

LA 2700: Foundations in Natural Resource Policy and History

(Cross-listed with ENVS 2700/ NREM 2700).

Credits: 3. Contact Hours: Lecture 3.

The development of natural resource conservation philosophy and policy from the Colonial Era to the present. North American wildlife, forestry, and environmental policy; national parks and other protected lands; federal and state agencies. Relationship to cultural contexts, including urban reform and American planning movement. Discussion of common pool resources, public and private lands. (Typically Offered: Fall)

LA 2720: Landscape Studies

Credits: 3. Contact Hours: Lecture 3.

Prereq: Landscape Architecture professional program

Exploration of landscapes, from broad settlement patterns to individual sites. Investigation of relationships between vernacular and designed landscapes. Landscapes considered as modes of cultural production that shape and are shaped by social, political, and economic processes. Lectures, reading, field studies, and writing. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall)

LA 2740: The Social and Behavioral Landscape

Credits: 3. Contact Hours: Lecture 3.

Exploration of social and behavioral factors pertinent to design of the domestic, civic, and commercial landscape. Focus on working familiarity with design principles as they relate to the behavior and activities of people across a broad demographic and cultural spectrum; application of these principles to design of outdoor environments. Lectures and discussions, including group exercises and field trips. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Spring)

LA 2810: Investigating Landscape Form, Process, and Detail

Credits: 3. Contact Hours: Lecture 1, Laboratory 6.

Prereq: Landscape Architecture professional program

Exploration of the poetics and principles of landscape construction. Investigation and interpretation of landform and geomorphic processes such as the hydrologic cycle, erosion, and sedimentation. Close observation and representation of detail design, with an emphasis on material types, their connections, and weathering. Readings, field studies, and drawings in analog and digital media. (Typically Offered: Fall)

LA 3010: Site Design II

Credits: 6. Contact Hours: Studio 12.

Prereq: LA 2020

Iterative development of half-acre to hundred-acre landscape design and planning proposals. Assess and interpret a program of use, organize subjective and objective site inventory and analysis, and develop functional and poetic conceptual design strategies. Development of high-quality verbal and graphic skills to support design process and iteration. (Typically Offered: Fall)

LA 3020: Ecological Design

Credits: 6. Contact Hours: Studio 12.

Prereq: LA 2820, LA 3010, LA 3810 and NREM 1200

Exploration and application of ecological theories and processes in design and planning to include hundred plus-acre scale in urban, urban fringe, and rural landscapes. Apply advanced landscape analysis of soil, water, topography, and vegetation utilizing geographic information systems with an emphasis on inventory and analysis mapping. (Typically Offered: Spring)

LA 3090: Field Travel

Credits: 1-2. Repeatable, maximum of 2 times.

Prereq: Landscape Architecture professional program

Observation of and reflection on professional practice and landscapes in urban, rural, and wilderness areas. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

LA 3220: Fundamentals of Planting Design

Credits: 3.

Prereq: LA 2020

The art and techniques of creating plant compositions in the landscape that respond to cultural and biophysical contexts. Methods of site inventory and analysis, developing plant palettes and composing plant assemblages that address biodiversity, expressive and functional needs. Introduction to the techniques of preparing planting plans, including standards for plant selection, plant lists and plant specification. (Typically Offered: Fall)

LA 3410: Contemporary Landscape Architecture

Credits: 1. Contact Hours: Lecture 1.

Prereq: LA 3010, LA 3810 and NREM 1200

Exploration of contemporary landscape architectural practice through individualized research into practicing firms. Preparation of paper and presentation outlining broad framework and specific parameters of a selected area of contemporary practice using specific projects as examples. Work may result in invitation of current practitioner(s) as a lecture series or event. Resume and portfolio preparation in advance of required off-campus semester (LA 4440 A, B or C). (Typically Offered: Spring)

LA 3710: History of Modern Landscapes, 1750 to Present

Credits: 3. Contact Hours: Lecture 3.

Investigation of landscape design concepts and trends as observed over time, from approximately 1750 to the present, with emphasis on the United States and Europe. Examination of significant figures and outstanding works (sites, gardens, landscapes, monuments, subdivisions, city plans, etc.) of varied geographic regions. Analysis of the social, economic, political, and technical forces contributing to the development of landscape design styles, vocabulary, and literature. Lectures, readings, projects, research papers. (Typically Offered: Fall)

LA 3730: Gardens and Landscapes from Antiquity to 1750

Credits: 3. Contact Hours: Lecture 3.

Investigation of international landscape design concepts and trends as observed over time, from pre-history to the mid 18th century. Examination of significant figures and outstanding works (sites, gardens, landscapes, monuments, subdivisions, city plans, etc.) of varied geographic regions. Analysis of the social, economic, political, and technical forces contributing to the development of landscape design styles, vocabulary, and literature. Lectures, readings, projects, research papers. Meets International Perspectives Requirement. (Typically Offered: Spring)

LA 3810: Shaping the Land

Credits: 3.

Design of landforms to achieve aesthetic, functional, and safety goals. Landform changes to accommodate human uses and activities. Impacts and implications of landform transformation on the surrounding environment. Surface and subsurface drainage design, storm water runoff best management practices, contour manipulation to incorporate slopes, swales, culverts, pads, retaining walls, walks, steps, terraces, buildings, and other structures in the landscape. Road layout and alignment, parking lot design, and earthwork volume estimates. Design communication using CAD, perspectives, cross-sections, contour maps, landform models, and narratives. Class exercises, case study precedents, and preliminary construction documents. (Typically Offered: Fall)

LA 4020: Urban Design

Credits: 6. Contact Hours: Studio 12.

Prereq: LA 3020

Comprehensive planning and design for urban sites or for sites within urban contexts. Projects typically include planning for a variety of integrated land uses, and cover the full range of design scales from master planning to proposals for site details. Emphasis on written and verbal as well as graphic communications. Integrated seminar component. (Typically Offered: Fall)

LA 4020H: Urban Design: Honors

Credits: 7. Contact Hours: Studio 12.

Repeatable.

Prereq: LA 3020; Membership in the University Honors Program

Comprehensive planning and design for urban sites or for sites within urban contexts. Projects typically include planning for a variety of integrated land uses, and cover the full range of design scales from master planning to proposals for site details. Emphasis on written and verbal as well as graphic communications. Integrated seminar component. (Typically Offered: Fall)

LA 4030H: Senior Thesis Preparation Tutorial

Credits: 2.

Prereq: LA 4020 or LA 4020H; permission of thesis advisor; Membership in the Honors Program

Preparation for senior thesis. (Typically Offered: Fall)

LA 4040: Advanced Landscape Architectural Design

Credits: 6. Contact Hours: Studio 12.

Repeatable, maximum of 2 times.

Prereq: LA 4020

Advanced forum for the demonstration of sophistication in landscape architectural design. Experimentation and innovation are encouraged. (Typically Offered: Fall)

LA 4040H: Advanced Landscape Architectural Design: Honors

Credits: 6-7. Contact Hours: Studio 12.

Repeatable, maximum of 2 times.

Prereq: LA 4020; Membership in the University Honors Program

Advanced forum for the demonstration of sophistication in landscape architectural design. Experimentation and innovation are encouraged. (Typically Offered: Fall)

LA 4050H: Senior Thesis

Credits: 6. Contact Hours: Studio 15.

Prereq: LA 4010; LA 4020; LA 4030; Department Permission; Membership in the University Honors Program

Individual advanced forum for the demonstration of sophistication in landscape architectural design. Experimentation and innovation are expected.

LA 4110: Advanced Digital Design for Landscape Architecture

Credits: 3. Contact Hours: Lecture 3.

Visualization of site scale design for presentation and analysis with emphasis on 3D modeling, rendering, videography, and parametric methods. (Typically Offered: Spring)

LA 4420: Professional Practice

(Dual-listed with LA 5420).

Credits: 2. Contact Hours: Lecture 2.

Prereq: LA 4810

Studies of conventional and developing forms of public and private practice. Explore relationships between professional life and the culture of the professional design firm; investigate firm identities and structures; understand design projects, their delivery process, and contractual agreements. Lecture and class discussion. (Typically Offered: Spring)

LA 4440A: Landscape Architecture Independent Educational Enrichment: Professional Internship

Credits: Required. Repeatable, maximum of 3 times.

Prereq: LA 3410 or Permission of Advisor and Chair

Independent educational enrichment through exploration of landscape architectural practice in a professional internship, international studies, or out-of-region national study experience. (Typically Offered: Fall, Spring, Summer)

LA 4440B: Landscape Architecture Independent Educational Enrichment: Study Abroad

Credits: Required. Repeatable, maximum of 3 times.

Prereq: LA 3410 or Permission of Advisor and Chair

Independent educational enrichment through exploration of landscape architectural practice in a professional internship, international studies, or out-of-region national study experience. (Typically Offered: Fall, Spring, Summer)

LA 4440C: Landscape Architecture Independent Educational Enrichment: National Student Exchange

Credits: Required. Repeatable, maximum of 0 credits.

Prereq: LA 3410 or Permission of Advisor and Chair

Independent educational enrichment through exploration of landscape architectural practice in a professional internship, international studies, or out-of-region national study experience. (Typically Offered: Fall, Spring, Summer)

LA 4540: Fundamentals of Remote Sensing and Spatial Analysis

(Dual-listed with CRP 5540/ LA 5540). (Cross-listed with CRP 4540).

Credits: 3. Contact Hours: Lecture 3.

Prereq: CRP 3510 or AGRON 2700 or NREM 3450 or GEOL 4520 or LA 3020 or CRP 5510 or GEOL 5520

Introduction to image processing techniques needed for analysis of optical remote sensing imagery, including filtering, enhancement, and classification. Analysis of elevation surfaces, hydrology, distance, overlays and visual programming with Model Builder. Practical applications in a variety of topics to understand how to analyze imagery. (Typically Offered: Spring)

LA 4590: Digital Design Methods for Landscape Architecture

(Dual-listed with LA 5590).

Credits: 3. Contact Hours: Lecture 3.

Introduction to digital tools used by landscape architects for design communication, visualization, and design development, with emphasis on 3D modeling and workflow interoperability. (Typically Offered: Spring)

LA 4780A: Topical Studies in Landscape Architecture: Landscape Design

(Dual-listed with LA 5780A).

Credits: 2-3. Contact Hours: Lecture 3.

Repeatable, maximum of 3 times.

Prereq: LA 2020 OR Senior or Graduate classification

Offerings vary with each term; check with department for available sections. (Typically Offered: Fall, Spring, Summer)

LA 4780B: Topical Studies in Landscape Architecture: Planting Design

(Dual-listed with LA 5780B).

Credits: 2-3. Contact Hours: Lecture 3.

Repeatable, maximum of 3 times.

Prereq: LA 2020 OR Senior or Graduate classification

Offerings vary with each term; check with department for available sections. (Typically Offered: Fall, Spring, Summer)

LA 4780C: Topical Studies in Landscape Architecture: Construction
(Dual-listed with LA 5780C).

Credits: 2-3. Contact Hours: Lecture 3.

Repeatable, maximum of 3 times.

Prereq: LA 2020 OR Senior or Graduate classification

Offerings vary with each term; check with department for available sections. (Typically Offered: Fall, Spring, Summer)

LA 4780D: Topical Studies in Landscape Architecture: History/Theory/Criticism
(Dual-listed with LA 5780D).

Credits: 2-3. Contact Hours: Lecture 3.

Repeatable, maximum of 3 times.

Prereq: LA 2020 OR Senior or Graduate classification

Offerings vary with each term; check with department for available sections. (Typically Offered: Fall, Spring, Summer)

LA 4780E: Topical Studies in Landscape Architecture: Landscape Planning
(Dual-listed with LA 5780E).

Credits: 2-3. Contact Hours: Lecture 3.

Repeatable, maximum of 3 credits.

Prereq: LA 2020 OR Senior or Graduate classification

Offerings vary with each term; check with department for available sections. (Typically Offered: Fall, Spring, Summer)

LA 4780F: Topical Studies in Landscape Architecture: Urban Design
(Dual-listed with LA 5780F).

Credits: 2-3. Contact Hours: Lecture 3.

Repeatable, maximum of 3 times.

Prereq: LA 2020 OR Senior or Graduate classification

Offerings vary with each term; check with department for available sections. (Typically Offered: Fall, Spring, Summer)

LA 4780G: Topical Studies in Landscape Architecture: Graphics
(Dual-listed with LA 5780G).

Credits: 2-3. Contact Hours: Lecture 3.

Repeatable, maximum of 3 times.

Prereq: LA 2020 OR Senior or Graduate classification

Offerings vary with each term; check with department for available sections. (Typically Offered: Fall, Spring, Summer)

LA 4780H: Topical Studies in Landscape Architecture: Honors
(Dual-listed with LA 5780H).

Credits: 2-3. Contact Hours: Lecture 3.

Repeatable, maximum of 3 times.

Prereq: LA 2020 OR Senior or Graduate classification; Membership in the University Honors Program

Offerings vary with each term; check with department for available sections. (Typically Offered: Fall, Spring, Summer)

LA 4780I: Quality of Life, Health, and the Environment
(Dual-listed with LA 5780I).

Credits: 2-3. Contact Hours: Lecture 3.

Repeatable, maximum of 3 times.

Prereq: LA 2020 OR Senior or Graduate classification

Offerings vary with each term; check with department for available sections. (Typically Offered: Fall, Spring, Summer)

LA 4780J: Topical Studies in Landscape Architecture: International Studies
(Dual-listed with LA 5780J).

Credits: 2-3. Contact Hours: Lecture 3.

Repeatable, maximum of 3 times.

Prereq: LA 2020 OR Senior or Graduate classification

Offerings vary with each term; check with department for available sections. (Typically Offered: Fall, Spring, Summer)

LA 4780K: Landscape Architecture: Computer Applications
(Dual-listed with LA 5780K).

Credits: 2-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: LA 2020 OR Senior or Graduate classification

Offerings vary with each term; check with department for available sections. Course contact hours can range from (2-0) to (3-0) depending on number of credits. (Typically Offered: Fall, Spring, Summer)

LA 4780L: Topical Studies in Landscape Architecture: Ecological Design
(Dual-listed with LA 5780L).

Credits: 2-3. Contact Hours: Lecture 3.

Repeatable, maximum of 3 times.

Prereq: LA 2020 OR Senior or Graduate classification

Offerings vary with each term; check with department for available sections. (Typically Offered: Fall, Spring, Summer)

LA 4780M: Topical Studies in Landscape Architecture: Landscape Architecture: Social/Behavioral
(Dual-listed with LA 5780M).

Credits: 2-3. Contact Hours: Lecture 3.

Repeatable, maximum of 3 times.

Prereq: LA 2020 OR Senior or Graduate classification

Offerings vary with each term; check with department for available sections. (Typically Offered: Fall, Spring, Summer)

LA 4780N: Topical Studies in Landscape Architecture: Natural Resources
(Dual-listed with LA 5780N).

Credits: 2-3. Contact Hours: Lecture 3.

Repeatable, maximum of 3 times.

Prereq: LA 2020 OR Senior or Graduate classification

Offerings vary with each term; check with department for available sections. (Typically Offered: Fall, Spring, Summer)

LA 4810: Landscape Materials

(Dual-listed with LA 5810).

Credits: 3. Contact Hours: Lecture 3.

Prereq: LA 3810

Examination and identification of characteristics, applications, systems, and uses of common landscape construction materials including wood, paving, walls, masonry, concrete, and metals. Investigation of the relationships between site plans and construction details with an emphasis on the aesthetic and functional use of landscape details. Preliminary preparation of construction documents using design documentation software. (Typically Offered: Spring)

LA 4820: Landscape Construction Documentation

Credits: 3. Contact Hours: Lecture 3.

Prereq: LA 4810

Development of advanced construction documents, including documentation processes, cost estimation, sheet coordination, and specification writing. Emphasis on documentation software as a tool for design communication. (Typically Offered: Spring)

LA 4900A: Independent Study: Landscape Design

Credits: 1-6. Repeatable, maximum of 3 times.

Prereq: Department Permission for Course

Investigation of a topic of special interest to the student. (Typically Offered: Fall, Spring, Summer)

LA 4900B: Independent Study: Planting Design

Credits: 1-6. Repeatable, maximum of 3 times.

Prereq: Department Permission for Course

Investigation of a topic of special interest to the student. (Typically Offered: Fall, Spring, Summer)

LA 4900C: Independent Study: Construction

Credits: 1-6. Repeatable, maximum of 3 times.

Prereq: Department Permission for Course

Investigation of a topic of special interest to the student. (Typically Offered: Fall, Spring, Summer)

LA 4900D: Independent Study: History/Theory/Criticism

Credits: 1-6. Repeatable, maximum of 3 times.

Prereq: Instructor Permission for Course

Investigation of a topic of special interest to the student. (Typically Offered: Fall, Spring, Summer)

LA 4900E: Independent Study: Landscape Planning

Credits: 1-6. Repeatable, maximum of 3 times.

Prereq: Department Permission for Course

Investigation of a topic of special interest to the student. (Typically Offered: Fall, Spring, Summer)

LA 4900F: Independent Study: Urban Design

Credits: 1-6. Repeatable, maximum of 6 credits.

Prereq: Department Permission for Course

Investigation of a topic of special interest to the student. (Typically Offered: Fall, Spring, Summer)

LA 4900G: Independent Study: Graphics

Credits: 1-6. Repeatable, maximum of 3 times.

Prereq: Department Permission for Course

Investigation of a topic of special interest to the student. (Typically Offered: Fall, Spring, Summer)

LA 4900H: Independent Study: Honors

Credits: 1-6. Repeatable, maximum of 3 times.

Prereq: Department Permission for Course; Membership in the University Honors Program

Investigation of a topic of special interest to the student. (Typically Offered: Fall, Spring, Summer)

LA 4900I: Independent Study: Interdisciplinary Studies

Credits: 1-6. Repeatable, maximum of 3 times.

Prereq: Department Permission for Course

Investigation of a topic of special interest to the student. (Typically Offered: Fall, Spring, Summer)

LA 4900J: Independent Study: International Studies

Credits: 1-6. Repeatable, maximum of 3 times.

Prereq: Department Permission for Course

Investigation of a topic of special interest to the student. (Typically Offered: Fall, Spring, Summer)

LA 4900K: Independent Study: Computer Applications

Credits: 1-6. Repeatable, maximum of 3 times.

Prereq: Department Permission for Course

Investigation of a topic of special interest to the student. (Typically Offered: Fall, Spring, Summer)

LA 4900L: Independent Study: Ecological Design

Credits: 1-6. Repeatable, maximum of 3 times.

Prereq: Department Permission for Course

Investigation of a topic of special interest to the student. (Typically Offered: Fall, Spring, Summer)

LA 4900M: Independent Study: Social/Behavioral

Credits: 1-6. Repeatable, maximum of 3 times.

Prereq: Department Permission for Course

Investigation of a topic of special interest to the student. (Typically Offered: Fall, Spring, Summer)

LA 4900N: Independent Study: Natural Resources

Credits: 1-6. Repeatable, maximum of 3 times.

Prereq: Department Permission for Course

Investigation of a topic of special interest to the student. (Typically Offered: Fall, Spring, Summer)

LA 4910: Environmental Law and Planning

(Dual-listed with CRP 5910/ LA 5910). (Cross-listed with ENVS 4910/ CRP 4910).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 6 credits natural sciences or permission of instructor

Environmental law and policy as applied in planning at the local and state levels. Brownfields, environmental justice, water quality, air quality, wetland and floodplain management, and local government involvement in ecological protection through land use planning and other programs. (Typically Offered: Spring)

Courses primarily for graduate students, open to qualified undergraduates:

LA 5090: Field Travel

Credits: 1. Repeatable, maximum of 2 times.

Prereq: Graduate Standing or Permission of Instructor

Observation of and reflection on professional and academic practice and landscapes. Field study and travel to conferences and educational events. Reading and final report. Offered on a satisfactory-fail basis only.

LA 5210: Introduction to Plants

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Observation and study of plants adapted to the Midwest ecoregion. Emphasis on plant communities, their distribution, structure, habitat and aesthetics. Plant identification and use of planted form in the designed landscape. (Typically Offered: Fall)

LA 5220: Advanced Plant Technology

Credits: 3. Contact Hours: Lecture 2, Studio 2.

Prereq: Graduate Standing or Permission of Instructor

Introduction to the science that supports green technologies. Plant and soil design for performance in the built environment. Design studies and lab explorations will complement readings, lecture and project case study presentations by practitioners. Green streets, green roofs, bio-phyto-remediation and other technologies are introduced. Final project integrates scientific and technical knowledge in a holistic landscape design. (Typically Offered: Fall)

LA 5410: Design Inquiry

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Examination of design inquiry and introduction to research methods relevant to design. Consideration of where knowledge comes from, and how different research methods help create knowledge in various contexts. Readings, discussions, and sketch problems. Preparation of a written research proposal. (Typically Offered: Spring)

LA 5420: Professional Practice

(Dual-listed with LA 4420).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Studies of conventional and developing forms of public and private practice. Explore relationships between professional life and the culture of the professional design firm; investigate firm identities and structures; understand design projects, their delivery process, and contractual agreements. Lecture and class discussion. (Typically Offered: Spring)

LA 5430: Colloquium: Landscape Architecture Research

Credits: 1. Contact Hours: Lecture 1.

Prereq: Graduate Standing or Permission of Instructor

Forum on current research in landscape architecture. Weekly presentation and discussion of scholarship relevant to the field. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

LA 5540: Fundamentals of Remote Sensing and Spatial Analysis

(Dual-listed with CRP 4540/ LA 4540). (Cross-listed with CRP 5540).

Credits: 3. Contact Hours: Lecture 3.

Introduction to image processing techniques needed for analysis of optical remote sensing imagery, including filtering, enhancement, and classification. Analysis of elevation surfaces, hydrology, distance, overlays and visual programming with Model Builder. Practical applications in a variety of topics to understand how to analyze imagery. (Typically Offered: Spring)

LA 5570: Landscape Parametrics & Design Coding

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to parametric landscape design through computer programming of the landscape palette. Terrain, vegetation, water, weather, and lighting effects are modeled and represented algorithmically in Rhino-Grasshopper. Computational thinking, logic, and interactivity are combined to address core design principles. (Typically Offered: Fall)

LA 5580: Web Mapping and Spatial Data Visualization

(Cross-listed with CRP 5580).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Use and development of online mapping tools and coding to support participatory GIS, Volunteered Geographic Information, information sharing, geodesign, and decision-making actions. Geoprocessing, spatial data science, and user interface design. Laboratory emphasis on practical applications and uses of Web GIS.

LA 5590: Digital Design Methods for Landscape Architecture

(Dual-listed with LA 4590).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to digital tools used by landscape architects for design communication, visualization, and design development, with emphasis on 3D modeling and workflow interoperability. (Typically Offered: Spring)

LA 5710: Landscape Architectural Theory

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Examination of the development of landscape architectural ideas in their historical contexts and in relation to social and cultural practices. Emphasis on exposure to key modern and contemporary texts and projects in landscape architecture, architecture, art, and related fields. Readings, discussions, and writings. (Typically Offered: Fall)

LA 5715: History of Landscape Architecture

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

History of the profession, with emphasis on its origins in the United States and Europe. Examination of significant figures and outstanding works (sites, gardens, landscapes, monuments, subdivisions, city plans, etc.) Analysis of the social, economic, political, and technical forces contributing to the development of the profession and its literature. Lectures, readings, projects, research papers. (Typically Offered: Fall)

LA 5740: Environmental Justice in Built Environments

(Dual-listed with LA 4740).

Credits: 3. Contact Hours: Lecture 3.

Introduction to inequitable access to healthy environments as an issue in planning and design. Focus on cumulative effects of climate change, environmental hazards, and physical design on vulnerable populations. Examination of current research. Mapping in GIS and spatial analysis to assess unjust environmental burdens and equitable built environments. (Typically Offered: Spring, Spring)

LA 5780A: Topical Studies in Landscape Architecture: Landscape Design

(Dual-listed with LA 4780A).

Credits: 2-3. Contact Hours: Lecture 3.

Repeatable, maximum of 3 times.

Prereq: Graduate Standing or Permission of Instructor

Offerings vary with each term; check with department for available sections. (Typically Offered: Fall, Spring, Summer)

LA 5780B: Topical Studies in Landscape Architecture: Planting Design

(Dual-listed with LA 4780B).

Credits: 2-3. Contact Hours: Lecture 3.

Repeatable, maximum of 3 times.

Prereq: Graduate Standing or Permission of Instructor

Offerings vary with each term; check with department for available sections. (Typically Offered: Fall, Spring, Summer)

LA 5780C: Topical Studies in Landscape Architecture: Construction

(Dual-listed with LA 4780C).

Credits: 2-3. Contact Hours: Lecture 3.

Repeatable, maximum of 3 times.

Prereq: Graduate Standing or Permission of Instructor

Offerings vary with each term; check with department for available sections. (Typically Offered: Fall, Spring, Summer)

LA 5780D: Topical Studies in Landscape Architecture: History/Theory/ Criticism

(Dual-listed with LA 4780D).

Credits: 2-3. Contact Hours: Lecture 3.

Repeatable, maximum of 3 times.

Prereq: Graduate Standing or Permission of Instructor

Offerings vary with each term; check with department for available sections. (Typically Offered: Fall, Spring, Summer)

LA 5780E: Topical Studies in Landscape Architecture: Landscape Planning

(Dual-listed with LA 4780E).

Credits: 2-3. Contact Hours: Lecture 3.

Repeatable, maximum of 3 times.

Prereq: Graduate Standing or Permission of Instructor

Offerings vary with each term; check with department for available sections. (Typically Offered: Fall, Spring, Summer)

LA 5780F: Topical Studies in Landscape Architecture: Urban Design

(Dual-listed with LA 4780F).

Credits: 2-3. Contact Hours: Lecture 3.

Repeatable, maximum of 3 times.

Prereq: Graduate Standing or Permission of Instructor

Offerings vary with each term; check with department for available sections. (Typically Offered: Fall, Spring, Summer)

LA 5780G: Topical Studies in Landscape Architecture: Graphics

(Dual-listed with LA 4780G).

Credits: 2-3. Contact Hours: Lecture 3.

Repeatable, maximum of 3 times.

Prereq: Graduate Standing or Permission of Instructor

Offerings vary with each term; check with department for available sections. (Typically Offered: Fall, Spring, Summer)

LA 5780I: Topical Studies in Landscape Architecture: Interdisciplinary Studies

(Dual-listed with LA 4780I).

Credits: 2-3. Contact Hours: Lecture 3.

Repeatable, maximum of 3 times.

Prereq: Graduate Standing or Permission of Instructor

Offerings vary with each term; check with department for available sections. (Typically Offered: Fall, Spring, Summer)

LA 5780J: Topical Studies in Landscape Architecture: International Studies

(Dual-listed with LA 4780J).

Credits: 2-3. Contact Hours: Lecture 3.

Repeatable, maximum of 3 times.

Prereq: Graduate Standing or Permission of Instructor

Offerings vary with each term; check with department for available sections. (Typically Offered: Fall, Spring, Summer)

LA 5780K: Landscape Architecture: Computer Applications

(Dual-listed with LA 4780K).

Credits: 2-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Offerings vary with each term; check with department for available sections. Course contact hours can range from (2-0) to (3-0) depending on number of credits. (Typically Offered: Fall, Spring, Summer)

LA 5780L: Topical Studies in Landscape Architecture: Ecological Design

(Dual-listed with LA 4780L).

Credits: 2-3. Contact Hours: Lecture 6.

Repeatable, maximum of 3 times.

Prereq: Graduate Standing or Permission of Instructor

Offerings vary with each term; check with department for available sections. (Typically Offered: Fall, Spring, Summer)

LA 5780M: Topical Studies in Landscape Architecture: Landscape Architecture: Social/Behavioral

(Dual-listed with LA 4780M).

Credits: 2-3. Contact Hours: Lecture 3.

Repeatable, maximum of 3 times.

Prereq: Graduate Standing or Permission of Instructor

Offerings vary with each term; check with department for available sections. (Typically Offered: Fall, Spring, Summer)

LA 5780N: Topical Studies in Landscape Architecture: Natural Resources

(Dual-listed with LA 4780N).

Credits: 2-3. Contact Hours: Lecture 3.

Repeatable, maximum of 3 times.

Prereq: Graduate Standing or Permission of Instructor

Offerings vary with each term; check with department for available sections. (Typically Offered: Fall, Spring, Summer)

LA 5800: Thesis, Creative Component Tutorial

Credits: 1-4. Repeatable, maximum of 4 credits.

Prereq: Instructor Permission for Course

Hands-on participation in a creative or research activity in the student's area of specialization. Development of a detailed prospectus that defines the thesis or creative component. (Typically Offered: Fall, Spring, Summer)

LA 5810: Landscape Materials

(Dual-listed with LA 4810).

Credits: 3. Contact Hours: Lecture 3.

Examination and identification of characteristics, applications, systems, and uses of common landscape construction materials including wood, paving, walls, masonry, concrete, and metals. Investigation of the relationships between site plans and construction details with an emphasis on the aesthetic and functional use of landscape details. Preliminary preparation of construction documents using design documentation software. (Typically Offered: Spring, Spring)

LA 5830: Landscape TopoGraphics

Credits: 3. Contact Hours: Lecture 3.

Prereq: LA 6020

Design of landforms to achieve aesthetic, functional, and safety goals. Impacts and implications of landform transformation on the surrounding environment. Design communication using CAD, perspectives, cross-sections, contour maps, landform models, and narratives. Class exercises, case study precedents, and preliminary construction documents. (Typically Offered: Fall)

LA 5900A: Special Topics: Landscape Design

Credits: 1-6. Repeatable, maximum of 2 times.

Prereq: Instructor Permission for Course

Investigation of a topic of special interest to the student. (Typically Offered: Fall, Spring, Summer)

LA 5900B: Special Topics: Planting Design

Credits: 1-6. Repeatable, maximum of 2 times.

Prereq: Instructor Permission for Course

Investigation of a topic of special interest to the student. (Typically Offered: Fall, Spring, Summer)

LA 5900C: Special Topics: Construction

Credits: 1-6. Repeatable, maximum of 2 times.

Prereq: Instructor Permission for Course

Investigation of a topic of special interest to the student. (Typically Offered: Fall, Spring, Summer)

LA 5900D: Special Topics: History/Theory/Criticism

Credits: 1-6. Repeatable, maximum of 2 times.

Prereq: Instructor Permission for Course

Investigation of a topic of special interest to the student. (Typically Offered: Fall, Spring, Summer)

LA 5900E: Special Topics: Landscape Planning

Credits: 1-6. Repeatable, maximum of 2 times.

Prereq: Instructor Permission for Course

Investigation of a topic of special interest to the student. (Typically Offered: Fall, Spring, Summer)

LA 5900F: Special Topics: Urban Design

Credits: 1-6. Repeatable, maximum of 2 times.

Prereq: Instructor Permission for Course

Investigation of a topic of special interest to the student. (Typically Offered: Fall, Spring, Summer)

LA 5900G: Special Topics: Graphics

Credits: 1-6. Repeatable, maximum of 2 times.

Prereq: Instructor Permission for Course

Investigation of a topic of special interest to the student. (Typically Offered: Fall, Spring, Summer)

LA 5900I: Special Topics: Interdisciplinary Studies

Credits: 1-6. Repeatable, maximum of 2 times.

Prereq: Instructor Permission for Course

Investigation of a topic of special interest to the student. (Typically Offered: Fall, Spring, Summer)

LA 5900J: Special Topics: International Studies

Credits: 1-6. Repeatable, maximum of 2 times.

Prereq: Instructor Permission for Course

Investigation of a topic of special interest to the student. (Typically Offered: Fall, Spring, Summer)

LA 5900K: Special Topics: Computer Applications

Credits: 1-6. Repeatable, maximum of 2 times.

Prereq: Instructor Permission for Course

Investigation of a topic of special interest to the student. (Typically Offered: Fall, Spring, Summer)

LA 5900L: Special Topics: Ecological Design

Credits: 1-6. Repeatable, maximum of 2 times.

Prereq: Instructor Permission for Course

Investigation of a topic of special interest to the student. (Typically Offered: Fall, Spring, Summer)

LA 5900M: Special Topics: Social/Behavioral

Credits: 1-6. Repeatable, maximum of 2 times.

Prereq: Instructor Permission for Course

Investigation of a topic of special interest to the student. (Typically Offered: Fall, Spring, Summer)

LA 5900N: Special Topics: Natural Resources

Credits: 1-6. Repeatable, maximum of 2 times.

Prereq: Instructor Permission for Course

Investigation of a topic of special interest to the student. (Typically Offered: Fall, Spring, Summer)

LA 5910: Environmental Law and Planning

(Dual-listed with CRP 4910/ ENVS 4910/ LA 4910). (Cross-listed with CRP 5910).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Environmental law and policy as applied in planning at the local and state levels. Brownfields, environmental justice, water quality, air quality, wetland and floodplain management, and local government involvement in ecological protection through land use planning and other programs. (Typically Offered: Spring)

LA 5990: Creative Component

Credits: 1-8. Repeatable, maximum of 8 credits.

Prereq: Instructor Permission for Course

Comprehensive study and original development of a project selected by the student and approved by the major professor. Completed project must be submitted to and approved by a graduate faculty committee as evidence of mastery of the principles of landscape architecture. (Typically Offered: Fall, Spring, Summer)

Courses for graduate students:

LA 6010: Introduction to Landscape Architecture

Credits: 6. Contact Hours: Studio 12.

Introduction to the theory and methods of landscape architectural design. Emphasis on creative space and place making at the site scale using the landscape palette. Exploration of two- and three-dimensional representation, both digital and analog, as a means of testing design ideas. (Typically Offered: Fall)

LA 6020: Designing the Living Environment

Credits: 6. Contact Hours: Studio 12.

Prereq: LA 6010

Landscape design integrating knowledge of theory, land patterns, plant ecosystems, and human processes. Projects involve landform and plants at varied scale of design. Emphasis on competencies in design based in natural process, human behavior, and representation. (Typically Offered: Spring)

LA 6030: Intermediate Landscape Architecture Studio

Credits: 6. Contact Hours: Studio 12.

Prereq: LA 6020

Theory and methods of landscape design at a variety of scales to achieve desired outcomes. Introduction to performance metrics drawn from design, humanities, and science. Development of program, inventory, and analysis to propose rigorous design "arguments" and meaningful, just and vibrant environments. (Typically Offered: Fall)

LA 6040: Urban Landscapes

Credits: 6. Contact Hours: Studio 12.

Prereq: LA 6030

Examination of sociopolitical, ecological, and visual-spatial conditions of the urban environment. Projects highlight the complexity of planning and design of urban systems. Development of innovative strategies for sustainable, healthy, and just cities. Investigation of climate impacts and evolutionary design strategies. (Typically Offered: Spring)

LA 6050: Advanced Landscape Architecture

Credits: 6. Contact Hours: Studio 12.

Prereq: LA 6040

Landscape design focusing on broadening landscape architectural concepts applied to complex sites at multiple scales. Emphasis on ideation and technical competency through advanced conceptualization, performance metrics, and skills in design research, digital representation, and teamwork.

LA 6990: Thesis Research

Credits: 1-8. Repeatable, maximum of 8 credits.

Prereq: Instructor Permission for Course

Advanced and original scholarship in a specialized area. Culminates in a thesis document submitted to and approved by a graduate faculty committee as evidence of mastery of research in landscape architecture. (Typically Offered: Fall, Spring, Summer)

Latin (LATIN)

Courses primarily for undergraduates:

LATIN 1010: Elementary Latin I

Credits: 3. Contact Hours: Lecture 3.

Grammar and vocabulary of classical Latin, within the context of Roman culture; reading knowledge through texts adapted from classical authors. (Typically Offered: Fall)

LATIN 1020: Elementary Latin II

Credits: 3. Contact Hours: Lecture 3.

Grammar and vocabulary of classical Latin, within the context of Roman culture; reading knowledge through texts adapted from classical authors. Meets International Perspectives Requirement. (Typically Offered: Spring)

LATIN 4900: Independent Study

Credits: 1-6. Repeatable, maximum of 9 credits.

Prereq: 9 credits in LATIN; Permission of Department Chair

Designed to meet the needs of students who seek work in areas other than those in which courses are offered, or who desire to integrate a study of literature or language with special problems in major fields. Graduation Restriction: No more than 9 credits in LATIN 4900 may be counted toward graduation.

Leadership Studies (LDST)

Courses primarily for undergraduates:

LDST 1220: Leading with Purpose

Credits: 1. Contact Hours: Lecture 1.

Designed for emerging student leaders. Basic leadership skills covering personal skills development, goal achievement, values-based behaviors and mission statement development. (Typically Offered: Fall, Spring)

LDST 2700: Campus Leadership Development

Credits: 3. Contact Hours: Lecture 3.

Introduce effective leadership practices for emerging leaders. Engage in experiential campus leadership opportunities. (Typically Offered: Fall, Spring, Summer)

LDST 2900: Independent Study

Credits: 1-3.

Prereq: Instructor Permission for Course

Independent study in leadership studies. Graduation Restriction: No more than 6 credits of LDST 2900 or LDST 4900 may count toward graduation. (Typically Offered: Fall, Spring, Summer)

LDST 2910A: Leading Change: General

Credits: 1-4. Contact Hours: Discussion 2, Lecture 2.

Repeatable, maximum of 6 credits.

Understand leading change and analyzing social issues through meaningful experiential learning. (Typically Offered: Fall, Spring, Summer)

LDST 2910B: Leading Change: U.S. Diversity

Credits: 1-4. Contact Hours: Lecture 4.

Repeatable, maximum of 6 credits.

Understand leading change and analyzing social issues through meaningful experiential learning with a U.S. Diversity focus. (Typically Offered: Fall, Spring, Summer)

LDST 2910C: Leading Change: International Perspectives

Credits: 1-4. Contact Hours: Lecture 4.

Repeatable, maximum of 6 credits.

Understand leading change and analyzing social issues through meaningful experiential learning with an international perspectives focus. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

LDST 2930: Special Projects

Credits: 1-3.

Prereq: Instructor Permission for Course

Special projects for the Leadership Studies Program. (Typically Offered: Fall, Spring, Summer)

LDST 3010: Leadership Theory and Practice

Credits: 3. Contact Hours: Lecture 3.

Critical examination of historical and contemporary leadership theory. Apply leadership theory to practice. (Typically Offered: Fall, Spring, Summer)

LDST 3220: Leadership in a Diverse Society

Credits: 3. Contact Hours: Lecture 3.

Experiential opportunity to understand, develop, and apply diversity-informed leadership practices. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall, Spring, Summer)

LDST 3330: Women, Gender, and Leadership

(Cross-listed with WGS 3330).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

An intersectional approach to understanding gender and leadership as it relates to women from various races, ethnicities, gender identities, sexual orientations and abilities. Meets U.S. Cultures and Communities Requirement.

LDST 3600: Cultural Competency and Global Leadership

Credits: 3. Contact Hours: Lecture 3.

Development of an intercultural mindset and leadership practice in international contexts. An analysis and development of global leadership capacities. Typically Offered: Fall (irregularly), Spring (annually), Summer (annually). Meets International Perspectives Requirement.

LDST 3700: Special Topics

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Seminar on special topics, research, or theory in leadership studies. Students must register for a different topic each time. Offered irregularly. (Typically Offered: Fall, Spring, Summer)

LDST 4220: Leadership Capstone Seminar: Theory to Practice

Credits: 3. Contact Hours: Lecture 3.

Prereq: LDST 3010 or LDST 3220 or Permission of Instructor

Analysis of adaptive leadership theory to inform practice, with emphasis on ethical leadership and creating change. (Typically Offered: Spring)

LDST 4900: Independent Study

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

Independent study in leadership studies. Graduation Restriction: No more than 6 credits of LDST 2900 or LDST 4900 may count toward graduation. (Typically Offered: Fall, Spring, Summer)

Learning and Leadership Sciences (LLS)

Courses primarily for undergraduates:

LLS 1120: Foundations of Learning and Productive Team Membership

Credits: 2. Contact Hours: Lecture 2.

Introduction to developing intentional learners and worthy team members. Learning as the foundation of human enterprise; intellectual curiosity; ethics as a personal responsibility; everyday leadership; effective team and community interactions including team learning and the effects on individuals; and growth through understanding self, demonstrating ownership of own learning, and internalizing commitment to helping others. Intentional mental processing as a means of enhancing learning. Interconnectedness of the individual, the community, and the world. (Typically Offered: Fall)

LLS 1140: Developing Responsible Learners and Effective Leaders

Credits: 2. Contact Hours: Lecture 2.

Prereq: Credit or concurrent enrollment in LLS 1120

Focus on team and community. Application of fundamentals of human learning; evidence of development as a responsible learner; intentional mental processing as a habit of mind; planning and facilitating learning opportunities for others; responsibility of the individual to the community and the world; leading from within; holding self and others accountable for growth and development as learners and leaders. (Typically Offered: Spring)

LLS 2120: Habits of Mind and Decision-Making in Leadership

Credits: 2. Contact Hours: Lecture 2.

Prereq: Credit or concurrent enrollment in LLS 1140

Application of theories about habits of mind, mindset, and critical thinking to structured cross-disciplinary problem-solving scenarios. Development and utilization of personal and team action plans for specific habits of mind associated with leadership. (Typically Offered: Fall)

LLS 3120: Problem Solving and Action Planning in Leadership

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or concurrent enrollment in LLS 2120

Transfer of theories about learning and leadership to practice. Leading for change. Using knowledge of self and interactive skills to explore interdependence. Development of an action plan that addresses a real-world problem. (Typically Offered: Spring)

LLS 4120: Learning and Leadership in Practice

Credits: 3.

Prereq: Credit or concurrent enrollment in LLS 3120

Teamwork in a practicum to execute a project that will positively change the community. Application of learning and leadership theory: framing a problem, justifying approaches, taking action, getting feedback, and planning new actions. Application to be accompanied by continual reflection and feedback. Development of final portfolio to showcase cumulative leadership growth in the Learning and Leadership Sciences minor. (Typically Offered: Fall)

Liberal Arts and Sciences Cross-Disciplinary Studies (LAS)

Courses primarily for undergraduates:

LAS 1010: Orientation

Credits: 1. Contact Hours: Lecture 1.

Prereq: Major in the College of Liberal Arts and Sciences (LAS)

For first-year LAS students. Introduction to university policies and deadlines, campus resources and services, academic success strategies, degree planning, and registration procedures. Assists with a successful academic transition to the university. Introduction to career resources. . Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

LAS 1030A: Frontiers of Research: General

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Introduction to "cutting edge" research activities of faculty members. Graduation Restriction: A maximum of three total credits of LAS 1030A, 1030B, 1030C, 1030D, 1030E can count for graduation. Offered on a satisfactory-fail basis only.

LAS 1030B: Frontiers of Research: Humanities

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Introduction to "cutting edge" research activities of faculty members. Graduation Restriction: A maximum of three total credits of LAS 1030A, 1030B, 1030C, 1030D, 1030E can count for graduation. Offered on a satisfactory-fail basis only.

LAS 1030C: Frontiers of Research: Communication

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Introduction to "cutting edge" research activities of faculty members. Graduation Restriction: A maximum of three total credits of LAS 1030A, 1030B, 1030C, 1030D, 1030E can count for graduation. Offered on a satisfactory-fail basis only.

LAS 1030D: Frontiers of Research: Mathematics and Natural Sciences

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Introduction to "cutting edge" research activities of faculty members. Graduation Restriction: A maximum of three total credits of LAS 1030A, 1030B, 1030C, 1030D, 1030E can count for graduation. Offered on a satisfactory-fail basis only.

LAS 1030E: Frontiers of Research: Social Sciences

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Introduction to "cutting edge" research activities of faculty members.

Graduation Restriction: A maximum of three total credits of LAS 1030A, 1030B, 1030C, 1030D, 1030E can count for graduation. Offered on a satisfactory-fail basis only.

LAS 1050: BOLD Learning Community Orientation

Credits: 1. Contact Hours: Lecture 1.

Orientation to the university for the 'Bridging Opportunities in Leadership and Diversity' (BOLD) Learning Community students. Support for academic, social, and leadership development. Opportunity to connect with campus and college resources, explore career opportunities and build group identity. Includes regular one to one peer mentoring with multicultural student leaders. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

LAS 1060: BOLD Learning Community Seminar

Credits: 1. Contact Hours: Lecture 1.

Continued exploration of university services, academic, social, and leadership development for BOLD Learning Community students. Individual and group identity development. Includes regular one-on-one peer mentoring with multicultural student leaders and an assessed service-learning component. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

LAS 1250A: Special Topics: General

Credits: 1. Contact Hours: Lecture 1.

Prereq: Freshman Classification

Non-disciplinary-specific special topics. Offered on a satisfactory-fail basis only.

LAS 1250B: Special Topics: Humanities

Credits: 1. Contact Hours: Lecture 1.

Prereq: Freshman Classification

Humanities special topics. Offered on a satisfactory-fail basis only.

LAS 1250C: Special Topics: Communication

Credits: 1. Contact Hours: Lecture 1.

Prereq: Freshman Classification

Communication special topics. Offered on a satisfactory-fail basis only.

LAS 1250D: Special Topics: Mathematics and Natural Sciences

Credits: 1. Contact Hours: Lecture 1.

Prereq: Freshman Classification

Special topics in mathematics and natural sciences. Offered on a satisfactory-fail basis only.

LAS 1250E: Special Topics: Social Sciences

Credits: 1. Contact Hours: Lecture 1.

Prereq: Freshman Classification

Special topics in social science. Offered on a satisfactory-fail basis only.

LAS 1510: Dean's Leadership Seminar I

Credits: 1. Contact Hours: Lecture 1.

Prereq: College Registration Approver Permission for Course

Beginning to study leadership through applied examples, including the importance of community, communication, trust, shared responsibility, modeling the way, and inspiring a shared vision. Students will be introduced to campus leadership opportunities. Selection based on application. (Typically Offered: Fall)

LAS 2030: Professional Career Preparation

Credits: 1. Contact Hours: Lecture 1.

Prereq: Liberal Arts and Sciences Sophomores, Juniors, or Seniors

Overview of practical skills such as writing resumes and cover letters, implementing an internship or job search, interviewing, evaluating offers, professional etiquette, and networking. Exploration of resources and online professional tools. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

LAS 2050X: Multicultural Leadership in Practice

Credits: 1.

Second year experience for students in the BOLD learning community to support the diverse representation and retention of undergraduate multicultural students in the College of Liberal Arts and Sciences. Continued discussion on multicultural leadership practice in higher education (i.e., current/historic leaders of color at Iowa State and other higher education institutions). Students are provided with the opportunity to design and execute student-focused campus leadership projects. Includes regular one-on-one and group peer mentoring with multicultural students leaders. (Typically Offered: Fall)

LAS 2060X: Multicultural Leadership and Communication

Credits: 1.

Second year experience for students in the BOLD learning community to support the diverse representation and retention of undergraduate multicultural students in the College of Liberal Arts and Sciences. The course expands on previous BOLD courses by delving into communication through a multicultural leadership perspective. Through a combination of guest lectures, group discussions, and interactive exercises, students will learn how to effectively communicate with and lead individuals from different cultural backgrounds as multicultural leaders themselves, as well as develop strategies for creating inclusive and equitable environments. (Typically Offered: Fall, Spring, Summer)

LAS 2400: Pre-Law Seminar

Credits: 1. Contact Hours: Lecture 1.

Preparation for law school and careers in law. Introduction to the culture of law school, law school application process and admission criteria, strategies for Law School Admissions Test preparation, and how to finance a legal education. Offered on a satisfactory-fail basis only.

LAS 2450: STEM Scholars Seminar

Credits: 1. Contact Hours: Lecture 1.

Introduction to the culture of science at a research university. Concepts and strategies supporting success in science courses and in career pathways in science. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

LAS 2900: Independent Study

Credits: 1-3. Repeatable.

Prereq: College Registration Approver Permission for Course

Independent work as appropriate to the student's degree program. Academic work under faculty supervision may include written projects, presentations, reports, and guided readings. (Typically Offered: Fall, Spring, Summer)

LAS 2910A: Service Learning: General

Credits: 1-4. Repeatable, maximum of 6 credits.

Prereq: College Registration Approver Permission for Course

Integration of meaningful service work with instruction and reflection. Academic work may include written projects, presentations, reports, and guided readings. (Typically Offered: Fall, Spring, Summer)

LAS 2910B: Service Learning: U.S. Diversity Project

Credits: 1-4. Repeatable, maximum of 6 credits.

Prereq: College Registration Approver Permission for Course

Integration of meaningful service work with instruction and reflection with a US Diversity focus. Academic work may include written projects, presentations, reports, and guided readings. (Typically Offered: Fall, Spring, Summer)

LAS 2910C: Service Learning: International Perspectives Project

Credits: 1-4. Repeatable, maximum of 6 credits.

Prereq: College Registration Approver Permission for Course

Integration of meaningful service work with instruction and reflection with an International Perspectives focus. Academic work may include written projects, presentations, reports, and guided readings. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

LAS 2930A: Special Projects: LAS Ambassadors

Credits: 1-3. Repeatable.

Prereq: College Registration Approver Permission for Course

Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

LAS 2930B: Special Projects: Advising Project

Credits: 1-3. Repeatable.

Prereq: College Registration Approver Permission for Course

Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

LAS 2930C: Special Projects: Career Services

Credits: 1-3. Repeatable.

Prereq: College Registration Approver Permission for Course

Special Project supervised by LAS Career Services. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

LAS 2930D: Special Projects: General

Credits: 1-3. Repeatable.

Prereq: College Registration Approver Permission for Course

Special project supervised by the College of Liberal Arts and Sciences. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

LAS 2980: Internship/Co-op

Credits: Required. Repeatable, maximum of 2 times.

Students participating in an internship or co-op on a full-time or part-time basis must register for this course prior to beginning their work experience to remain in student status. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

LAS 3450: Innovation and Entrepreneurship I

Credits: 1. Contact Hours: Lecture 1.

Prereq: Accepted into Start Something LAS Academy

Introduction to the entrepreneurial mindset and key concepts related to innovation and entrepreneurship. Application of principles through case studies, group work and direct mentoring. Opportunities for experiential learning with LAS mentors, entrepreneurs, and alumni. (Typically Offered: Fall)

LAS 3460: Innovation and Entrepreneurship II

Credits: 1. Contact Hours: Lecture 1.

Prereq: Credit or enrollment in LAS 3450

Exploration of key concepts related to innovation and entrepreneurship. Application of principles through case studies, group work and direct mentoring. Opportunities for experiential learning with LAS mentors, entrepreneurs, and alumni. (Typically Offered: Spring)

LAS 3500A: Topics in Interdisciplinary Studies: Interdisciplinary

Credits: 2-4. Contact Hours: Lecture 4.

Repeatable, maximum of 8 credits.

LAS 3500B: Topics in Interdisciplinary Studies: Humanities

Credits: 2-4. Contact Hours: Lecture 4.

Repeatable, maximum of 8 credits.

LAS 3500C: Topics in Interdisciplinary Studies: Mathematics and Natural Science

Credits: 2-4. Contact Hours: Lecture 4.

Repeatable, maximum of 8 credits.

LAS 3500D: Topics in Interdisciplinary Studies: Social Sciences

Credits: 2-4. Contact Hours: Lecture 4.

Repeatable, maximum of 8 credits.

LAS 3990: Undergraduate Research

Credits: Required. Repeatable.

Prereq: College Registration Approver Permission for Course

Supervised research. (Typically Offered: Fall, Spring, Summer)

LAS 4900A: Independent Study: General

Credits: 1-30. Repeatable, maximum of 9 credits.

Prereq: College Registration Approver Permission for Course

Independent work as appropriate to the student's degree program.

Academic work under supervision; may include written projects,

presentations, reports, and guided readings. Graduation Restriction:

No more than 9 credits of LAS 4900 may be applied toward graduation.

(Typically Offered: Fall, Spring, Summer)

LAS 4900E: Independent Study: Entrepreneurship

Credits: 1-30. Repeatable, maximum of 9 credits.

Prereq: College Registration Approver Permission for Course

Independent work as appropriate to the student's degree program.

Academic work under supervision; may include written projects,

presentations, reports, and guided readings. This section intended for

students in the Entrepreneurship Minor. Graduation Restriction: No more

than 9 credits of LAS 4900 may be applied toward graduation. (Typically

Offered: Fall, Spring, Summer)

LAS 4910A: Advanced Service Learning: General

Credits: 1-4.

Prereq: College Registration Approver Permission for Course

Integration of meaningful service work with advanced instruction and

reflection. Academic work may include written projects, presentations,

reports, and guided readings. (Typically Offered: Fall, Spring, Summer)

LAS 4910B: Advanced Service Learning: U.S. Diversity Project

Credits: 1-4.

Prereq: College Registration Approver Permission for Course

Integration of meaningful service work with advanced instruction and

reflection with a U.S. Diversity focus. Academic work may include written

projects, presentations, reports, and guided readings. (Typically Offered:

Fall, Spring, Summer)

LAS 4910C: Advanced Service Learning: International Perspectives Project

Credits: 1-4.

Prereq: College Registration Approver Permission for Course

Integration of meaningful service work with advanced instruction and

reflection with an International Perspectives focus. Academic work may

include written projects, presentations, reports, and guided readings.

Meets International Perspectives Requirement. (Typically Offered: Fall,

Spring, Summer)

LAS 4980: Internship/Co-op

Credits: Required. Repeatable, maximum of 2 times.

Students participating in an internship or co-op on a full-time or part-

time basis must register for this course prior to beginning their work

experience to remain in student status. Offered on a satisfactory-fail

basis only. (Typically Offered: Fall, Spring, Summer)

LAS 4990: Internship

Credits: 1-4. Repeatable.

Semester-long internship appropriate to the student's degree program.

Must include an academic component under faculty supervision such

as written projects, reports, and guided reading. Students must register

for this course prior to beginning their internship. (Typically Offered: Fall,

Spring, Summer)

Library (LIB)

Courses primarily for undergraduates:**LIB 1600: Introduction to College Level Research**

Credits: 1. Contact Hours: Lecture 1.

Eight-week course required for undergraduate degree. Provides a

foundation for college level research. Students will develop the critical

thinking skills necessary to successfully navigate the research process:

developing a research question, searching strategically, evaluating

sources, and using information ethically. To be taken as early as

possible in the student's undergraduate career. See course descriptions

of ENGL 1500 and ENGL 2500 for requirements related to LIB 1600.

(Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

Linguistics (LING)

Courses primarily for undergraduates:

LING 1010: Introduction to the Study of Linguistics

Credits: 1. Contact Hours: Lecture 1.

Cross-disciplinary perspectives on the study of linguistics. Applications of linguistics to real world problems. Careers in linguistics. (Typically Offered: Spring)

LING 1190: Introduction to World Languages

(Cross-listed with WLC 1190).

Credits: 3. Contact Hours: Lecture 3.

Study of language diversity and the personal, social and political effects of diversity. Language families, attitudes toward language and language use, language and culture, multilingualism, foreign language learning, written codes, official languages, and language policy. Meets International Perspectives Requirement.

LING 1200: Computers and Language

(Cross-listed with ENGL 1200).

Credits: 3. Contact Hours: Lecture 3.

Introduction to the use of linguistic knowledge in computer applications today and the basic computational techniques used in such applications. The development of these techniques throughout the history of computational linguistics. How the study of language has contributed to the advancement of technology and how certain computational problems have influenced the way linguists study language.

LING 2070: Introduction to Symbolic Logic

(Cross-listed with PHIL 2070).

Credits: 3. Contact Hours: Lecture 3.

Introduction to fundamental logical concepts and logical symbolism. Development of natural deduction through first order predicate logic with identity. Applications to arguments in ordinary English and to philosophical issues. Linguistics majors should take LING/PHIL 2070 as early as possible. (Typically Offered: Fall, Spring)

LING 2190: Introduction to Linguistics

(Cross-listed with ENGL 2190).

Credits: 3. Contact Hours: Lecture 3.

Introduction to linguistic concepts and principles of linguistic analysis with English as the primary source of data. Sound and writing systems, sentence structure, vocabulary, and meaning. Issues in the study of usage, regional and social dialects, language acquisition, and language change. (Typically Offered: Fall, Spring)

LING 2200: Descriptive English Grammar

(Cross-listed with ENGL 2200).

Credits: 3. Contact Hours: Lecture 3.

Overview of grammatical structures and functions. Parts of speech; phrase, clause, and sentence structure; sentence types and sentence analysis; rhetorical grammar and sentence style; terminology. Not a remedial, English composition, or ESL course. (Typically Offered: Fall, Spring)

LING 3090: Introduction to Culture and Language

(Cross-listed with ANTHR 3090).

Credits: 3. Contact Hours: Lecture 3.

Introduction to study of language, culture and society from an anthropological perspective. Focus on language and thought, ethnography of speaking, discourse and narrative, writing and literacy, and media communication. Discussion of key theories and methods of linguistic anthropology. ANTHR 2010 recommended. Meets International Perspectives Requirement.

LING 3170: Truth, Meaning, and Necessity

(Cross-listed with PHIL 3170).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 3 credits in PHIL

Major movements in recent and contemporary philosophy such as realism, logical positivism, ordinary language philosophy, and naturalism. Russell, Wittgenstein, Quine and other leading figures. Topics include knowledge of the material world, mind, language, values, and philosophical method. PHIL 2010 recommended. (Typically Offered: Spring)

LING 3180: Introduction to ESL methods and materials

(Cross-listed with ENGL 3180).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2190 or LING 2190

Introduction to methods and materials for teaching English as a Second Language (ESL) for elementary and secondary students. Strategies and resources for teaching reading, writing, speaking and listening skills. Elementary Education students must take this course in the same semester as either EDUC 2800S or EDUC 4800S. (Typically Offered: Fall)

LING 3190: Studies in Language and Diversity

(Cross-listed with ENGL 3190).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Prereq: ENGL 2500

Special topics related to the role of language and linguistics in US diversity, such as Dialects and American literature, American English Accents, Legal and Social Aspects of English-only Laws in the US. Connections between language use and social diversity. (Typically Offered: Fall)

LING 3200: Topics in Linguistic Structure

(Cross-listed with ENGL 3200).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Prereq: ENGL 2190/LING 2190 or ENGL 2200/LING 2200

Special topics related to the study of linguistic structure. Focus on language structure in areas not covered in detail by existing courses. Topics include field linguistics, morphology, forensic linguistics, neurolinguistics, semantics, non-English phonology, acoustic phonetics, linguistic universals, and historical linguistics. (Typically Offered: Spring)

LING 3220: Language and Society

(Cross-listed with ENGL 3220).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2190 or LING 2190

Introduction to variation in language use in society. Survey of factors affecting language use, including background characteristics of language users, location, and purpose of interaction in addition to institutional, state, and national language policies. (Typically Offered: Spring)

LING 3240: Introduction to Teaching ESL Literacy

(Cross-listed with ENGL 3240).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2190 or LING 2190

Introduction to the issues and methods involved in teaching literacy skills to English as a second language (ESL) learners. The nature of literacy and materials and methods for developing ESL literacy at the middle school, high school, and adult ages across multiple levels of competency. (Typically Offered: Fall)

LING 3250: Teaching Methods for ESL Learners: Oral Communication Skills

(Cross-listed with ENGL 3250).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2190 or LING 2190

Issues and methods in teaching oral communication skills (listening, speaking, pronunciation) to English as a second language (ESL) learners. The nature of oral language ability. Materials and Methods for developing oral communication skills at middle school, high school, and adult contexts. (Typically Offered: Spring)

LING 3310: Theory of Computing

(Cross-listed with COMS 3310).

Credits: 3. Contact Hours: Lecture 3, Discussion 1.

Prereq: Minimum of C- in (COMS 2280; MATH 1660; ENGL 2500); (COMS 2300 or CPRE 3100)

Models of computation: finite state automata, pushdown automata and Turing machines. Study of grammars and their relation to automata. Limits of digital computation, unsolvability and Church-Turing thesis. Relations between classes of languages. (Typically Offered: Fall, Spring)

LING 3510: Introduction to Spanish-English Translation

(Cross-listed with SPAN 3510/ USLS 3510).

Credits: 3. Contact Hours: Lecture 3.

Prereq: SPAN 3030A or SPAN 3030B or SPAN 3040 or SPAN 3050

Introduction to the theory, methods, techniques, and problems of translation. Consideration of material from business, literature, and the social sciences. Taught in Spanish. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

LING 3520: Spanish Pronunciation

(Cross-listed with SPAN 3520).

Credits: 3. Contact Hours: Lecture 3.

Prereq: SPAN 3030A or SPAN 3030B or SPAN 3040 or SPAN 3050

An introductory study of the articulation, classification, distribution, and regional variations of the sounds of the Spanish language. Taught in Spanish. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

LING 3540: Introduction to Spanish-English Interpretation

(Dual-listed with SPAN 5540/ LING 5540). (Cross-listed with SPAN 3540).

Credits: 3. Contact Hours: Lecture 3.

Prereq: SPAN 3510

Introduction to the theory, methods, techniques, and problems of consecutive and simultaneous interpretation. Consideration of material from business, agriculture, law, design, medicine, literature, advertisement, and sports. Taught in Spanish. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

LING 3710: Phonetics and Phonology

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2190

Terminology, theory, research, and applications of the science of the sounds of spoken language. Emphasis on American English and International Phonetic Alphabet.

LING 3950: Study Abroad

Credits: 3. Repeatable, maximum of 2 times.

Instruction in issues of language policy, practice and learning. Observation and experience with language use outside of the United States. Meets International Perspectives Requirement.

LING 4100: Language as Data

(Cross-listed with ENGL 4100).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior standing

Methods of discovering language patterns in text documents solve practical text analysis problems in the disciplines. Fundamentals of linguistics and its role in text analysis. Practice writing R scripts to perform text analysis and visualize textual data. (Typically Offered: Spring)

LING 4130: Psychology of Language

(Cross-listed with PSYCH 4130).

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 1010

Introduction to psycholinguistics. Topics may include origin of language, speech perception, language comprehension, reading, bilingualism, brain bases of language, and computational modeling of language processes. (Typically Offered: Spring)

LING 4200: History of the English Language

(Cross-listed with ENGL 4200).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2190/LING 2190 and ENGL 2200/LING 2200

Comparison of English to other languages by family background and by type. Analysis of representative Old, Middle, Early Modern and present-day English texts, including both literary works and non-literary documents. (Typically Offered: Fall, Spring)

LING 4220: Women, Men, and the English Language

(Cross-listed with ENGL 4220/ WGS 4220).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2190 or LING 2190

The ways men and women differ in using language in varied settings and the ways in which language both creates and reflects gender divisions. (Typically Offered: Spring)

LING 4250: Second Language Learning and Teaching

(Cross-listed with ENGL 4250).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2190/LING 2190 and Junior classification

The process of second language learning and principles and techniques of teaching second languages. Learning and teaching in specific situations and for particular purposes. Current applications of technology in teaching and assessment. (Typically Offered: Spring)

LING 4370: Grammatical Analysis

(Cross-listed with ENGL 4370).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (ENGL 2190 or LING 2190); (ENGL 2200 or LING 2200); Junior classification

Theories and methods for analysis of syntax and morphology. (Typically Offered: Fall)

LING 4620: Contrastive Analysis of Spanish/ English for Translators

(Cross-listed with SPAN 4620).

Credits: 3. Contact Hours: Lecture 3.

Prereq: SPAN 3510

Linguistic study of the major differences between the Spanish and English grammatical systems and their applications in the translation of Spanish to English. Taught in Spanish.

LING 4630: Contemporary Spanish Linguistics

(Dual-listed with SPAN 5630/ LING 5630). (Cross-listed with SPAN 4630).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: SPAN 3520

Study of various topics related to the Spanish language. Topics may include bilingualism, historical linguistics and dialectology, Spanish in the U.S., language assessment, computer-assisted language learning and instruction, and second language acquisition. Taught in Spanish. Meets International Perspectives Requirement.

LING 4710: Language and Reading Development in Children

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2190 or LING 2190 or PSYCH 2300 or HDFS 1020

Development of spoken language, reading and writing covering semantics, syntax, morphology, phonology, and pragmatics.

LING 4860: Methods in Elementary School World Language Instruction

(Cross-listed with EDUC 4860/ WLC 4860).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 25 credits in a World Language

Planning, implementation, and assessment of standards-based, student-centered, and thematic instruction in the elementary (K-8) classroom. Special emphasis on K-8 students' communicative skills, cultural knowledge, and content learning. (Typically Offered: Fall)

LING 4870: Methods in Secondary School World Language Instruction

(Cross-listed with EDUC 4870/ WLC 4870).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 25 credits in a world language; Department Permission

Theories and principles of contemporary world language learning and teaching. Special emphasis on designing instruction and assessments for active learning. Admission to teacher education required. (Typically Offered: Fall)

LING 4900B: Independent Study: Linguistics

(Cross-listed with ENGL 4900B).

Credits: 1-30. Repeatable, maximum of 9 credits.

Prereq: 9 credits in English beyond ENGL 2500; Junior classification; Department Permission

Designed to meet the needs of students who wish to study in areas other than those in which courses are offered. Graduation Restriction: No more than 9 credits of ENGL 4900 may be used toward graduation. (Typically Offered: Fall, Spring)

LING 4900D: Independent Study: Linguistic Anthropology

(Cross-listed with ANTHR 4900D).

Credits: 1-5. Repeatable, maximum of 9 credits.

Prereq: 9 credits in ANTHR; Permission of Instructor

Graduation Restriction: No more than 9 credits of ANTHR 4900 may be counted toward graduation.

Courses primarily for graduate students, open to qualified undergraduates:

LING 5100: Introduction to Computers in Applied Linguistics

(Cross-listed with ENGL 5100).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Use of software and web applications for language teaching, linguistic analysis, and statistical analysis. Issues and problems in applied linguistics related to computer methods. (Typically Offered: Fall)

LING 5110: Introduction to Linguistic Analysis

(Cross-listed with ENGL 5110).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Principles and methods of linguistic analysis with emphasis on phonology, morphology, and syntax. Description of linguistic variation and current theoretical approaches to linguistics. (Typically Offered: Fall)

LING 5120: Second Language Acquisition

(Cross-listed with ENGL 5120).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Theory, methods, and results of second language acquisition research with emphasis on approaches relevant to second language teaching.

LING 5130: Language Assessment Practicum

(Cross-listed with ENGL 5130).

Credits: 3.

Prereq: Graduate Standing or Permission of Instructor

Advanced practicum in language assessment. (Typically Offered: Fall, Spring, Summer)

LING 5140: Sociolinguistics

(Cross-listed with ENGL 5140).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Theories and methods of examining language in its social setting. Analysis of individual characteristics (e.g., age, gender, ethnicity, social class, region), interactional factors (e.g., situation, topic, purpose) and national policies affecting language use.

LING 5150: Statistical Natural Language Processing

(Cross-listed with HCI 5150/ ENGL 5150).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to computational techniques involving human language and speech in applications such as information retrieval and extraction, automatic text categorization, word prediction, intelligent Web searching, spelling and grammar checking, speech recognition and synthesis, statistical machine translation, n-grams, POS-tagging, word-sense disambiguation, on-line lexicons and thesauri, markup languages, corpus analysis, and Python programming language.

LING 5160: Methods of Formal Linguistic Analysis

(Cross-listed with ENGL 5160).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Data and knowledge structures for formal representation of natural language and speech data. Designing and implementing algorithms for automating linguistic analysis tasks. Conceptual issues for natural language and speech processing programming. Offered even-numbered years. (Typically Offered: Spring)

LING 5170: Corpus Linguistics

(Cross-listed with ENGL 5170).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Corpus linguistics methods of language analysis, including corpus design, construction and annotation; data in corpus studies; tools and methods of analysis. Corpus methods applied in vocabulary, grammar, register and dialect variation, language change, pragmatics, semantics, stylistics, language learning and teaching, and language testing. Offered even-numbered years. (Typically Offered: Spring)

LING 5190: Second Language Assessment

(Cross-listed with ENGL 5190).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Principles of second language assessment including reliability, validity, authenticity and practicality. Constructing, scoring, interpreting, and evaluating second language tests for a variety of situations. (Typically Offered: Spring)

LING 5200: Computational Analysis of English

(Cross-listed with HCI 5200/ ENGL 5200).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Concepts and practices for analysis of English by computer with emphasis on the applications of computational analysis to problems in applied linguistics such as corpus analysis and recognition of learner language in computer-assisted learning and language assessment.

LING 5240: Literacy: Issues and Methods for Nonnative Speakers of English

(Cross-listed with ENGL 5240).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Theoretical and practical issues and techniques in the teaching of literacy in a variety of contexts, involving children and adults at basic skill levels and teens and adults in academic and vocational programs. Offered even-numbered years. (Typically Offered: Fall)

LING 5250: Research and Teaching of Second Language Pronunciation

(Cross-listed with ENGL 5250).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Theoretical and practical issues and techniques in the teaching of second language pronunciation as it relates to other areas of language, especially listening and speaking skills. Topics will include segmental and suprasegmental features; intelligibility; pronunciation in language assessment; classroom, technology and individual instruction; and research issues. Topics will be relevant to those intending to teach or research in various contexts. Offered odd-numbered years. (Typically Offered: Fall)

LING 5260: Technology for Language Learning

(Cross-listed with ENGL 5260).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Theory, research, and practice in computer use for teaching nonnative speakers of English. Methods for planning and evaluating computer-based learning activities. Offered odd-numbered years. (Typically Offered: Spring)

LING 5270: Discourse Analysis

(Cross-listed with ENGL 5270).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Methods and theoretical foundations for linguistic approaches to discourse analysis. Applications of discourse analysis to the study of texts in a variety of settings, including academic and research contexts. Offered odd-numbered years. (Typically Offered: Spring)

LING 5280: English for Specific Purposes

(Cross-listed with ENGL 5280).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Issues and techniques in analyzing, teaching, and assessing English for specific purposes. Topics include theories of specific purpose language use, analysis of learner needs in target language contexts, and corpus-informed syllabus and materials development for teaching and assessment.

LING 5300: Technology and Oral Language

(Cross-listed with ENGL 5300).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Structure and description of oral language and discourse. How spoken language is linguistically described, analyzed, and taught for research and for education. Using technology to record, transcribe, and analyze spoken language at all levels of linguistic structure. Offered even-numbered years. (Typically Offered: Fall)

LING 5370: Corpus Approaches to Grammatical Analysis

(Cross-listed with ENGL 5370).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Corpus-informed analysis of syntax in authentic writing and speech, with emphasis on approaches used in applied linguistics.

LING 5540: Introduction to Spanish-English Interpretation

(Dual-listed with SPAN 3540/ LING 3540). (Cross-listed with SPAN 5540).

Credits: 3. Contact Hours: Lecture 3.

Prereq: SPAN 3510

Introduction to the theory, methods, techniques, and problems of consecutive and simultaneous interpretation. Consideration of material from business, agriculture, law, design, medicine, literature, advertisement, and sports. Taught in Spanish. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

LING 5630: Contemporary Spanish Linguistics

(Dual-listed with SPAN 4630/ LING 4630). (Cross-listed with SPAN 5630).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: SPAN 3520

Study of various topics related to the Spanish language. Topics may include bilingualism, historical linguistics and dialectology, Spanish in the U.S., language assessment, computer-assisted language learning and instruction, and second language acquisition. Taught in Spanish.

LING 5880: Supervised Practice Teaching in Teaching English as a Second Language

(Cross-listed with ENGL 5880).

Credits: 3. Contact Hours: Lecture 1, Laboratory 5.

Prereq: Graduate Standing or Permission of Instructor

Intensive observation of ESL instruction and supervised practice in teaching learners of English in a context appropriate to the student teacher's goals. Graduation Restriction: ENGL 5880 cannot be used for teacher licensure. (Typically Offered: Fall, Spring)

LING 5900B: Special Topics: Teaching English as a Second Language (TESL)/Applied Linguistics

(Cross-listed with ENGL 5900B).

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

LING 5900G: Special Topics: Applied Linguistics and Technology

(Cross-listed with ENGL 5900G).

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

LING 5910: Studies in Applied Linguistics

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: Graduate Standing or Permission of Instructor

Intensive study of applied linguistic theory as it relates to specific issues in language acquisition, teaching, or use.

LING 5910B: Directed Readings: Teaching English as a Second Language (TESL)/Applied Linguistics

(Cross-listed with ENGL 5910B).

Credits: 1-30. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

(Typically Offered: Fall, Spring, Summer)

LING 5910G: Directed Readings: Applied Linguistics and Technology

(Cross-listed with ENGL 5910G).

Credits: 1-30. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

(Typically Offered: Fall, Spring, Summer)

Courses for graduate students:

LING 6230A: Research Methods in Applied Linguistics: Quantitative

(Cross-listed with ENGL 6230A).

Credits: 3. Contact Hours: Lecture 3.

Survey of quantitative research methods used in applied linguistics.

Offered odd-numbered years. (Typically Offered: Spring)

LING 6230B: Research Methods in Applied Linguistics: Qualitative

(Cross-listed with ENGL 6230B).

Credits: 3. Contact Hours: Lecture 3.

Survey of qualitative research methods used in applied linguistics.

Offered even-numbered years. (Typically Offered: Spring)

LING 6260: Computer-Assisted Language Testing

(Cross-listed with ENGL 6260).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 5190 or LING 5190

Principles and practices for the use and study of computers and the Internet in second language assessment. Offered even-numbered years.

(Typically Offered: Spring)

LING 6300: Seminar in Applied Linguistics

(Cross-listed with ENGL 6300).

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Topic changes each semester. Topics include advanced methods in natural language processing, technology and literacy in a global context, feedback in CALL programs, technology and pronunciation, and advances in language assessment.

Management (MGMT)

Courses primarily for undergraduates:

MGMT 3200: Corporate Entrepreneurship

(Cross-listed with ENTSP 3200).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Introduces entrepreneurial approaches aimed at the identification, development and exploitation of technical and organizational innovations, the management of new product or process developments, and the effective management of new ventures. Focuses on mid-size to large corporations, especially in the manufacturing and service industries. Develops an awareness and understanding of the range, scope, and complexity of issues related to the creation of a corporate environment that is supportive of entrepreneurial endeavors as well as the effective implementation of technological and organizational innovations in corporate settings. (Typically Offered: Fall, Spring)

MGMT 3700: Managing Organizations

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Introduction to management as a field and function within organizations. Provides an overview of what managers do in organizations, including how they deal with multiple stakeholders; make decisions about organizational goals, strategies, and structures that align with the external and internal environment; as well as how they lead and manage human resources effectively. (Typically Offered: Fall, Spring, Summer)

MGMT 3710: Organizational Behavior

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Introduction to the attitudes and behaviors of individuals and groups in organizations, as well as their antecedents: e.g., individual characteristics, interpersonal processes, manager and leader influences, and organizational characteristics and practices. Builds awareness of one's own and others' characteristics, attitudes, behaviors, and interpersonal and decision-making skills to improve as an employee and a manager. (Typically Offered: Fall, Spring)

MGMT 3720: Ethical and Responsible Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Introduces the many aspects of ethical and responsible management in today's organization, including the ethical implications of business decision-making (and the implications of having multiple stakeholders); corporate social responsibility; ethical leadership and other leadership styles as they pertain to responsible management; and the role of corporate governance and ethical codes in developing and institutionalizing an ethical organization. Builds ethical decision-making strategies and awareness of one's own ethical leadership philosophy. (Typically Offered: Fall, Spring)

MGMT 3770: Competitive Strategy

Credits: 3. Contact Hours: Lecture 3.

Developing competitive strategy and achieving competitive advantage in firms, including: industry analysis, generic strategies, hypercompetition, competing against time, and building distinctive capabilities. (Typically Offered: Fall)

MGMT 3810: Managing Family Businesses

(Cross-listed with ENTSP 3810).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Introduction to the important role family businesses play in the domestic and global economies as well as the complex and unique challenges and opportunities encountered by such businesses and their family members and other employees. Explores best practices for successfully managing family businesses.

MGMT 4140: International Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Explains complexities managers face when doing business in countries where political, legal, economic, and cultural systems are different and require making decisions about the change, innovation, or adaptation needed to successfully formulate strategies for entering and operating in international markets. (Typically Offered: Fall, Spring)

MGMT 4150: Managing New Ventures

Credits: 3. Contact Hours: Lecture 3.

Examination of business problems and main issues concerning new ventures. Students work in teams to identify problems in growing and new firms. The emphasis is on analyzing and solving an existing business problem. Includes a field project, a report, and a presentation to a business owner. (Typically Offered: Fall, Spring)

MGMT 4190: Social Responsibility of Business

Credits: 3. Contact Hours: Lecture 3.

A consideration of the role of business in society. Critical analysis of ethical, managerial, and public issues as they affect the corporation. (Typically Offered: Spring)

MGMT 4210X: Personality and Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: MGMT 3710

Surveys the literature relating to personality, individual differences, and management. Explores the significant implications of personality for important topics in human resource management, organizational behavior, and strategic management, as well as the other functional areas of business, including leadership, motivation, perception, decision making, organizational citizenship behavior, job satisfaction, and much, much more. Allows students to explore their own personalities using rigorous academic measurement scales and discover what academic research says about how personality is related to a variety of management topics. (Typically Offered: Fall, Spring)

MGMT 4220: Negotiation and Conflict Resolution

Credits: 3. Contact Hours: Lecture 3.

Prereq: MGMT 3700 or MGMT 3710

Introduces the theory and practice of negotiation (i.e., the art and science of securing an agreement between two or more interdependent parties) in a variety of settings, especially those faced by managers and professionals in organizations. Focuses on understanding the behavior of individuals, groups and organizations in the context of competitive situations, and the underlying interdependent relationships and processes. Builds analytical skills needed to discover optimal solutions to problems and a broad array of negotiation skills needed in order for those solutions to be accepted and implemented.

MGMT 4510X: Current Issues in Human Resource Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: MGMT 4710

Designed to complement the required curriculum in the Human Resource Management (HRM) major. Explores a rotating selection of cutting edge and timely topics in the area of HRM, with an emphasis on the application of HRM knowledge and skills to the challenges facing today's organizations. Develops an awareness and understanding of the range, scope, and complexity of issues related to managing human resources in the modern (and post-pandemic) organization. Opportunities to apply introduced HRM knowledge, skills, and tools through class projects and exercises.

MGMT 4520X: Current Issues in Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: MGMT 3700

Designed to complement the required curriculum in the Management (MGMT) major. Explores a rotating selection of cutting edge and timely topics in the area of management, with an emphasis on the application of managerial knowledge and skills to the challenges facing today's organizations. Develops an awareness and understanding of the range, scope, and complexity of issues related to managing in the modern (and post-pandemic) organization. Opportunities to apply introduced managerial knowledge, skills, and tools through class projects and exercises.

MGMT 4700: Leadership and Change Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: MGMT 3700 or MGMT 3710

Focuses on the practical application of leadership skills required in today's evolving business environment, including the need to effectively manage change. Develops through multiple hands-on activities an understanding of how leaders are able to inspire and lead their peers, direct reports, as well as themselves, and how leaders can create a culture that supports and inspires change within an organization. (Typically Offered: Fall, Spring, Summer)

MGMT 4710: Introduction to Human Resource Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: MGMT 3710 and STAT 2260 and ENGL 2500

Introduces the field of human resource management (HRM) and its relevance to managers, employees, and organizational strategic goal achievement. Explains how HRM practices can be a source of competitive advantage for organizations and develops knowledge and skills in the functional areas of HRM, including job analysis, selection, recruitment, compensation, and training and development. Builds skills critical to HRM (and other) professionals, such as communication, feedback, and teamwork skills. (Typically Offered: Fall, Spring)

MGMT 4720: Diversity, Equity, and Inclusion in Organizations

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior classification or above and BUSAD 2030

Introduces the important topics of diversity, equity, and inclusion in organizations. Focuses on understanding dimensions of diversity and the importance of inclusion; effectively managing legal, ethical, media, and marketing issues in this area; and managing organizational change initiatives in this area. Builds students' abilities to work within and lead diverse teams and organizations and develops critical thinking about one's identity and equality of opportunity in organizations. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall, Spring)

MGMT 4730: Evidence-Based Decision Making in Human Resource Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 1130 and ENGL 2500 and STAT 2260 and MGMT 3710

Focuses on evidence-based analysis of short- and long-term consequences of specific talent management practices on the organization and on society as a whole. Introduces, and provides hands-on experience with, measurement and analytic techniques applicable to business professionals. Builds knowledge and skills to describe, diagnose and improve processes pertaining to planning, recruiting, selecting, training, and developing talent in an organization as well as compensating, retaining, and managing the performance and careers of a diverse and talented workforce. (Typically Offered: Fall)

MGMT 4740: Compensation and Benefits

Credits: 3. Contact Hours: Lecture 3.

Prereq: MGMT 4710

Introduces the fundamental elements of employee compensation and benefits (including strategies, structures, and practices), within the larger context of total rewards. Discusses impact of compensation and benefits on employee recruitment, retention, and engagement, the employer/employee relationship, as well as individual, organizational and societal returns. Provides tools and a holistic understanding to competently assess, manage and negotiate compensation and benefits, not only as a management/human resource professional but also as an employee (in any phase of their own compensation lifecycle). (Typically Offered: Fall, Spring)

MGMT 4750: Employment Law for Human Resource Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: ACCT 2150 and MGMT 4710

Introduces fundamentals of U.S. employment law necessary for human resource management. Topics include sources of employment law, classification of workers, lawful hiring practices, liability arising from harassment and discrimination, worker's rights and duties, employment contract issues, and lawful termination of an employee. Builds knowledge and skills for effectively managing each of these areas. (Typically Offered: Fall, Spring)

MGMT 4760: Applied Projects in Human Resource Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: MGMT 4710 and MGMT 4740 and MGMT 4750

Takes an experiential and holistic view to address human resource management (HRM) issues, especially in small and mid-sized companies. Project-based format includes partnering with local companies to understand, research, and propose evidence-based HRM solutions that support the organization's overall strategy and business needs. Requires consideration and application of multiple HRM perspectives including hiring, employee development and retention, performance management, compensation and benefits, legal considerations, etc. Emphasis on developing situation-specific solutions that integrate multiple HRM best practices. (Typically Offered: Summer)

MGMT 4780: Strategic Management

Credits: 3. Contact Hours: Lecture 3.

*Prereq: Credit or enrollment in (ACCT 2850;**ENTSP 3100; FIN 3010; MKT 3400; (MGMT 3700 or MGMT 3710);**SCM 3010; MIS 3010); Senior classification*

Examines why some organizations perform better than others, with an emphasis on how taking a holistic view of the organization and environment can lead to sustained competitive advantage. Evaluates how capabilities in various organizational functions can help enable and determine organizational strategy, and considers how strategic choices affect expectations of various functional areas and their interdependence. Emphasis on case analysis and discussion to build student competencies in the areas of internal and external analysis, complex decision-making, and the formulation, implementation, and evaluation of strategies. (Typically Offered: Fall, Spring, Summer)

MGMT 4810X: Nonprofit Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior classification

Executives in nonprofits are recognizing the need to incorporate contemporary management skills into their organization and connect their organizations to related business. Executives in for-profit businesses interact with the nonprofit sector in business operations or in service as a board member for a nonprofit organization. Management practices that can be applied across lines in both nonprofit organization and for-profit businesses. Focus on the strategy, governance, management and leadership of nonprofit organizations and explore how this sector fits into the business landscape. (Typically Offered: Spring)

MGMT 4900: Independent Study

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Courses primarily for graduate students, open to qualified undergraduates:

MGMT 5020: Organizational Behavior

Credits: 3. Contact Hours: Lecture 3.

Prereq: Ivy College of Business Graduate Student or instructor permission

Understanding human behavior in organizations and the nature of sustainable organizations from a managerial perspective. Special emphasis is placed on how individual differences, such as perceptions, personality, and motivation, influence individual and group behavior in organizations and on how behavior can be influenced by job design, leadership, groups, and the structure of organizations. (Typically Offered: Fall)

MGMT 5030: Professional Responsibility in Business and Society

Credits: 3. Contact Hours: Lecture 3.

Prereq: ACCT 5010, FIN 5010, MGMT 5020, MKT 5010; Ivy College of Business graduate student or Engineering Management Student or Instructor Permission

Ethical and social responsibilities of top managers in corporations. Topics include stakeholder management, corporate social responsibilities, strategies for sustainable development, pursuit of societal and corporate goals, board and chief executive leadership roles, governance reform and ethics, and executive leadership style and values. The presentation of course concepts is facilitated by the use of cases, discussion scenarios, and ethical dilemmas.

MGMT 5040: Strategic Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit in any 4 of the following courses (SCM 5010, SCM 5240, MIS 5010, MKT 5010, ACCT 5010, ACCT 5810, FIN 5320, ECON 5320, FIN 5010, MGMT 5020, MGMT 5030)

Critical analysis of case studies in strategic management with an emphasis on integrative decision making. Strategy implementation in light of the global, legal, economic, cultural, and political contexts of business.

MGMT 5200: Corporate Entrepreneurship, Innovation and Technology Management

(Cross-listed with ENTSP 5200).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate classification

Management of venture creation and innovation at large and established organizations. New ideas, concepts, and techniques on how to stimulate and exploit innovative activities to make established firms not only more responsive and flexible, but also more proactive and opportunity-creating. Related approaches combine activities targeted at the individual, team, organization, industry, regional, national and global level. Introduction to how today's large and established corporations (1) identify, develop and exploit innovative opportunities, (2) manage product development processes, and (3) create, spin-in, spin-off and manage new innovative ventures. This case-based course introduces emerging, non-traditional, evidence-based approaches, such as agile product development, design-thinking, entrepreneurial leadership, entrepreneurial ecosystems, open innovation and blue-ocean strategies. (Typically Offered: Fall, Spring, Summer)

MGMT 5220: Negotiation and Conflict Resolution

Credits: 3. Contact Hours: Lecture 3.

Prereq: Ivy College of Business Graduate Student or instructor permission

Theory and practice of negotiation in a variety of settings, while focusing on understanding the behavior of individuals, groups and organizations in the context of competitive situations. Team work and team building is integrated to better understand interdependent relationships and processes.

MGMT 5230: Leadership

Credits: 3. Contact Hours: Lecture 3.

Prereq: Enrollment in MBA Program or Permission of Instructor

Applied overview of organizational leadership and teamwork, with special emphasis on the ability to successfully influence in a variety of contexts. Areas of emphasis include: research to better understand the influence process; leadership, followership, and management as a process; change and how to better lead and manage change in organizations.

MGMT 5250: Evidence-Based Talent Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: Ivy College of Business Graduate Student or instructor permission

Introduces talent management as integral to the ongoing success of any organization, with a focus on contemporary, evidence-based approaches to effectively managing talent. Highlights best practices related to the capture, integration, and utilization of employee data for making decisions about talent and talent management practices, and builds practical skills related to the identification and development of talent. Intended for current managers from any functional background.

MGMT 5300: Leadership and Conflict Resolution

Credits: 3. Contact Hours: Lecture 3.

Prereq: Ivy College of Business Graduate Student or instructor permission

Introduction to the theory and practice of leadership and negotiation. Emphasis on the science of influencing and resolving conflict, and securing an agreement between two or more interdependent parties. Behavior of individuals, groups, and organizations in the context of demanding situations.

MGMT 5600: Leadership Development

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Applied overview of organizational leadership leveraging a 360 leadership evaluation, with special emphasis on the ability to be successful in a variety of contexts. The 360 leadership evaluation will form the foundation to create a leadership action plan. This will great assist in increasing one's leadership effectiveness as the students' strengths and weaknesses discovered. (Typically Offered: Spring)

MGMT 5650: Early Stage Entrepreneurship - Mind to Market

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Commercialization of new technology. Topics covered include market analysis, intellectual property, product development, feasibility analysis, and new business evaluation.

MGMT 5710: Seminar in Personnel and Human Resources Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: MGMT 3710 or MGMT 5020 or SOC 4200

Topics and issues in personnel management with a focus on the management of human resources in organizations. Current personnel practices, philosophies, and behavioral science research. (Typically Offered: Spring)

MGMT 5720: Personality and Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Critical analysis of case studies in strategic management with an emphasis on integrative decision making. Strategy implementation in light of the global, legal, economic, cultural, and political contexts of business.

MGMT 5820: Corporate Governance and Top Management

(Cross-listed with ACCT 5820).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MGMT 5030 or permission

Duties, structure, and functioning of top management teams and corporate boards of directors. CEO/board tenure and succession planning, top management compensation, board committee composition, assessment of CEO and board performance, theories of corporate governance, management of the corporate strategic agenda, governance codes, international governance, and chairman/CEO duality. Case studies and contemporary issues discussed.

MGMT 5830: Formulating and Implementing Innovation Strategies

(Cross-listed with ENTSP 5830).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MGMT 5040 or permission of instructor

Key strategies, models, and tools to foster and drive organizational innovation. Analysis of industry dynamics, sources and types of innovations, timing of entry; formulation of innovation strategies; developing innovation portfolios and collaboration strategies, protecting innovation; implementing technological innovation strategy, including new product development and deployment strategy. Essential traits of innovative strategic leaders. Critical analysis and discussion of cases focused on entrepreneurship and innovation and project requiring hands-on practical application of course concepts.

MGMT 5840: Management Consulting

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Provides the opportunity for students to understand the role of the professional consultant, the issues facing the management consulting industry, the competencies of various management consulting firms, the nature and form of strategic consulting engagement, and the nature and scope of strategic change in business firms. Students will learn about management consulting functions and will practice the consultant role through cases and field studies.

MGMT 5900: Special Topics

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

For students wishing to do individual research in a particular area of management. (Typically Offered: Fall, Spring, Summer)

Courses for graduate students:**MGMT 6010: Philosophy of Science**

Credits: 3. Contact Hours: Lecture 3.

Prereq: Enrollment in MGMT PhD program

This course provides a philosophical introduction to the theoretical and empirical development of scientific knowledge. It focuses on a variety of basic problems common to the social sciences: the nature of explanation, the structure of theories, forms of knowledge, scientific laws, nature of theory and ethics. The purpose of the course is to help doctoral students define a research context by addressing the purposes, assumptions and primary components of scientific inquiry.

MGMT 6020: Organizational Theory

Credits: 3. Contact Hours: Lecture 3.

Prereq: Enrollment in MGMT PhD program

This seminar involves the examination of the core theories and perspectives in organizational theory, as well as their applications and extensions. This material addresses the fundamental rationale for organizations in modern society, basic processes of organizing and organizational structure, a consideration of inter-organizational relationships and the external environment, and a variety of factors that help determine organizational effectiveness.

MGMT 6030: Strategic Management of Technology and Innovation

Credits: 3. Contact Hours: Lecture 3.

Prereq: MGMT 6010

This course will offer a critical review of organizational decision making with respect to technology and innovation. Students will learn how technological change can alter the basis of competition; how competitive strategy drives technology investment decisions; how market-orientation should be the other backbone of technological innovation; and best practices of organizing and managing the new product development process to achieve strategic goals.

MGMT 6040: Seminar in Organizational Behavior

Credits: 3. Contact Hours: Lecture 3.

Prereq: Enrollment in MGMT PhD program

The purpose of this seminar is to introduce behavioral science literature relevant to the study of behavior in organizational settings. The course will focus on the individual's role within organizations and cover topics such as individual differences, motivation, leadership, decision-making. Learning, risk taking, interpersonal relations, etc. Both theoretical and empirical contributions will be examined, with emphasis on integration of diverse theoretical perspectives.

MGMT 6050: Seminar in Strategic Management

(Cross-listed with ENTSP 6050).

Credits: 3. Contact Hours: Lecture 3.

Critical review of theory and research in the field of strategic management. Introduction to representative conceptual and empirical research. Review theories that provide the foundation for management research, and review current research in associate research streams. The review will cover fundamental questions in strategy. Offered odd-numbered years. (Typically Offered: Fall)

MGMT 6060: Historical Foundations of Entrepreneurship Research

(Cross-listed with ENTSP 6060).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Enrollment in MGMT PhD program

Seminal readings, theoretical perspectives, and historical roots of Entrepreneurship research. A broad variety of core foundational theories, perspectives, and approaches are discussed.

MGMT 6070: Current Topics in Entrepreneurship Research

(Cross-listed with ENTSP 6070).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Enrollment in MGMT PhD program

Current theoretical perspectives and methodological approaches in entrepreneurship research. Current entrepreneurship research is inherently interdisciplinary such that we will draw on insight from scholars across a range of disciplines. Offered even-numbered years. (Typically Offered: Spring)

MGMT 6080: Human Resources Management Theory & Research

Credits: 3. Contact Hours: Lecture 3.

Advanced research seminar in human resources management. The scope and coverage of the seminar is designed to representatively reflect the important content areas in the field, and the major theoretical and empirical contributions in each area. The seminar will be decidedly research focused with discussions concentrating on critical reviews and evaluations of existing work, and the identification of potential directions for theory development and future research. Through reading assignments, weekly papers, and the development of a theoretical paper, students should gain an appreciation for the current status of theory and research, and begin to articulate major issues and challenges facing the field of human resources management. (Typically Offered: Spring)

MGMT 6090: Organizational Research Methods

(Cross-listed with ENTSP 6090).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Enrollment in ENTSP or MGMT PhD program or permission of instructor.

Solid methodological foundation that will prepare you to be a productive producer and educated consumer of scientific research in the field of Management, Entrepreneurship, and other related disciplines. Introduction to numerous concepts and techniques with relevance to your future scholarship in this domain. Conceptual underpinnings necessary to appreciate the strengths and limitations of various approaches used in these fields and the interplay between theoretical advancement and rigorous empirical investigation. (Typically Offered: Fall)

MGMT 6120: Seminar in Micro Management Topics

(Cross-listed with ENTSP 6120).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Ivy College of Business PhD student or instructor permission

Foundation in micro research including domains of organizational behavior (OB) and human resource management (HR). Discuss classic micro topics (e.g., job performance), as well as topics that exemplify recent advances within the OB/HR literatures (e.g., big data). Multiple levels of analysis and consider how micro topics complement other areas of management research (i.e., entrepreneurship and macro topics). Theory and empirical research within the applied context of the OB/HR environment. Emphasize a systematic and scientific approach to deepening collective knowledge and understanding of topics. (Typically Offered: Fall)

MGMT 6200AX: Special Topics: Resources and Capabilities

Credits: 1. Contact Hours: Lecture 3.

Prereq: Graduate classification

Provide students with a deeper content knowledge of foundational and contemporary research on organizational resources and capabilities. Concepts (e.g., resources, capabilities, sustainable competitive advantage, knowledge, etc.) theoretical frameworks (e.g., Resource-based Theory; Dynamic Capabilities; Resource-dependency Theory; Knowledge-based view), and relevant findings in this area of research. Multiple levels of analysis and consideration of how these topics emerge across different areas of management (micro and macro) and entrepreneurship research. Theory and empirical research embedded within the applied context of the management field. Emphasis on a systematic and scientific approach to deepening our knowledge and understanding of topics. (Typically Offered: Spring)

MGMT 6200BX: Special Topics: Leadership

Credits: 1. Contact Hours: Lecture 3.

Prereq: Graduate classification

Provide a deeper content knowledge of leadership. Review major behavioral styles of leadership, as well as leader-follower relationships and a variety of other current leadership issues. Multiple levels of analysis and consideration of how these topics emerge across different areas of management (micro and macro) and entrepreneurship research. Theory and empirical research embedded within the applied context of the management field. Emphasis on a systematic and scientific approach to deepening the knowledge and understanding of topics. (Typically Offered: Spring)

MGMT 6200CX: Special Topics: Groups and Teams

Credits: 1. Contact Hours: Lecture 3.

Prereq: Graduate classification

Provide content knowledge of research in teams within the field of management, broadly defined. Covers research on teams from the perspective of the input-mediator-output-input model, which considers teams as complex, dynamic, and adaptive systems. Discussion of questions concerning composition and structure, processes and emergent states, and multilevel as well as temporal dynamics. Consideration of teams in students' specific area of study (e.g., entrepreneurial teams, top management teams). Blend of theory and empirical research within the applied context of the management field. Emphasis on a systematic and scientific approach to deepening knowledge and understanding of topics. (Typically Offered: Spring)

MGMT 6200DX: Special Topics: Crafting Research Ideas

(Cross-listed with ENTSP 6200DX).

Credits: 1. Contact Hours: Lecture 3.

Role as a scholar is more than publishing research. The purpose of scholarship is to add to usable knowledge - which means knowledge that can be used to solve real - world problems. To publish an article, students need to convince other scholars of the quality of their research. To create usable knowledge, you need to solve a problem that managers face and communicate that solution to managers. Most managers do not read academic journals, so the publication of an article does not guarantee that anyone who needs the knowledge will find it. Introduction an ideal form of scholarship that Andy Van de Ven calls 'engaged scholarship.' This form of scholarship requires the rigorous theory and methods by adds the additional component of connecting research to practitioners throughout the research process. (Typically Offered: Spring)

MGMT 6200EX: Special Topics: Effective Academic Writing

(Cross-listed with ENTSP 6200EX).

Credits: 1. Contact Hours: Lecture 3.

Provide skills and training necessary to navigate the professional landscape of the management and entrepreneurship fields. Discussion of effective academic writing, focusing on the discipline of management (but certainly applicable beyond this field). Blend of theory, research and practice focused on understanding one's role as a scholar, the implications of scholarly work, and successful advancement through career stages. (Typically Offered: Spring)

MGMT 6200FX: Special Topics: Professional Development in Management and Entrepreneurship Research

(Cross-listed with ENTSP 6200FX).

Credits: 1. Contact Hours: Lecture 3.

Repeatable, maximum of 2 times.

Provide skills and training necessary to navigate the professional landscape of the management/entrepreneurship fields. Includes topics such as research collaborations and networking, the peer review process, ethics, scholarly writing, presenting scholarly work, developing a research identity, understanding the research process, receiving and utilizing feedback, and navigating career milestones. Blend of theory, research, and practice focused on understanding one's role as a scholar, the implications of scholarly work, and successful advancement through career stages. (Typically Offered: Fall)

MGMT 6200GX: Special Topics: Bayesian Analysis in Management and Entrepreneurship Research

(Cross-listed with ENTSP 6200GX).

Credits: 1. Contact Hours: Lecture 3.

Provides a deeper understanding of research methodology. Introduces the fundamental concepts of Bayesian statistics as an advanced methodology to empirically investigate entrepreneurship and management phenome. Analytical topics include Bayes theorem, prior specification, likelihood functions, Markov Chain Monte Carlo simulations, analysis diagnostics, and posterior distributions. Application topics include Bayesian point estimates, intervals, predictions and hypothesis tests. Contrasts Bayesian approaches with frequentist paradigms such as statistical null-hypothesis significance tests. Designed to complement knowledge of MGMT 6090 Organizational Research Methods. Focus on exercises and discussions regarding how to collect, analyze and interpret empirical data to develop and advance micro- and macro-level theories in management and entrepreneurship. (Typically Offered: Fall)

MGMT 6200HX: Applied Social Network Perspectives

(Cross-listed with ENTSP 6200HX).

Credits: 1. Contact Hours: Lecture 3.

Provide a deeper content knowledge of social networks in organizational contexts. Cover conceptual foundations of the social network perspective, including how it fundamentally differs from other research perspectives. Explore important implications of various social network attributes and processes in the context of contemporary organizational scholarship. Discuss research design and empirical considerations associated with this perspective. Consider course topics from multiple levels of analysis and consider how these topics emerge across different areas (i.e., micro and macro) of management and entrepreneurship research. Blend of theory and empirical research within the applied context of the management field. Emphasis on a systematic and scientific approach to deepening knowledge and understanding of topics. (Typically Offered: Spring)

MGMT 6200IX: Mergers and Acquisitions

(Cross-listed with ENTSP 6200IX).

Credits: 1. Contact Hours: Lecture 3.

Provide a deeper content knowledge of mergers and acquisitions (M&As). Cover various M&A topics (premiums, deal completion, CEO characteristics, post-merger integration, acquisition performance, etc.), theoretical frameworks, as well as relevant findings of M&A research. Consider course topics from multiple levels of analysis and consider how these topics emerge across different areas of management (micro and macro) and entrepreneurship research. Blend of theory and empirical research within the applied context of the management field. Emphasis on a systematic and scientific approach to deepening knowledge and understanding of topics. (Typically Offered: Spring)

MGMT 6200JX: Artificial Intelligence, Machine Learning and Big Data in Management and Entrepreneurship Research

(Cross-listed with ENTSP 6200JX).

Credits: 1. Contact Hours: Lecture 3.

Repeatable, maximum of 2 times.

Provide a deeper understanding of research methodology implications of artificial intelligence, machine learning and big data for management and entrepreneurship scholars. Introduce students to the fundamental concepts and emerging capabilities of artificial intelligence and machine learning and investigate their applications in the context of data collection, data analysis and communication of research findings. Explore broader implications of these technologies for the objects of management research: organizations and their members. Designed to complement knowledge students can gain in MGMT 6090 Organizational Methods and ENTSP/MGMT 6200GX Bayesian Aalysis in management and Entrepreneurship Research. (Typically Offered: Fall, Spring, Summer)

MGMT 6200KX: How to Manage the Revise and Resubmit Process

(Cross-listed with ENTSP 6200KX).

Credits: 1. Contact Hours: Lecture 3.

Prereq: Enrollment in the PhD Program

Provide skills and training necessary to navigate the professional landscape of the management and entrepreneurship fields. Explore how to successfully manage the R&R (revise and resubmit process) at scholarly journals. Discussion of the purpose and stages of the peer review process. Blend of theory, research, and practice focused on understanding one's role as a scholar, the review process and implications of reviewing, and successful advancement through career stages. (Typically Offered: Spring)

MGMT 6200LX: Social Influence and Conflict: From Status to Stigma

Credits: 1. Contact Hours: Lecture 3.

Prereq: Graduate classification

Provide content knowledge of social influence processes. Explore how status and stigma impact individual and team influence and conflict outcomes. Discuss how social influence individual characteristics such as political skill will influence these processes. Evaluate course topics from multiple levels of analysis ad consider how these topics emerge across different areas of management (micro and macro) and entrepreneurship research, Blend of theory and empirical research within the applied context of the management field. Emphasis on a systematic and scientific approach to deepening knowledge and understanding of topics. (Typically Offered: Spring)

MGMT 6200MX: Ethics and Values in Management and Entrepreneurship

(Cross-listed with ENTSP 6200MX).

Credits: 1. Contact Hours: Lecture 3.

Provides content knowledge of business ethics, especially the variety of behavioral ethics. Offers an exposure to business ethics literature, experiments with blending different methodology with substantive content and develops interesting research questions related to business ethics & values. Evaluate course topics from multiple levels of analysis and consider how these topics emerge across different areas of management (micro and macro) and entrepreneurship research. Blend of theory and empirical research within the applied context of the management field. Emphasis on a systematic and scientific approach to deepening knowledge and understanding of topics. (Typically Offered: Spring)

MGMT 6200NX: Corporate Governance and Upper Echelons

Credits: 1. Contact Hours: Lecture 3.

Prereq: Graduate classification

Provide content knowledge of macro topics in management, specifically corporate governance and upper echelons. Covers research related to agency theory, the role of the board of directors, executive compensation and incentives, upper echelons theory, CEO succession, CEO characteristics, and external governance (e.g., the role of social movement, media, shareholder activists). Blend of theory and empirical research within the applied context of the management field. Emphasis on a systematic and scientific approach to deepening knowledge and understanding of topics. (Typically Offered: Fall, Spring)

MGMT 6200OX: Employee Participation

Credits: 1. Contact Hours: Lecture 3.

Prereq: Graduate classification

Provide content knowledge of employee participation. Explore how organizations encourage and foster employee involvement through the implementation of engagement-oriented policies and practices. Examine how these policies and practices motivate and empower individuals to be involved in the workplace, ultimately leading to participatory behaviors (voice, issue, selling, upward influence, etc.). Blend of theory and empirical research within the applied context of the management field. Emphasis on a systematic and scientific approach to deepening knowledge and understanding of topics. (Typically Offered: Fall, Spring)

MGMT 6500: Research Practicum I

Credits: 1.

Prereq: Ivy College of Business PhD student or instructor permission

Preparation of a research manuscript to be submitted to a peer-reviewed academic journal. Students will work with a faculty mentor on a research project.

MGMT 6510: Research Practicum II

Credits: 1.

Prereq: Ivy College of Business PhD student or instructor permission

Preparation of a second research manuscript to be submitted to a peer-reviewed academic journal. Although students work under the supervision of a faculty mentor, the students will take independent responsibility for the research project.

MGMT 6990: Dissertation

Credits: 1-12.

Prereq: Department Permission for Course

Research.

Management Information Systems (MIS)

Courses primarily for undergraduates:

MIS 2070: Fundamentals of Programming for Business and Analytics

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 1500 or credit or enrollment in MATH 1400 or higher

Introduction to programming (what it is and how it works) and problem-solving methods, emphasizing the basics of good programming techniques and style. Covers data types, control and data structures, functions, parameter passing, library functions, and object-oriented design to develop business and analytics applications. (Typically Offered: Fall, Spring)

MIS 3010: Management Information Systems

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 1130

The role of information technology in organizations. Overview of methodologies for design and development of systems including decision support systems, expert systems, data bases, end-user computing, etc. Computer applications relate concepts to practice. Lecture and laboratory work emphasizes the enabling role of IT in contemporary organizations. (Typically Offered: Fall, Spring, Summer)

MIS 3070: Intermediate Business Programming

Credits: 3. Contact Hours: Lecture 3.

Prereq: MIS 2070 and credit or enrollment in MIS 3010

Introduction to the concepts and use of data structures, file accesses and object oriented programming methodologies in contemporary business environments. Application development environments will be covered.

MIS 3100: Information Systems Analysis

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or enrollment in MIS 3010

Critical analysis of business processes, data and process modeling, feasibility studies, CASE tools, and developing system design specifications.

MIS 3116X: Data Visualization and Storytelling

Credits: 3. Contact Hours: Lecture 3.

Prereq: MIS 3010

Learn various skills to transform complex data into compelling visual stories using business intelligence tools such as Tableau. (Typically Offered: Spring)

MIS 3150: Business Data Streams and Issues

(Cross-listed with ACCT 3150).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ACCT 2840 and MIS 3010

Identification of open data sources and other private data sources. Develop methods of data access, collection, and sharing; develop methods to validate and standardize data sources; develop methods to assess data worthiness (risk). Typically Offered: Fall (even-numbered years), Spring (odd-numbered years), Summer (annually).

MIS 3200: Database Management Systems

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or enrollment in MIS 3010

Database design, development, and implementation. Focus on data models, both classical and object oriented. Uses relational and/or object oriented database management systems.

MIS 3400: Project Management

(Cross-listed with SCM 3400).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or enrollment in MIS 3010

Equips students to support team activities in the general project management environment and better manage their careers. Practical experience using project management techniques and tools. Course topics include project initiation and execution, risk assessment, estimating and contracts, planning, human factors, and standard methods.

MIS 3670: Consultative Problem Solving

(Cross-listed with MKT 3670).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Consultative problem-solving approach to address complex problems in marketing and related fields. Topics include problem definition, issue tree dis-aggregation, hypotheses development and the Pyramid Principle. Development of skills such as formulating problems, structuring and prioritizing problems, synthesizing results and communicating intuition from quantitative analyses. (Typically Offered: Fall, Spring)

MIS 4001X: Technology Entrepreneurship

Credits: 3. Contact Hours: Lecture 3.

Prereq: MIS 3010

This course focuses on how technology entrepreneurs take ideas from conception to commercialization. Topics will include innovation development, marketing, legal, organizational structure, operations, and business financing. (Typically Offered: Spring)

MIS 4030: Healthcare Information Systems

(Cross-listed with HCM 4030).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MIS 3010 and credit or enrollment in HCM 3010

Explores the critical role information technologies and systems play in healthcare organizations. The focus is on evaluating and implementing software and IT systems that facilitate delivery of health care; understanding information technology governance, data privacy, and security; planning and project management; and tracking future developments of information technology in healthcare management. Introduction to Electronic Health Records (EHR) and other Management and Financial Information System applications used by healthcare organizations.

MIS 4070: Advanced Business Programming

Credits: 3. Contact Hours: Lecture 3.

Prereq: MIS 3070.

Advanced software development and topics in contemporary programming languages. Topics include basic syntax, advanced programming techniques, file structures and management, database access, algorithm design, web forms and graphical user interfaces.

MIS 4100: Blockchain and Cryptocurrency

Credits: 3. Contact Hours: Lecture 3.

Prereq: MIS 2070 or COMS 2070 or COMS 2270

The design and application aspects of blockchain technologies, cryptocurrencies, and the key value these technologies bring - distributed consensus and trust disintermediation. Study of how blockchain technology works with consideration to its potential disruptive impact on business and society. Key concepts include mining, hashing, proof-of-work, proof-of-stake, public key cryptography, smart contracts, and the double-spend problem. (Typically Offered: Fall)

MIS 4350: Cybersecurity in Business

Credits: 3. Contact Hours: Lecture 3.

Prereq: MIS 3010

Introduction to fundamental concepts in networking and cloud computing and related cybersecurity concepts. Examination of network and cloud architectures, technologies, management and governance, security controls and techniques used to design, deploy, and protect resources in those environments. Exposure to cybersecurity tools in hands-on labs and explore methods of implementing and maintaining effective networks and cybersecurity programs in private, public, and cloud infrastructures.

MIS 4360: Introduction to Business Analytics

Credits: 3. Contact Hours: Lecture 3.

Prereq: (MIS 3200 or ACCT 3840) and credit or enrollment in STAT 3260 or STAT 3410

Introduction to the field of business analytics (BA). Students will examine BA processes and techniques used in transforming data to knowledge and creating value for organizations. Business cases, presentations by business professionals, class lectures and discussions on data analysis, design and modeling, and extensive hands-on analytical exercises.

MIS 4390: Topics in Management of Information Systems

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: MIS 3010

A variety of topics will be covered and topics may vary between semesters. Some of the topics are information resources management, electronic commerce, decision support systems, and expert systems.

MIS 4400: Supply Chain Information Systems

(Cross-listed with SCM 4400).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MIS 3010, SCM 3010

Internal and inter-organizational information systems necessary for a supply chain to achieve competitive advantage. Topics include: design, development, implementation, and maintenance of supply chain information systems; enterprise resource planning; advanced planning and scheduling, manufacturing execution systems; and the interface between manufacturing planning and control processes, logistics processes, and the information system.

MIS 4410X: Cybersecurity Analytics

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: MIS 4350 and MIS 4360

Introduction to information security concepts, specifically how adversaries exploit systems and data for their benefit and how organizations can use analytics to detect and respond to security incidents. Survey of existing and emerging machine learning and artificial intelligence security tools for detecting and responding to security incidents. (Typically Offered: Spring)

MIS 4420X: Generative AI in Business Decision-Making

(Dual-listed with ACCT 5420X/ MIS 5420X). (Cross-listed with ACCT 4420X).

Credits: 3. Contact Hours: Lecture 3.

This intensive course is designed to equip students with the knowledge and skills to leverage generative AI in business decision-making. Through learning modules, interactive case studies, and practical assignments, students will learn to create effective prompts and use Generative AI to transform business processes and decision-making. (Typically Offered: Spring, Summer)

MIS 4450: Enterprise Cybersecurity

Credits: 3. Contact Hours: Lecture 3.

Prereq: MIS 3010

Introduction to the elements of a cybersecurity program in the administrative, technical, and physical security domains. Learn methods to analyze and assess organizational risk and determine appropriate controls, be exposed to offensive and defensive cybersecurity tools in hands-on labs, and explore methods of implementing and maintaining effective cybersecurity programs. Examination of policy, frameworks, laws, regulations, and compliance and how they influence and contribute to cybersecurity programs.

MIS 4460: Advanced Business Analytics

Credits: 3. Contact Hours: Lecture 3.

Prereq: (MIS 3200 or ACCT 3840) and credit or enrollment in STAT 3260 or STAT 3410

Projects-based course which provides an in-depth understanding of BA methods of visualization, data mining, text mining, web-mining, and predictions through the use of specific BA tools. For students who are interested in understanding advanced techniques and applications of data analytics and acquiring hands-on skills for making intelligent business decisions in data-rich organizations.

MIS 4470: Information Systems Development

Credits: 3. Contact Hours: Lecture 3.

Prereq: MIS 3010 and MIS 3100

Design of business systems using contemporary tools and methods such as SQL, CASE tools, OOD tools, etc. Focuses on synthesizing concepts from earlier MIS courses.

MIS 4500: Enterprise Resource Planning Systems in Supply Chain

(Cross-listed with SCM 4500).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (MIS 3010 and SCM 3010) or (IE 1480 and IE 3410)

Enterprise Resource Planning Systems in Supply Chain.

MIS 4680: Analytics for Marketing Strategies

(Cross-listed with MKT 4680).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MKT 3400 and STAT 2260 or equivalent

Use of different tools to conduct various analyses to support marketing strategies. Topics include data visualization and exploration, forecasting, social media analytics and other marketing techniques. Development of skills such as structuring problems, and synthesizing results from quantitative analyses. (Typically Offered: Fall, Spring)

MIS 4900: Independent Study

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

MIS 4950: Executive Analysis and Presentation

(Dual-listed with MIS 5950X/ SCM 5950X). (Cross-listed with SCM 4950).

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Sophomore classification in the Ivy College of Business

The development of professional skills with the focus on analyzing real business problems and developing strategic solutions for companies' senior management. Hands-on learning and practices through case studies and real-world examples. Key aspects include business issue identification, analysis and problem-solving, actional solution evaluation, proposal development, and presentation to senior executives. (Typically Offered: Fall)

Courses primarily for graduate students, open to qualified undergraduates:

MIS 5010: Management Information Systems

Credits: 3. Contact Hours: Lecture 3.

Prereq: Ivy College of Business Graduate Student or instructor permission

Current theories and practices appropriate for understanding the role and application of information systems for individuals, organizations, and society within a globally competitive context. Focus on information technology and its uses in improving work practices, products, and tools for individuals and organizations. Issues pertaining to current and emerging topics in the development and use of technology, the role of technology in and its alignment with organizational strategy and sustainable business practices, information system planning and the development of enterprise architectures, and human interface and personal characteristics in the design and use of technology. (Typically Offered: Fall, Spring)

MIS 5100: Blockchain and Cryptocurrency

Credits: 3. Contact Hours: Lecture 3.

Prereq: MIS 5320

The design and application aspects of blockchain technologies, cryptocurrencies, and the key value these technologies bring - distributed consensus and trust disintermediation. Study of how blockchain technology works with consideration to its potential disruptive impact on business and society. Key concepts include mining, hashing, proof-of-work, proof-of-stake, public key cryptography, smart contracts, and the double-spend problem. (Typically Offered: Fall)

MIS 5116X: Data Visualization and Design Thinking for Business Analytics

Credits: 3. Contact Hours: Lecture 3.

Gain knowledge about data visualization techniques, along with hands-on experience. Learn how to think critically and creatively to help make intelligent decisions with data in modern business environments. (Typically Offered: Fall)

MIS 5150: Big Data for Business

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Classification or Permission of Instructor

Understanding the issues and challenges of data from multiple sources, different velocities, in large volumes with questionable veracity. (Typically Offered: Fall)

MIS 5200: Healthcare Analytics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Classification or Permission of Instructor

A project-based course that provides an in-depth understanding of Healthcare Analytics methods of visualization, data mining, and predictions through the use of specific analytics tools. For students interested in understanding advanced techniques and applications of healthcare analytics and acquiring hands-on skills to apply to medicine and healthcare. (Typically Offered: Spring)

MIS 5210: Health Care Data Privacy, Security & Compliance

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Focus on healthcare data, the intricacies of security and privacy in the healthcare industry, and problems with compliance and reporting. Exposure to many sorts of data sources and data components used in healthcare as a health IT professional. Emphasis on fundamental terms used in healthcare data as well as the delicate nature of protected health information. Detailed coverage of HIPAA and the dangers of security lapses, malware, and phishing. In depth attention of some of the most significant laws and rules that are unique to the healthcare industry and the significance of compliance. (Typically Offered: Fall)

MIS 5320: Programming Foundations for Business Analytics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Classification or Permission of Instructor

Explores the application of structured programming techniques for business analytics. Topics include data collection, processing, analysis, and more. Focus is on individual and group activities that reinforce skills development and provide the basis for later advanced work in data modeling. (Typically Offered: Summer)

MIS 5330: Data Management for Decision Makers

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Classification or Permission of Instructor

Addresses data needs of functions such as marketing, finance, and production. Advanced skills needed to design, develop and use database, data warehousing and data mining systems for effective decision support. Emphasis on importance of contemporary technologies.

MIS 5350: Networks and Information Security Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Classification or Permission of Instructor

Issues involved in the management of telecommunications function. Overview of communications technology used in various business applications, local area network, wide area network, broad band network, wireless and voice networks. Internet technologies and protocols. Analyzing the strategic impact of these technologies on organizations. Strategic planning for telecommunications, including network planning and analysis.

MIS 5360: Business Analytics Foundation

Credits: 3. Contact Hours: Lecture 3.

Prereq: MIS 5320

Introduction to Business Analytics (BA) concepts and tools. Hands-on lab exercises and business case studies in data preparation, data querying and data visualization. Also covers various modeling techniques in predictive and prescriptive analytics.

MIS 5370: Project Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Classification or Permission of Instructor

Prepares students to support team activities in the general project management environment and provides them with a working understanding of the full scope of project management activities. Students will also have practical experience using project management techniques and tools. Course topics include project initiation and execution, risk assessment, estimating and contracts, planning, human factors, and standard methods. The course follows the recommended content areas of the Project Management Institute, and provides students with a recognized foundational training in project management.

MIS 5380: Business Process Systems

Credits: 3. Contact Hours: Lecture 3.

Prereq: MIS 5010; Graduate classification or Permission of Instructor

Examine current and historical perspectives on business process management. Topics include process identification, mapping, and improvement. Additional topics will address business process automation and integration, business process outsourcing. Investigate current and potential tools and methods for business process management. Include process management projects.

MIS 5390: Topics in Management of Information Systems

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: Graduate Classification or Permission of Instructor

A variety of topics may be offered in different semesters. Topics may include electronic commerce, information resources management, decision support systems, and expert systems.

MIS 5410: Analytics in Finance

(Cross-listed with FIN 5410).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BUSAD 5020

Introduction to Business Analytics (BA) in finance and the insurance industry. The concepts and tools discussed in this course, to be followed and complemented by more advanced courses in the area. Basic analytical thinking and business acumen focusing on applications from finance and insurance. Practical data analytic skills based on building real analytic applications on real data. (Typically Offered: Spring)

MIS 5420X: Generative AI in Business Decision-Making

(Dual-listed with ACCT 4420X/ MIS 4420X). (Cross-listed with ACCT 5420X).

Credits: 3. Contact Hours: Lecture 3.

This intensive course is designed to equip students with the knowledge and skills to leverage generative AI in business decision-making. Through learning modules, interactive case studies, and practical assignments, students will learn to create effective prompts and use Generative AI to transform business processes and decision-making. (Typically Offered: Fall, Spring, Summer)

MIS 5440: Social Media Business Applications and Analytics

Credits: 3. Contact Hours: Lecture 3.

Prereq: MIS 5360

The role of new collaborative social technologies and analysis of social media data. Exploration of strategic and operational applications of social media and of tools that support the analysis of social network and social media data. Application of text analysis and social network theory. (Typically Offered: Summer)

MIS 5450: Enterprise Cybersecurity Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Classification or Permission of Instructor

Challenges, technologies, and practices of information security management in enterprise operations. (Typically Offered: Spring)

MIS 5460: Advanced Business Analytics

Credits: 3. Contact Hours: Lecture 3.

Prereq: MIS 5320

An in-depth discussion of various advanced topics in Business Analytics (BA) such as Big Data Analytics, Text Analytics, and Web Analytics. Extensive hands-on exercises of using BA tools to solve real-world problems. Preparation for students' capstone projects. (Typically Offered: Fall, Spring)

MIS 5480: Data Wrangling for Business Analytics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Classification or Permission of Instructor

Introduction to applications for data science concepts in the business domain. As big data, machine learning, business analytics, business intelligence and other concepts grow in business applications, it is essential for students to understand the underlying concepts, data, models, and applications to be successful in a data-driven world. Learn to determine problem types, data restrictions, model selection, tool choice, and analysis of data science concepts for greater business value. (Typically Offered: Fall)

MIS 5560: Business Analytics Capstone Project

Credits: 3.

Prereq: MIS 5360

Synthesize analytics concepts, skills, and practices learned during the program of study to complete a course project. Projects proposals relevant to a firm are proposed and accepted midway through the program. Student cohort teams will complete the capstone project under the supervision of an advisory team of faculty. At the completion of the course teams will present their project marking the completion of the program of study. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

MIS 5900: Special Topics

Credits: 1-3. Repeatable, maximum of 3 credits.

Prereq: Instructor Permission for Course

For students wishing to do individual research in a particular area of MIS. (Typically Offered: Fall, Spring, Summer)

MIS 5950X: Executive Analysis and Presentation

(Dual-listed with MIS 4950/ SCM 4950). (Cross-listed with SCM 5950X).

Credits: 3. Contact Hours: Lecture 3.

This course prepares graduate students to analyze complex business issues, develop strategic recommendations, and compete in case competitions. Topics include analysis techniques, strategic decision-making, stakeholder management, and executive-level presentation skills, with a focus on presenting to C-suite executives. (Typically Offered: Fall, Spring)

MIS 5980: Research Seminar in Management Information Systems

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate classification

Examines issues such as the nature and content of information systems research; aspects of starting and pursuing research topics in information systems; exploring and understanding relevant research methods and tools. Develop preliminary research proposals.

MIS 5990: Creative Component

Credits: 3. Repeatable.

Prereq: Instructor Permission for Course

Preparation and writing of creative component.

Courses for graduate students:**MIS 6020: Introduction to Information Systems Research II**

Credits: 3. Contact Hours: Lecture 3.

Prereq: MIS 5010 and enrollment as a PhD student in Business

Three fundamental areas of Information Systems, namely, infrastructure, management, and processes. Infrastructure studies examine the IT architecture including computing, communication, data, and application. Management focuses on addressing the value added notion of IT. Finally processing addresses topics related to enabling role of IT in myriad of areas.

MIS 6030: Seminar on IT Strategy and Structure

Credits: 3. Contact Hours: Lecture 3.

Prereq: MIS 6010

Strategic issues in IT management. Address issues such as aligning IT strategy with corporate strategy and functional strategies, IT structure, valuation, governance and control, and related topics. Provide students with research skills related to the boundary between IT and the firm's external environment.

MIS 6040: Collaboration, Knowledge, and Intelligence in Organizations

Credits: 3. Contact Hours: Lecture 3.

Prereq: MIS 6010

Research issues in the emerging areas of collaboration, knowledge management, and enterprise intelligence. Topics will include emerging and contemporary technologies of Data Mining, Knowledge Discovery from Databases, Web Mining, organizational memory, and knowledge management.

MIS 6200: Overview of MIS Research

Credits: 3. Contact Hours: Lecture 3.

Introduce doctoral students to the most cited research in IS, as well as to various behavioral research methods. Readings on research topics will cover categories of IS knowledge including: IS development, IT & individuals, IT & groups, IT & organizations, and IT & markets. Offered odd-numbered years. (Typically Offered: Fall)

MIS 6250: Analytical Research in Information Systems

Credits: 3. Contact Hours: Lecture 3.

Mathematical models to capture the essence or abstractions of real-world problems and applying established techniques to derive optimal solutions or business insights. Application of theories and tools from operations research, economics, computer science, and statistics to tackle problems regarding the development, marketing, utilization, and management of information technologies and systems in organizations and the society. Offered odd-numbered years. (Typically Offered: Spring)

MIS 6300: Empirical Research in MIS

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 2 times.

Intermediate level statistical and econometric methods used in MIS research. Preparation to conduct rigorous longitudinal analyses. Statistical and econometric methods used to examine phenomena that can evolve with the passage of time. Methods used for analyzing cross-sectional data. Application of advanced empirical methods in combination with rigorous theoretical arguments. (Typically Offered: Fall)

MIS 6350: Computational Research in MIS

Credits: 3. Contact Hours: Lecture 3.

Introduction for doctoral students to Information Systems research methods rooted in computational thinking. Topics include important issues in IS research that benefit from computational thinking; and computational methodologies commonly used in IS research.

MIS 6500: Research Practicum I

Credits: 1.

Prereq: Ivy College of Business PhD student or instructor permission

Preparation of a research manuscript to be submitted to a peer-reviewed academic journal. Students will work with a faculty mentor on a research project. (Typically Offered: Fall, Spring, Summer)

MIS 6510: Research Practicum II

Credits: 1.

Prereq: Ivy College of Business PhD student or instructor permission

Preparation of a second research manuscript to be submitted to a peer-reviewed academic journal. Although students work under the supervision of a faculty mentor, the students will take independent responsibility for the research project.

MIS 6550: Organizational and Social Implications of Human Computer Interaction

(Cross-listed with HCI 6550).

Credits: 3. Contact Hours: Lecture 3.

Examine opportunities and implications of information technologies and human computer interaction on social and organizational systems. Explore ethical and social issues appurtenant to human computer interaction, both from a proscriptive and prescriptive perspective. Develop informed perspective on human computer interaction. Implications on research and development programs.

MIS 6990: Research

Credits: 3-6. Repeatable.

Prereq: Instructor Permission for Course

Research. (Typically Offered: Fall, Spring, Summer)

Marketing (MKT)

Courses primarily for undergraduates:**MKT 3400: Principles of Marketing**

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or enrollment in ECON 1010

The role of marketing in society. Markets, marketing institutions, and marketing functions with emphases on product, price, marketing communication, and marketing channel decisions. (Typically Offered: Fall, Spring, Summer)

MKT 3420: Foundation Of Personal Selling

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

The process of selling and how to sell effectively. Focus on selling in a business environment and applying to concepts to general interpersonal settings in personal life. Students will actively participate in class, collaborate with teammates to develop skills to sell ideas and become more effective in representing themselves and their company and its products and services. Develop skills necessary to build long-term, profitable relationships with clients. (Typically Offered: Fall, Spring)

MKT 3510: Services Marketing

Credits: 3. Contact Hours: Lecture 3.

Prereq: MKT 3400

In-depth appreciation and understanding of the unique challenges inherent in creating, managing, and delivering quality services. Students will be introduced to and have the opportunity to work with concepts, tools, and strategies that address these challenges. (Typically Offered: Fall)

MKT 3610: Social Media Marketing Strategy

Credits: 3. Contact Hours: Lecture 3.

Prereq: MKT 3400

The course will cover marketing, advertising and communications strategies in the new media landscape where traditional media (e.g., television, print) and the online social media (i.e., Web 2.0; e.g., online social networks, user-generated content, blogs, forums) co-exist. Students will be expected to have knowledge about the fundamentals of traditional advertising methods and strategies. With this background knowledge, the primary focus of this course will be on understanding social media, how to build social media marketing strategies, and how to track their effectiveness. This course will not look at more tactical aspects of advertising/communications such as creative, message management, and publicity. This will first and foremost be a marketing strategy course.

MKT 3620: Digital Marketing

Credits: 3. Contact Hours: Lecture 3.

Prereq: MKT 3400

A survey course that explores key topics and competencies that will help formulate a digital marketing strategy and power a digital marketing campaign. Digital marketing is a broader toolkit that includes search engine marketing (SEM), search engine optimization (SEO), content marketing, mobile marketing, email marketing, landing page optimization, social media marketing, and more. (Typically Offered: Fall, Spring, Summer)

MKT 3630: Creative Tools for Digital Marketing

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

An interactive course that explores the basics of design software (Canva, Photoshop, Lightroom, Illustrator, InDesign), non-linear editing software (Premiere Pro, After Effects, Media Encoder) photography, videography and lighting (DSLR and mobile), and working with and manipulating assets developed by designers to promote companies, brands, events, and products on digital platforms. (Typically Offered: Fall, Spring)

MKT 3670: Consultative Problem Solving

(Cross-listed with MIS 3670).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Consultative problem-solving approach to address complex problems in marketing and related fields. Topics include problem definition, issue tree dis-aggregation, hypotheses development and the Pyramid Principle. Development of skills such as formulating problems, structuring and prioritizing problems, synthesizing results and communicating intuition from quantitative analyses. (Typically Offered: Fall, Spring)

MKT 4100: Promotional Strategy

Credits: 3. Contact Hours: Lecture 3.

Prereq: MKT 3400

Principles, concepts, and problems involved in the development and implementation of promotional strategies. Coordination of a variety of promotional elements: advertising, sales promotion, direct marketing, public relations and publicity of web communications, and personal selling. (Typically Offered: Fall, Spring)

MKT 4420: Sales Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: MKT 3400 and STAT 2260 or equivalent

Functional aspects of sales force management; personal selling methods; procedures for recruiting, selecting, and training new salespeople; compensation and expense control systems; problems of sales force motivation and supervision; methods of territorial and quota assignment; sales department budgets; distributor-dealer relations; other selected topics. (Typically Offered: Fall, Spring)

MKT 4430: Strategic Marketing Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: MKT 4440 and (MKT 3420 or MKT 4470)

Analysis of major elements of strategic marketing management. May include case studies or business simulations involving decision making using marketing tools from previous courses. (For marketing majors only.). (Typically Offered: Fall, Spring, Summer)

MKT 4440: Fundamentals of Marketing Analytics

Credits: 3. Contact Hours: Lecture 3.

Prereq: MKT 3400 and STAT 2260 or equivalent

Marketing research techniques: problem formulation, research design, questionnaire construction, sampling, data collection procedures, and analysis and interpretation of data related to marketing decisions. (Typically Offered: Fall, Spring)

MKT 4450: Customer Relationship Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: MKT 3400 and STAT 2260 or equivalent

Examines how customer data can be used to enhance decisions relating to acquisition, development and retention. Topics include customer lifetime value, customer as assets, customer loyalty programs and customization. (Typically Offered: Fall, Spring)

MKT 4470: Consumer Behavior

Credits: 3. Contact Hours: Lecture 3.

Prereq: MKT 3400

Study of how consumers select, purchase, use, and dispose of goods and services. Includes analyses of how markets and others influence these processes. Application of concepts and methods of the behavioral sciences to marketing management decision making. (Typically Offered: Fall, Spring)

MKT 4480: Global Marketing

Credits: 3. Contact Hours: Lecture 3.

Prereq: MKT 3400

Marketing from a global perspective and familiarity with the problems and perspectives that global companies face. Concepts and principles of marketing strategies, market assessment, identify marketing opportunities, entry decision, emerging markets, effects of political, legal, economic and cultural environments, and decisions relating to segmentation, positioning, branding, product, price, distribution and promotions in a global setting. (Typically Offered: Fall, Spring)

MKT 4500: Advanced Professional Selling

Credits: 3. Contact Hours: Lecture 3.

Prereq: MKT 3400; (IE 4500 or MKT 3420)

Analysis of the theory and practice of personal selling with the context of relationship marketing and salesforce automation. Topics include: goal setting, prospecting, time/territory management, questioning, presentations, objections, commitment and customer service; simulations of selling situations.

MKT 4510: Omnichannel Marketing

Credits: 3. Contact Hours: Lecture 3.

Prereq: MKT 3400

Focuses on marketing channels, the downstream part of a value chain, companies that come together to bring products and services from their point of origin to the point of consumption. Topics include channel institutions, channel design, channel coordination and implementation. Highlights international and technological aspects of marketing channels so that students can successfully develop and manage marketing channels in a contemporary business environment. (Typically Offered: Fall, Spring)

MKT 4520: Sales Enablement Tools and Technology

Credits: 3. Contact Hours: Lecture 3.

Prereq: MKT 3400

An applied study of the concepts, practice, and technical skills required to perform meaningful analytics in support of professional selling. Topics include: nature and aims of sales analytics; customer relationship management platform basics; sales data structure; data visualization; dashboard construction; predictive analytics; artificial intelligence. (Typically Offered: Fall)

MKT 4530: Brand Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: MKT 3400

Examines the role of brands and branding in market environments characterized by intense competition and consumer power. Covers issues relating to why branding is important to firms, what brands represent to consumers, and what should be done to manage them effectively. (Typically Offered: Fall, Spring)

MKT 4540: Entrepreneurial Marketing

(Cross-listed with ENTSP 4540).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MKT 3400

Basic understanding of marketing for those interested in creating or working for a start-up or an innovation-oriented company or consultancy. Relevant to marketing roles in entrepreneurial firms across both B2B and B2C markets. Integrates theory and practice, and provides insight into how entrepreneurs take both strategic and tactical marketing decisions in uncertain business environments. For hands-on perspective, incorporates projects involving real-world marketing problems confronting start-ups, and guest talks from entrepreneurs and frequent case analyses. (Typically Offered: Fall)

MKT 4550X: Managing for Creativity and Innovation

(Dual-listed with MKT 5550X).

Credits: 3.

Prereq: MKT 3400

Understanding the managerial space between how people enhance their individual creativity and the deployment of human and technology resources at group and department levels. Each class session focuses on a different managerial practice (e.g., hiring, assembling teams, job assignments) and how to enhance organizational creativity through them. Psychological and social factors applicable to those practices and that impinge on creativity will be discussed, and business cases related to the practices will be used to close the gap between theory and practice. (Typically Offered: Spring)

MKT 4560X: Digital Marketing Analytics

Credits: 3. Contact Hours: Lecture 3.

Prereq: MKT 3400 and STAT 2260 or equivalent

Digital marketing provides marketers with a lot of consumer data. This course explores topics such as organic and paid search, social media, and email marketing to understand how they contribute to a cohesive online presence. Identification of key performance indicators to determine the performance of the digital marketing activity in each channel, as well as how to leverage these insights to formulate future strategies are key objectives. (Typically Offered: Spring)

MKT 4580X: New Product Marketing

Credits: 3. Contact Hours: Lecture 3.

Prereq: MKT 3400

A project-driven course focused on the knowledge and skills needed to successfully develop and launch product or service innovations into today's competitive marketplace. From need identification through concepting, evaluation, and introduction, this course applies foundational marketing principles and processes along with new concepts such as pricing and forecasting. Student teams will work to turn opportunities and ideas into viable businesses, in collaboration with students studying new product design/development in other colleges. (Typically Offered: Fall, Spring)

MKT 4590X: Sustainable Marketing

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: MKT 3400

Focus on sustainable marketing strategies. (Typically Offered: Fall)

MKT 4600X: Franchising Strategy

(Cross-listed with ENTSP 4600X).

Credits: 3. Contact Hours: Lecture 3.

Go-to-market practices with focus on franchising. Connecting franchising with other sister disciplines (entrepreneurship, marketing, and retailing). Developing and managing a franchise from a franchisor's standpoint and understanding franchising from a franchisee's standpoint. (Typically Offered: Spring)

MKT 4680: Analytics for Marketing Strategies

(Cross-listed with MIS 4680).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MKT 3400 and STAT 2260 or equivalent

Use of different tools to conduct various analyses to support marketing strategies. Topics include data visualization and exploration, forecasting, social media analytics and other marketing techniques. Development of skills such as structuring problems, and synthesizing results from quantitative analyses. (Typically Offered: Fall, Spring)

MKT 4840: Technology, Globalization and Culture

(Dual-listed with WLC 5840/ ME 5840/ MKT 5840). (Cross-listed with ME 4840/ WLC 4840).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior or Senior Classification

Cross-disciplinary examination of the present and future impact of globalization with a focus on preparing students for leadership roles in diverse professional, social, and cultural contexts. Facilitate an understanding of the threats and opportunities inherent in the globalization process as they are perceived by practicing professionals and articulated in debates on globalization. Use of a digital forum for presenting and analyzing globalization issues by on-campus and off-campus specialists. Meets International Perspectives Requirement. (Typically Offered: Fall)

MKT 4900: Independent Study

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

MKT 4920: Comparative Marketing

Credits: 3. Contact Hours: Lecture 3.

Prereq: MKT 3400

Provides experience to students in culture, social, economic, and political environment of marketing in a foreign country. Students complete a term project (e.g., a marketing plan) based on information collected in the foreign country. Students attend briefings by experts/officials of private and public organizations. (Typically Offered: Summer)

MKT 4950: Live Cases in Marketing

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: MKT 3400

Teamwork with companies to solve their current marketing challenges. Opportunity to gain critical thinking skills, experience with quantitative analysis, client management experience, professional presentation skills, strategies for effective teamwork, practice giving and receiving feedback, and practical marketing experience. Experience will strengthen student resume, make connections with industry, and practice applying marketing concepts in real-world situations. The companies and challenges will be different each semester. Graduation Restriction: Only 3 credits of MKT 4950 may count as a MKT major or minor choice elective. (Typically Offered: Fall, Spring)

Courses primarily for graduate students, open to qualified undergraduates:

MKT 5010: Marketing

Credits: 3. Contact Hours: Lecture 3.

Prereq: Ivy College of Business graduate student or Engineering Management student or instructor permission

An analytical approach to the study of marketing issues and challenges of business firms and nonprofit organizations. Emphasis on the influence of the global marketplace and the marketing environment on marketing decision making; the determination of the organization's products, prices, channels and communication strategies; an orientation that ensures sustainability of marketing operations; and the organization's system for planning and controlling its marketing effort.

MKT 5420: New Product Strategy and Analytics

Credits: 3. Contact Hours: Lecture 3.

Prereq: MKT 5010; (Graduate classification or Permission of Instructor)

Principles and concepts of new product development and introduction; decision areas include market definition and structure, idea generation, concept evaluation, test marketing, launch tracking, and global product planning; models and techniques of new product evaluation used by consumer product companies. (Typically Offered: Spring)

MKT 5470: Consumer Behavior

Credits: 3. Contact Hours: Lecture 3.

Prereq: MKT 5010; (Graduate classification or Permission of Instructor)

The behavior of consumers. Intensive review of literature from relevant disciplines. Applications of concepts and methods of the behavioral sciences to marketing management decision making. (Typically Offered: Spring)

MKT 5480X: Customer Relationship Management Strategy and Analytics

Credits: 3. Contact Hours: Lecture 3.

Prereq: MKT 5010

Companies are shifting their focus from products to customers in response to increased globalization and intensity of competition in most markets. New technologies and tools that capture customer data in real time are now available because of the Internet revolution. These two trends in combination have opened up a new way of addressing customers and capturing value from customers--termed 'Customer Relationship management'. Focus on the adoption of CRM practices and key strategies that contribute to improved customer and firm performance. Key topics covered include CRM definition and strategy, customer satisfaction and loyalty models, social media and customer engagement, retention and churn models, campaign management and customer value metrics and drivers. Use of customer databases and analytical modeling of important CRM outcomes. Offered even-numbered years. (Typically Offered: Spring)

MKT 5520: Strategic Marketing Analytics

Credits: 3. Contact Hours: Lecture 3.

Prereq: major in Business Analytics

Integrate various concepts to solve problems in marketing. Enhance skills such as formulating problems, structuring and prioritizing problems, synthesizing results and communicating intuition from complicated analyses. Topics include problem definition, issue tree dis-aggregation and the Pyramid Principle. Overview of various newly developed marketing theories and analytical tools.

MKT 5530X: Brand Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: MKT 5010

With dwindling product differences, branding has become an important managerial tool for developing competitive advantage. A brand name, and its associated brand equity, is one of the most valuable assets any firm has. Although brand management has been in vogue among select consumer product companies for the last 40 to 50 years, service firms and B2B firms have discovered its usefulness only recently. Moreover, management education has not always paid sufficient attention to managing brands. To address this oversight, this course addresses important branding decisions faced by organizations. We believe that knowledge of theory and practice relating to brand management is a must for every marketing student. (Typically Offered: Fall)

MKT 5550X: Managing for Creativity and Innovation

(Dual-listed with MKT 4550X).

Credits: 3.

Prereq: MKT 3400 or MKT 5010

Understanding the managerial space between how people enhance their individual creativity and the deployment of human and technology resources at group and department levels. Each class session focuses on a different managerial practice (e.g., hiring, assembling teams, job assignments) and how to enhance organizational creativity through them. Psychological and social factors applicable to those practices and that impinge on creativity will be discussed, and business cases related to the practices will be used to close the gap between theory and practice. (Typically Offered: Spring)

MKT 5840: Technology, Globalization and Culture

(Dual-listed with WLC 4840/ ME 4840/ MKT 4840). (Cross-listed with ME 5840/ WLC 5840).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate classification

Cross-disciplinary examination of the present and future impact of globalization with a focus on preparing students for leadership roles in diverse professional, social, and cultural contexts. Facilitate an understanding of the threats and opportunities inherent in the globalization process as they are perceived by practicing professionals and articulated in debates on globalization. Use of a digital forum for presenting and analyzing globalization issues by on-campus and off-campus specialists. Meets International Perspectives Requirement. (Typically Offered: Fall)

MKT 5900: Special Topics

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

For students wishing to do individual research in a particular area of marketing.

Courses for graduate students:**MKT 6010: Seminar in Consumer Behavior**

Credits: 3. Contact Hours: Lecture 3.

Prereq: Ivy College of Business PhD student or instructor permission

A rigorous foundation of the major conceptual and methodological paradigms in the consumer-behavior literature. Seeks to aid students in understanding the psychological, sociological, and anthropological roots of consumer behavior research. Read the latest research in the area reported in leading consumer behavior/psychology journals.

MKT 6020: Marketing Strategy

Credits: 3. Contact Hours: Lecture 3.

Prereq: Ivy College of Business PhD student or instructor permission

Review major contributions and recent developments in marketing strategy research and practice. Review commonly used modeling approaches and research methods to study strategic interaction between firms seeking to build competitive advantages. Provide an overview of empirical research regarding measurement, level and persistence of business success and implications of findings for theory and strategy development.

MKT 6030: Marketing Strategy II

Credits: 3. Contact Hours: Lecture 3.

Prereq: MKT 6010

Addresses key strategy and implementation issues behind customer management. Topics such as typology of CM strategies, antecedents and outcomes; environmental and managerial influences on strategy formation; technology and impact on CM strategy; and value of CM strategy. Examine theories and concepts behind important CM issues such as customer satisfaction, customer loyalty and customer profitability.

MKT 6040: Marketing Issues in Inter-Organizational Relations

Credits: 3. Contact Hours: Lecture 3.

Prereq: Ivy College of Business PhD student or instructor permission

Inter-firm and network competition; relationship among suppliers, distributors, alliance partners, external employees, and internal employees. Theories including agency theory, network theory, relationship marketing, channels of distribution theories on cooperation versus competition, IOS theories.

MKT 6050: Marketing Analytics: Quantitative Models and Applications

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 3 times.

Survey of quantitative methods used in the field of marketing analytics. Topics include discrete choice models, unobserved heterogeneity, endogeneity, Hidden Markov models and other newly-developed techniques. Understand, develop and estimate quantitative models and understand main topics in marketing analytics. Offered odd-numbered years. (Typically Offered: Fall)

MKT 6060: Seminar in Consumer Behavior II

Credits: 3. Contact Hours: Lecture 3.

Prereq: MKT 6010

A rigorous foundation of the major conceptual and methodological paradigms in the consumer-behavior literature. Seeks to further develop and study issues contained in MKT 6010. Offered odd-numbered years. (Typically Offered: Fall)

MKT 6500: Research Practicum I

Credits: 1.

Prereq: Ivy College of Business PhD student or instructor permission

Preparation of a research manuscript to be submitted to a peer-reviewed academic journal. Students will work with a faculty mentor on a research project.

MKT 6510: Research Practicum II

Credits: 1.

Prereq: Ivy College of Business PhD student or instructor permission

Preparation of a second research manuscript to be submitted to a peer-reviewed academic journal. Although students work under the supervision of a faculty mentor, the students will take independent responsibility for the research project.

MKT 6990: Dissertation

Credits: 12. Repeatable.

Prereq: Graduate classification and Permission of Instructor
Research.

Materials Engineering (MATE)

Courses primarily for undergraduates:

MATE 1010: Materials Science & Engineering Learning Community Seminar

Credits: Required. Contact Hours: Lecture 1.

Introduction to the Materials Science & Engineering Department and resources available to support student success. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

MATE 1700: Numeric, Symbolic, and Graphical Methods for Materials Engineering

Credits: 3.

Prereq: ENGR 1600

Introduction to computer-based problem solving techniques including data analysis, data visualization, and materials simulation using spreadsheet, array, and symbolic methods that are necessary for materials science. Introduction to 3D CAD with consideration for additive manufacturing techniques. (Typically Offered: Spring)

MATE 2140: Structural Characterization of Materials

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: (MATE 2150 or MATE 2730 or MATE 3920); PHYS 2310

Structural characterization of materials. Techniques include optical and electron microscopy, x-ray diffraction, and thermal analysis. Identification of materials type, microstructure, and crystal structure. (Typically Offered: Fall, Spring)

MATE 2150: Introduction to Materials Science and Engineering I

Credits: 3. Contact Hours: Lecture 3.

Prereq: (CHEM 1670 or CHEM 1770); MATH 1650

Introduction to the structure and properties of engineering materials. Structure of crystalline solids and imperfections. Atomic diffusion. Mechanical properties and failure of ductile and brittle materials. Dislocations and strengthening mechanisms. Phase equilibria, phase transformations, microstructure development, and heat treatment principles of common metallurgical systems including steels and aluminum alloys. Engineering applications. Graduation Restriction: Only one of MATE 2150, MATE 2730, or MATE 3920 may count toward graduation. (Typically Offered: Fall, Spring)

MATE 2150L: Introduction to Materials Science and Engineering I - Lab

Credits: 1. Contact Hours: Laboratory 2.

Prereq: Credit or enrollment in MATE 2150 or MATE 2730 or MATE 3920

Materials Engineering majors only. Laboratory exercise in materials. (Typically Offered: Fall, Spring)

MATE 2160: Introduction to Materials Science and Engineering II

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATE 2150, MATE 2730 or MATE 3920; credit or enrollment in PHYS 2320

Materials Engineering majors only. Fundamentals of ceramic, polymeric, and composite materials; electronic, thermal, magnetic, and optical properties of materials. Materials for energy, biomaterials, and nanomaterials. (Typically Offered: Fall, Spring)

MATE 2160L: Introduction to Materials Science and Engineering II - Lab

Credits: 1. Contact Hours: Laboratory 2.

Prereq: Credit or enrollment in MATE 2160

Materials Engineering majors only. Laboratory exercise in materials. (Typically Offered: Fall, Spring)

MATE 2200: Globalization and Sustainability

(Cross-listed with ANTHR 2200/ ENVS 2200/ GLOBE 2200/ ME 2200/ SOC 2200).

Credits: 3. Contact Hours: Lecture 3.

An introduction to understanding the key global issues in sustainability. Focuses on interconnected roles of energy, materials, human resources, economics, and technology in building and maintaining sustainable systems. Applications discussed will include challenges in both the developed and developing world and will examine the role of technology in a resource-constrained world. Graduation Restriction: Cannot be used for technical elective credit in any engineering department. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

MATE 2730: Principles of Materials Science and Engineering

Credits: 3. Contact Hours: Lecture 3.

Prereq: (CHEM 1670 or CHEM 1770); MATH 1650

Introduction to the structure and properties of engineering materials. Structure of crystalline solids and imperfections. Atomic diffusion. Mechanical properties and failure of ductile and brittle materials. Dislocations and strengthening mechanisms. Phase equilibria, phase transformations, microstructure development, and heat treatment principles of common metallurgical systems including steels and aluminum alloys. Structure and mechanical properties of ceramic, polymeric and composite materials. Thermal properties of materials. Corrosion and degradation. Basic electronic properties of materials. Engineering applications. Graduation Restriction: Only one of MATE 2150, MATE 2730, or MATE 3920 may count toward graduation. (Typically Offered: Fall, Spring)

MATE 3010: Materials Engineering Professional Planning

Credits: Required. Contact Hours: Lecture 1.

Prereq: Sophomore classification and MATE majors only

Preparation for a career in industry or advanced study in graduate school. Lectures and guest speakers discuss various topics, including: strategies to achieve academic and technical success; strategies for effective communication and teamwork; professional ethics, safety, and standards; entrepreneurial/intrapreneurial skills; resumes and interviewing; leadership and networking; and career pathways and graduate school opportunities. Offered on a satisfactory-fail basis only. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

MATE 3110: Thermodynamics in Materials Engineering

Credits: 3. Contact Hours: Lecture 3.

Prereq: CHEM 1780; MATE 2150 or MATE 2730 or MATE 3920; and credit or enrollment in MATE 2160 and MATH 2670

Basic laws of thermodynamics applied to phase stability, phase equilibria, transformations, and reactions in materials. Concepts of heat, work, energy, and entropy. Reversible and irreversible processes. Ideal and non-ideal behavior in single-component and multi-component systems. Interpretation of unary, binary, and ternary phase diagrams. Methods for experimental measurement and computational modeling. Applications in materials design. (Typically Offered: Fall)

MATE 3140: Kinetics and Phase Equilibria in Materials

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATE 2140; MATE 2160; MATE 3110

The energetics and kinetics of transformations in materials. Quantitative descriptions of materials state, stability, and time-dependent evolution of constitution and microstructure. Relationships between phenomenology, driving forces, mechanisms, and kinetics as tools for controlling material state and associated properties. Fundamental concepts of thermodynamics, diffusional transport, interfaces, and other heterogeneities - applied to various types of diffusional and diffusionless transformations in materials state. Methods for experimental measurement and computational modeling. Applications in process design. (Typically Offered: Spring)

MATE 3170: Introduction to Electronic Properties of Materials

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATE 2160; PHYS 2320

Materials Engineering majors only. Introduction to electronic properties of materials and their practical applications. Classical conduction models and electronic properties of metallic and ceramic materials. Elementary quantum mechanics and band theory of electron states in solids. Quantum theory of metallic conduction. Elementary semiconductor theory and devices. Polarization and dielectric properties of materials. (Typically Offered: Fall)

MATE 3190: Mechanics of Structures and Materials

Credits: 3. Contact Hours: Lecture 3.

Prereq: PHYS 2310; credit or concurrent enrollment in MATH 1660

Fundamentals of engineering mechanics as applied to materials. Forces and moments; stresses in loaded bodies; elasticity and stress analysis including stress / strain relationships. Graduation Restriction: Only one of MATE 3190 or EM 3240 may be used for graduation requirements. (Typically Offered: Spring)

MATE 3210: Introduction to Ceramic Science

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATE 2160

Ceramic crystal structures, defects, diffusion and transport. Phase equilibria and microstructures. Thermal, electronic, optical and magnetic properties of ceramics. (Typically Offered: Fall)

MATE 3220: Introduction to Ceramic Processing

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: MATE 3210

Synthesis and characterization of ceramic powders. Colloidal phenomena, rheology of suspensions, ceramic forming methods, and drying. High temperature ceramic reactions, liquid and solid-state sintering, grain growth, microstructure development. Processing/microstructure/property relationships. (Typically Offered: Spring)

MATE 3320: Semiconductor Materials and Devices

(Cross-listed with EE 3320).

Credits: 3. Contact Hours: Lecture 3.

Prereq: CPRE and EE majors: EE 2300, MATE majors: MATE 3170

Introduction to semiconductor material and device physics. Quantum mechanics and band theory of semiconductors. Charge carrier distributions, generation/recombination, transport properties. Physical and electrical properties and fabrication of semiconductor devices such as MOSFETs, bipolar transistors, laser diodes and LED's. (Typically Offered: Spring)

MATE 3340: Electronic & Magnetic Properties of Metallic Materials

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATE 3170

Electronic conduction in metals and the properties of conducting materials. Quantum mechanical behavior of free electrons and electrons in potentials wells, bonds and lattices. Development of the band theory of electron states in solids and the Free and Nearly Free Electron models. Density-of-states in energy bands and the Fermi-Dirac statistics of state occupancy. Quantum mechanical model of metallic conduction; Brillouin zones and Fermi surfaces. Additional topics include the thermal properties of metals, electron phase transitions in metallic alloys and the BCS theory of superconductivity. Classical and quantum mechanical treatment of the origins of magnetism in materials; orbital and spin angular momentum. Theory of magnetic behavior in dia-, para-magnetic, ferromagnetic materials. Offered odd-numbered years. (Typically Offered: Spring)

MATE 3410: Metals Processing

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATE 2150 or MATE 2730 or MATE 3920

Theory and practice of metal processing, including: extractive metallurgy; casting and solidification; welding and joining; deformation processes (e.g., forging, extrusion); powder metallurgy; and additive manufacturing. (Typically Offered: Fall)

MATE 3420: Structure/Property Relations in Nonferrous Metals

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATE 2150 or MATE 2730 or MATE 3920

Physical properties of non-ferrous metals and their dependence on compositions microstructure and microstructures. Strengthening mechanisms in non-ferrous metals and alloys. Principles and practices to engineer compositions and processes to enhance these properties. Shape memory and elastocaloric alloy development and applications. (Typically Offered: Spring)

MATE 3480: Solidification Processes

(Cross-listed with IE 3480).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: IE 2480 and MATE 2730, or MATE 2150

Theory and applications related to metal casting, welding, polymer processing, powder metallurgy, and composites manufacturing, and related rapid manufacturing processes. (Typically Offered: Spring)

MATE 3500: Polymers and Polymer Engineering.

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATE 2160 or MATE 2730 or MATE 3920

Fundamental concepts of soft matter, including polymer, colloid and surfactant. Their physical and chemical properties, rheology and production methods. Applications of polymers in the chemical industry. Related topics in surface, diffusion and stability. (Typically Offered: Spring)

MATE 3510: Introduction to Polymeric Materials

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATE 2160 or MATE 2730 or MATE 3920

Introduction to polymer synthesis, structure, and properties. Develop a foundation in polymer chemistry and physics for in-depth polymer engineering. Relationship between polymer composition, processing, and properties. (Typically Offered: Fall)

MATE 3620: Principles of Nondestructive Testing

(Cross-listed with EM 3620).

Credits: 3. Contact Hours: Lecture 3.

Prereq: PHYS 1320 OR PHYS 2320 or PHYS 2320H

Radiography, ultrasonic testing, magnetic particle inspection, eddy current testing, dye penetrant inspection, and other techniques. Physical bases of nondestructive tests, materials to which applicable, effects of material condition, types of defects detectable, calibration standards, and reliability safety precautions. (Typically Offered: Fall, Spring)

MATE 3620L: Nondestructive Testing Laboratory

(Cross-listed with EM 3620L).

Credits: 1. Contact Hours: Laboratory 2.

Prereq: Credit or enrollment in MATE 3620 or EM 3620

Application of nondestructive testing techniques to the detection and sizing of flaws in materials and to the characterization of material's microstructure. Included are experiments in hardness, dye penetrant, magnetic particle, x-ray, ultrasonic and eddy current testing. (Typically Offered: Fall, Spring)

MATE 3910: Introduction to US Women's Roles in Industry and Preparation for Summer Study

Credits: 3. Contact Hours: Lecture 3.

Prereq: Instructor Permission for Course

Introduction to the historical role of women as related to US industry, family and community with emphasis on the years 1830 - 1945, but also related to the current climate. Topics completed in 3920 with arranged lectures at Brunel University. Orientation for Brunel summer study program. Graduation Restriction: Credit for graduation allowable only upon completion of summer study abroad program. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

MATE 3920: Principles of Materials Science and Engineering

Credits: 3. Contact Hours: Lecture 3.

Prereq: (CHEM 1670 or CHEM 1770); MATH 1650; MATE 3910

Introduction to the structure and properties of engineering materials. Structure of crystalline solids and imperfections. Atomic diffusion. Mechanical properties and failure of ductile and brittle materials. Dislocations and strengthening mechanisms. Phase equilibria, phase transformations, microstructure development, and heat treatment principles of common metallurgical systems including steels and aluminum alloys. Structure and mechanical properties of ceramic, polymeric and composite materials. Thermal properties of materials. Corrosion and degradation. Basic electronic properties of materials. Engineering applications. Graduation Restriction: Only one of MATE 2150, MATE 2730, or MATE 3920 may count toward graduation. Meets International Perspectives Requirement. (Typically Offered: Summer)

MATE 4130: Materials Design and Professional Practice I

Credits: 3. Contact Hours: Lecture 3.

Prereq: Senior classification or above

Fundamentals of engineering team behavior and professional preparation; Materials selection and design. Analysis of design problems, development of solutions, selected case studies. Oral presentation skills. Preparations for continued project in MATE 4140. MATE 4130-4140 sequence is intended for students in their final two semesters before graduation. (Typically Offered: Fall, Spring)

MATE 4140: Materials Design and Professional Practice II

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: MATE 4130

Team projects specified by either industry or academic partners. Written and oral final project reports. Integration of materials processing, structure/composition, properties and performance principles in materials engineering problems. Multi-scale design of materials, materials processing, case studies including cost analysis, ethics, risk and safety. (Typically Offered: Fall, Spring)

MATE 4180: Mechanical Behavior of Materials

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATE 2160; Credit or enrollment in MATE 3190

Mechanical behavior of ceramics, metals, polymers, and composites. Relationships between materials processing and atomic aspects of elasticity, plasticity, creep, fracture, and fatigue. Life prediction, stress-and failure analysis. (Typically Offered: Fall)

MATE 4190: Magnetism and Magnetic Materials

(Dual-listed with MSE 5190/ EE 5190). (Cross-listed with EE 4190).

Credits: 3. Contact Hours: Lecture 3.

Prereq: EE 3110 or MATE 3170 or PHYS 3640

Magnetic fields, flux density and magnetization. Magnetic materials, magnetic measurements. Magnetic properties of materials. Domains, domain walls, domain processes, magnetization curves and hysteresis. Types of magnetic order, magnetic phases and critical phenomena. Magnetic moments of electrons, theory of electron magnetism. Technological application, soft magnetic materials for electromagnets, hard magnetic materials, permanent magnets, magnetic recording technology, magnetic measurements of properties for materials evaluation. Offered odd-numbered years. (Typically Offered: Fall)

MATE 4250: Glass Science and Engineering

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: MATE 3210

Composition, structure, properties manufacturing, and applications of inorganic glasses. Mechanical, structural, thermal, optical, ionic, electronic, and biological applications of inorganic glasses, especially silicate glasses. Contemporary topics in glass science and engineering such as glass optical fiber communication and flat panel display technologies. Laboratory exercises in the preparation and characterization of silicate glasses. (Typically Offered: Fall)

MATE 4320: Microelectronics Fabrication Techniques

(Dual-listed with EE 5320/ MSE 5320). (Cross-listed with EE 4320).

Credits: 4. Contact Hours: Lecture 2, Laboratory 4.

Prereq: CPRE and EE majors: EE 2300, MATE majors: MATE 3170

Techniques used in modern integrated circuit fabrication, including diffusion, oxidation, ion implantation, lithography, evaporation, sputtering, chemical-vapor deposition, and etching. Process integration. Process evaluation and final device testing. Extensive laboratory exercises utilizing fabrication methods to build electronic devices. Use of computer simulation tools for predicting processing outcomes. Recent advances in processing CMOS ICs and micro-electro-mechanical systems (MEMS).

MATE 4330: Advanced Ceramics and Electronic Materials

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATE 3170 and MATE 3210

Charged point defects and formation equations. Non-stoichiometric conductors, dielectric, ferroelectric, and piezoelectric materials and applications. Optical properties, optical spectra of materials, optoelectronic devices. Magnetic and superconducting materials. Contemporary topics in advanced ceramics. (Typically Offered: Spring)

MATE 4370: Electronic Properties of Materials

(Dual-listed with EE 5370/ MSE 5370). (Cross-listed with EE 4370).

Credits: 3. Contact Hours: Lecture 3.

Prereq: EE 3320 or MATE 3170 or PHYS 3220

Magnetic fields, flux density and magnetization. Magnetic materials, magnetic measurements. Magnetic properties of materials. Domains, domain walls, domain processes, magnetization curves and hysteresis. Types of magnetic order, magnetic phases and critical phenomena. Magnetic moments of electrons, theory of electron magnetism. Technological application, soft magnetic materials for electromagnets, hard magnetic materials, permanent magnets, magnetic recording technology, biomedical applications of magnetism, magnetic evaluation of materials. (Typically Offered: Spring)

MATE 4430: Physical Metallurgy of Ferrous Alloys

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATE 3110

Production and processing of ferrous metals with emphasis on control of structure and properties. Industrial processes for ironmaking, steelmaking, alloying, melt treatment, casting, and forming. Heat treatment and thermomechanical processing. Equilibrium and nonequilibrium phases in the Fe-C system. Transformation diagrams, hardenability, and surface treatments. Properties and processing of cast irons, plain carbon and alloy steels, stainless steels, tool steels, and advanced high-strength steels. Alloy specifications and testing standards. Alloy selection and process design. (Typically Offered: Fall)

MATE 4440: Corrosion and Failure Analysis

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: MATE 2150 or MATE 2730 or MATE 3920

Failure analysis. Characteristics of common types of metallic failures, case studies of failures, designing to reduce failure risk. Corrosion and corrosion control of metallic systems. Fundamentals of corrosion and oxidation, classification of different types of metallic corrosion/oxidation, their properties of various engineering alloys, and their engineering control. (Typically Offered: Spring)

MATE 4520: Scanning and Auger Electron Microscopy

(Dual-listed with MSE 5520).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: PHYS 2320

Characterization of materials using scanning electron microscopes (SEM) and variants thereof, including electron microprobe, Auger spectrometer, and DualBeam focused ion beams (FIB)/SEMs). Compositional determination using energy and wavelength dispersive x-ray and Auger spectroscopies. Orientation determination using electron backscattered diffraction. Specimen preparation. Laboratory covers SEM operation. (Typically Offered: Fall)

MATE 4530: Physical and Mechanical Properties of Polymers

(Dual-listed with MSE 5530).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: MATE 3510

Overview of polymer chemical composition, microstructure, thermal and mechanical properties, rheology, and principles of polymer materials selection. Intensive laboratory experiments include chemical composition studies, microstructural characterization, thermal analysis, and mechanical testing. (Typically Offered: Fall)

MATE 4540: Polymer Composites and Processing

(Dual-listed with MSE 5540).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATE 3510

Basic concepts in polymer composites, blends, and block copolymers. Phase separation and miscibility, microstructures and mechanical behavior. Fiber reinforced and laminated composites. Viscosity, rheology, viscoelasticity of polymers. Polymer melt processing methods such as injection molding and extrusion; selection of suitable processing methods and their applications. (Typically Offered: Spring)

MATE 4560: Biomaterials

(Dual-listed with MSE 5560). (Cross-listed with BME 4560).

Credits: 3. Contact Hours: Lecture 3.

Prereq: CHEM 1780 and (MATE 2160 or MATE 2730 or MATE 3920)

Presentation of the basic chemical and physical properties of biomaterials, with special emphasis on metallic, ceramic, polymeric, and composite biomaterials, as they are related to their manipulation by the engineer for incorporation into living systems. Role of microstructure and properties needed to select and design biomaterials used in medical devices, artificial organs, implants, and prostheses. Overview of medical science vis-à-vis materials science. (Typically Offered: Fall)

MATE 4570: Chemical and Physical Metallurgy of Rare Earth Metals

(Dual-listed with MSE 5570).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATE 3110 or CHEM 3250

Electronic configuration, valence states, minerals, ores, beneficiation, extraction, separation, metal preparation and purification. Crystal structures, phase transformations and polymorphism, and thermochemical properties of rare earth metals. Chemical properties: inorganic and organometallic compounds, alloy chemistry, nature of the chemical bonding. Physical properties: mechanical and elastic properties, magnetic properties, resistivity, and superconductivity. Offered even-numbered years. (Typically Offered: Spring)

MATE 4800: Ultrasonic Nondestructive Evaluation

(Cross-listed with AERE 4800/ EM 4800).

Credits: 3. Contact Hours: Lecture 3.

Prereq: EM 3240 or MATE 3190; MATH 2660 or MATH 2670; PHYS 2320

Introduction to stress/strain, Hooke's law, and elastic wave propagation in two dimensions in isotropic media. Ultrasonic plane-wave reflection and transmission; and simple straight-crested guided waves. Transducer construction, behavior, and performance. Simple signal analysis and discrete signal processing. The last few weeks of the course are devoted to case studies. (Typically Offered: Spring)

MATE 4880: Eddy Current Nondestructive Evaluation

(Dual-listed with EE 5880/ MSE 5880). (Cross-listed with EE 4880).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 2650 and (MATE 2160 or MATE 2730 or MATE 3920 or EE 3110 or PHYS 3640)

Electromagnetic fields of various eddy current probes. Probe field interaction with conductors, crack and other material defects. Ferromagnetic materials. Layered conductors. Elementary inversion of probe signals to characterize defects. Special techniques including remote-field, transient, potential drop nondestructive evaluation and the use of Hall sensors. Practical assignments using a 'virtual' eddy current instrument will demonstrate key concepts. Offered odd-numbered years. (Typically Offered: Fall)

MATE 4900: Independent Study

Credits: 1-30. Repeatable.

Prereq: Department Permission for Course

Investigation of individual research or special topics. Independent study that is being proposed to be used toward graduation or minor requirements. This course requires an approved proposal to the MSE Department's Undergraduate Curriculum Committee prior to the beginning of the semester. (Typically Offered: Fall, Spring, Summer)

MATE 4900H: Independent Study: Senior Honors Project

Credits: 1-30.

Prereq: Department Permission for Course; Membership in the University Honors Program

Independent study that is being proposed to be used for an honors project. This course requires an approved proposal to the College of Engineering Honors Committee. Arranged: Additional Meetings or Activity Required. (Typically Offered: Fall, Spring, Summer)

MATE 4990: Undergraduate Research Opportunity

Credits: Required. Repeatable, maximum of 12 times.

Prereq: Department Permission for Course

Independent study working in research lab with faculty member.

Designed to allow students opportunity to gain experience that may assist them in obtaining future employment. Graduation Restriction: The course cannot be applied toward any graduation requirements. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

Materials Science and Engineering (MSE)

Courses primarily for graduate students, open to qualified undergraduates:

MSE 5010: Fundamentals of Materials Science and Engineering I

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

An examination of structure-property-process relationships in materials, focusing on control and measurement of end-use performance characteristics. Materials design fundamentals are discussed as they pertain to various critical industries, applications, and manufacturing technologies. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

MSE 5020: Fundamentals of Materials Science and Engineering II

Credits: 1. Contact Hours: Lecture 1.

Repeatable, maximum of 1 credits.

Prereq: Graduate Standing or Permission of Instructor

An examination of the physical behavior of materials, as underpinned by multiphase multicomponent thermodynamics, transport phenomena, interfaces, defect structures, the kinetics of phase transformations, and the mechanistic origins of structure-property-processing relationships in various types of materials. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

MSE 5030: Fundamentals of Materials Science and Engineering III

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Prereq: MSE 5010 and MSE 5020

Directed study of advanced topics in Materials Science and Engineering. Fundamental principles and relationships connecting structure, chemistry, stability, physical behavior, properties, and processing response are reviewed. Experimental and computational methods for materials research are emphasized. Offered on a satisfactory-fail basis only. (Typically Offered: Summer)

MSE 5100: Fundamentals of Structure and Chemistry of Materials

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Crystal structure and symmetry operations, including geometric and algebraic representations of symmetry. Structure, chemistry, and basic properties of covalent, ionic, and metallic solids, glasses and liquids, and polymers. Interactions of materials with particles and waves. Relationships between direct and reciprocal spaces. The kinematical theory of diffraction, with an introduction to the dynamical theory. (Typically Offered: Fall)

MSE 5190: Magnetism and Magnetic Materials

(Dual-listed with EE 4190/ MATE 4190). (Cross-listed with EE 5190).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Magnetic fields, flux density and magnetization. Magnetic materials, magnetic measurements. Magnetic properties of materials. Domains, domain walls, domain processes, magnetization curves and hysteresis. Types of magnetic order, magnetic phases and critical phenomena. Magnetic moments of electrons, theory of electron magnetism. Technological application, soft magnetic materials for electromagnets, hard magnetic materials, permanent magnets, magnetic recording technology, magnetic measurements of properties for materials evaluation. Offered odd-numbered years. (Typically Offered: Fall)

MSE 5200: Thermodynamics and Kinetics in Multicomponent Materials

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

A review of the fundamental principles of heat, work, basic thermodynamic relations, and criteria for equilibrium. Analytical treatments for the thermodynamic description of multicomponent chemical solutions and reacting systems are developed and employed to predict phase equilibria in materials systems. Builds on the thermodynamic construction to treat the kinetics of chemical reactions and phase transformations. Topics include general first order and second order transitions, along with chemical diffusion. Detailed examples involving nucleation and diffusion limited growth, spinodal decomposition, martensitic transformations, magnetic and electric transitions, and glass formation will be considered. (Typically Offered: Fall)

MSE 5210: Mechanical Behavior and Manufacturing of Polymers and Composites

(Cross-listed with ME 5210).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior, Senior, or Graduate Standing

Effect of chemical structure and morphology on properties. Linear viscoelasticity, damping and stress relaxation phenomena. Structure and mechanics of filler and fiber reinforced composites. Mechanical properties and failure mechanisms. Material selection and designing with polymers. Processing of polymer and composite parts. (Typically Offered: Spring)

MSE 5300: Solid State Science

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Development of a quantitative description of the electronic structure of solids starting with fundamentals of atoms, atomic bonding, basic crystallography, and band theory of solids. Continuum properties of solids in response to electromagnetic fields and thermal gradients. Quantitative description of the atomistic properties of solids through electron-electron interactions, electron-phonon interactions, and dipole interactions. (Typically Offered: Spring)

MSE 5320: Microelectronics Fabrication Techniques

(Dual-listed with EE 4320/ MATE 4320). (Cross-listed with EE 5320).

Credits: 4. Contact Hours: Lecture 2, Laboratory 4.

Prereq: Graduate Standing or Permission of Instructor

Techniques used in modern integrated circuit fabrication, including diffusion, oxidation, ion implantation, lithography, evaporation, sputtering, chemical-vapor deposition, and etching. Process integration. Process evaluation and final device testing. Extensive laboratory exercises utilizing fabrication methods to build electronic devices. Use of computer simulation tools for predicting processing outcomes. Recent advances in processing CMOS ICs and micro-electro-mechanical systems (MEMS).

MSE 5370: Electronic Properties of Materials

(Dual-listed with EE 4370/ MATE 4370). (Cross-listed with EE 5370).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Magnetic fields, flux density and magnetization. Magnetic materials, magnetic measurements. Magnetic properties of materials. Domains, domain walls, domain processes, magnetization curves and hysteresis. Types of magnetic order, magnetic phases and critical phenomena. Magnetic moments of electrons, theory of electron magnetism. Technological application, soft magnetic materials for electromagnets, hard magnetic materials, permanent magnets, magnetic recording technology, biomedical applications of magnetism, magnetic evaluation of materials. (Typically Offered: Spring)

MSE 5400: Mechanical Behavior of Materials

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Mechanical behavior of materials with emphasis on micromechanics of deformation in three generic regimes: elasticity, plasticity, and fracture. A materials science approach is followed to understand and model the mechanical behavior that combines continuum mechanics, thermodynamics, kinetics, and microstructure. Some topics include elastic properties of materials, permanent deformation mechanisms at different temperatures (e.g., via dislocation motion and creep), and fracture in ductile and brittle materials. Specific classes of materials that are studied: metals, ceramics, polymers, glasses and composites. (Typically Offered: Spring)

MSE 5500: Nondestructive Evaluation

(Cross-listed with EM 5500).

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Principles of five basic NDE methods and their application in engineering inspections. Materials behavior and simple failure analysis. NDE reliability, and damage-tolerant design. Advanced methods such as acoustic microscopy, laser ultrasonics, thermal waves, and computed tomography are analyzed. Computer-based experiments on a selection of methods: ultrasonics, eddy currents, x-rays are assigned for student completion. (Typically Offered: Spring)

MSE 5510: Characterization Methods in Materials Science

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Characterization of ceramic, metal, polymer and glassy materials using modern analytical techniques. Spectroscopic (IR, Raman, UV/VIS/NIR, and NMR), thermal (DSC, DTA/TGA, and DMA) methods, mechanical and rheological testing, magnetic and electrical characterization, and powder characterization. (Typically Offered: Spring)

MSE 5520: Scanning and Auger Electron Microscopy

(Dual-listed with MATE 4520).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Characterization of materials using scanning electron microscopes (SEM) and variants thereof, including electron microprobe, Auger spectrometer, and DualBeam focused ion beams (FIB)/SEMs). Compositional determination using energy and wavelength dispersive x-ray and Auger spectroscopies. Orientation determination using electron backscattered diffraction. Specimen preparation. Laboratory covers SEM operation. (Typically Offered: Fall)

MSE 5530: Physical and Mechanical Properties of Polymers

(Dual-listed with MATE 4530).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Overview of polymer chemical composition, microstructure, thermal and mechanical properties, rheology, and principles of polymer materials selection. Intensive laboratory experiments include chemical composition studies, microstructural characterization, thermal analysis, and mechanical testing. (Typically Offered: Fall)

MSE 5540: Polymer Composites and Processing

(Dual-listed with MATE 4540).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Basic concepts in polymer composites, blends, and block copolymers. Phase separation and miscibility, microstructures and mechanical behavior. Fiber reinforced and laminated composites. Viscosity, rheology, viscoelasticity of polymers. Polymer melt processing methods such as injection molding and extrusion; selection of suitable processing methods and their applications. (Typically Offered: Spring)

MSE 5560: Biomaterials

(Dual-listed with BME 4560/ MATE 4560).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Presentation of the basic chemical and physical properties of biomaterials, with special emphasis on metallic, ceramic, polymeric, and composite biomaterials, as they are related to their manipulation by the engineer for incorporation into living systems. Role of microstructure and properties needed to select and design biomaterials used in medical devices, artificial organs, implants, and prostheses. Overview of medical science vis-à-vis materials science. (Typically Offered: Fall)

MSE 5570: Chemical and Physical Metallurgy of Rare Earth Metals

(Dual-listed with MATE 4570).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Electronic configuration, valence states, minerals, ores, beneficiation, extraction, separation, metal preparation and purification. Crystal structures, phase transformations and polymorphism, and thermochemical properties of rare earth metals. Chemical properties: inorganic and organometallic compounds, alloy chemistry, nature of the chemical bonding. Physical properties: mechanical and elastic properties, magnetic properties, resistivity, and superconductivity. (Typically Offered: Spring)

MSE 5640: Fracture and Fatigue

(Cross-listed with AERE 5640/ ME 5640/ EM 5640).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Materials and mechanics approach to fracture and fatigue. Fracture mechanics, brittle and ductile fracture, fracture and fatigue characteristics, fracture of thin films and layered structures. Fracture and fatigue tests, mechanics and materials designed to avoid fracture or fatigue. Offered even-numbered years. (Typically Offered: Fall)

MSE 5690: Mechanics of Composite and Combined Materials

(Cross-listed with AERE 5690/ EM 5690).

Credits: 3. Contact Hours: Lecture 3.

Prereq: EM 3240

Mechanics of fiber-reinforced materials. Micromechanics of lamina. Macromechanical behavior of lamina and laminates. Strength and interlaminar stresses of laminates. Failure criteria. Stress analysis of laminates. Thermal moisture and residual stresses. Joints in composites. Offered even-numbered years. (Typically Offered: Spring)

MSE 5800: Introduction of Project Management for Thesis Research

(Cross-listed with CHE 5800/ IE 5800).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Tools and skills of Project Management (PM) adapted from industry to improve efficiency in thesis research. Project charter initiation for thesis, timeline and meeting scheduling tools, expectation management, and communication with advisors. Practice of the PM skills using student's own thesis. Presentation of a project charter. Demonstration of knowledge of related PM skills and the ability of utilizing these skills for thesis research. Sharing thesis ideas and learning experience in the Graduate for Advancing Professional Skills (GAPS) learning community. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

MSE 5810: Computational Modeling of Materials

(Dual-listed with MATE 4810).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to the basic methods used in the computational modeling and simulation of materials, from atomistic simulations to methods at the mesoscale. Students will be expected to develop and run sample programs. Topics to be covered include, for example, electronic structure calculations, molecular dynamics, Monte Carlo, phase-field methods, etc. (Typically Offered: Fall)

MSE 5820X: Data Analytics and Machine Learning in Materials Research

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Basics of data mining and machine learning as applied to materials data from both experiment and computational modeling. Focus on determining the correlation of structures and properties in a wide range of materials systems, with an emphasis on mesoscale structures (e.g., microstructures). Understanding of and proficiency in these tools to apply them in their research. Applications oriented, with those applications taken from real-world materials data.

MSE 5880: Eddy Current Nondestructive Evaluation

(Dual-listed with EE 4880/ MATE 4880). (Cross-listed with EE 5880).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Electromagnetic fields of various eddy current probes. Probe field interaction with conductors, crack and other material defects.

Ferromagnetic materials. Layered conductors. Elementary inversion of probe signals to characterize defects. Special techniques including remote-field, transient, potential drop nondestructive evaluation and the use of Hall sensors. Practical assignments using a 'virtual' eddy current instrument will demonstrate key concepts. Offered odd-numbered years. (Typically Offered: Fall)

MSE 5900: Special Topics

Credits: 1-30. Repeatable.

Prereq: Department Permission for Course

(Typically Offered: Fall, Spring, Summer)

MSE 5990: Creative Component

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

Courses for graduate students:**MSE 6010: Materials Seminar**

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Seminar course - presentations given on a weekly basis by leading U.S. and International researchers that are experts in their respective fields closely related to Materials Science. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

MSE 6200: Fundamentals of Phase Transformations

Credits: 3. Contact Hours: Lecture 3.

Prereq: MSE 5200

Explores various advanced theoretical treatments of the energetics and kinetics of multicomponent materials. Topics include analytical and computational descriptions of thermodynamic quantities, experimental measurement of essential physical properties, analytical and computational treatments of kinetic processes, and the use of theoretical predictions of phase equilibria and evolution in materials systems. (Typically Offered: Spring)

MSE 6300: Physical Properties of Solids

Credits: 3. Contact Hours: Lecture 3.

Prereq: MSE 5300

Advanced course in the behavior of solids within the framework of solid state physics and chemistry. Includes magnetic, dielectric, transport, and optical phenomena in solids. Influence of phase transformations and crystal symmetry on the physical properties.

MSE 6510: Powder Diffraction Methods

Credits: 3. Contact Hours: Lecture 3.

Prereq: MSE 5100 or instructor permission

Advanced structural characterization of materials using powder diffraction. Production of X-ray and neutron radiation. Review of symmetry, group and kinematical theories of diffraction. Mathematical and computational backgrounds of powder diffraction data. Introduction to single crystal diffraction methods, origin of powder diffraction pattern, history of the technique. Modern powder diffraction methods. Indexing of powder diffraction patterns, figures of merit, precise lattice parameters. Phase problem, determining crystal structures from symmetry and geometry, Patterson, direct and Fourier methods. Rietveld method, precise crystal structures: atomic parameters, qualitative and quantitative phase identification, preferred orientation, grain size, strain, residual stress, order-disorder. Powder diffraction at non-ambient conditions. Applications of powder diffraction: data bases, phase transformations, phase diagrams, local structures, magnetism. (Typically Offered: Spring, Summer)

MSE 6520: Transmission Electron Microscopy

Credits: 3. Contact Hours: Lecture 3.

Prereq: MSE 5100

Theory and application of transmission electron microscopy to inorganic materials. Specimen preparation, selected area and convergent beam electron diffraction, bright field/dark field/high resolution imaging, scanning transmission electron microscopy, in-situ/operando electron microscopy, compositional analysis using X-ray and electron energy loss spectroscopy. (Typically Offered: Spring)

MSE 6900: Advanced Topics in Materials Science

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

Prereq: Department Permission for Course

(Typically Offered: Fall, Spring, Summer)

MSE 6970: Engineering Internship

Credits: Required. Repeatable.

One semester and one summer maximum per academic year professional work period. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

MSE 6990: Research

Credits: 1-30. Repeatable.

Prereq: Department Permission for Course

(Typically Offered: Fall, Spring, Summer)

Mathematics (MATH)

Courses primarily for undergraduates:

MATH 1010: Orientation in Mathematics

Credits: 1. Contact Hours: Lecture 1.

A required orientation for all first-year and transfer students in mathematics. Provides information about campus resources and opportunities available to students, assists with transition to the University, and academic planning. Offered on a satisfactory/fail basis only. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

MATH 1040: Introduction to Probability

Credits: 3. Contact Hours: Lecture 3.

Prereq: Satisfactory math placement test score (ALEKS 15+)

Permutations, combinations, probability, expected value, and applications. Satisfactory placement scores can be found at <https://math.iastate.edu/academics/undergraduate/aleks/placement/>.

(Typically Offered: Fall, Spring, Summer)

MATH 1050: Introduction to Mathematical Ideas

Credits: 3. Contact Hours: Lecture 3.

Prereq: Satisfactory math placement test score (ALEKS 15+)

Introduction to the use of basic mathematics to solve real-world problems in the areas of voting issues, measuring power in situations where people have different numbers of votes, apportionment, fair division, and elementary game theory. No prior background in politics or history is necessary for this course. Satisfactory placement scores can be found at <https://math.iastate.edu/academics/undergraduate/aleks/placement/>. (Typically Offered: Fall, Spring, Summer)

MATH 1390: College Algebra Supplement

Credits: 1. Contact Hours: Lecture 1.

Prereq: Satisfactory math placement test score (ALEKS 15+)

Math concepts to provide supplemental assistance with course topics of MATH 1400. Satisfactory placement scores can be found at <https://math.iastate.edu/academics/undergraduate/aleks/placement/>. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

MATH 1400: College Algebra

Credits: 3. Contact Hours: Lecture 2, Discussion 1.

Prereq: Satisfactory math placement test score (ALEKS, 39+) or (concurrent enrollment in MATH 1390 and ALEKS 15+)

Coordinate geometry, quadratic and polynomial equations, functions, graphing, rational functions, exponential and logarithmic functions, inverse functions, quadratic inequalities, systems of linear equations. Satisfactory placement scores can be found at <https://math.iastate.edu/academics/undergraduate/aleks/placement/>. Credits earned in MATH 1400 cannot be applied toward graduation by Math majors. (Typically Offered: Fall, Spring, Summer)

MATH 1430: Preparation for Calculus

Credits: 4. Contact Hours: Lecture 2, Discussion 2.

Prereq: Satisfactory performance on placement assessment or MATH 1400

Preparation for MATH 1600 or MATH 1650. Functions, graphing, basic trigonometry, logarithms, exponentials. Emphasis on co-variational reasoning. Satisfactory placement scores can be found at <https://math.iastate.edu/academics/undergraduate/aleks/placement/>. Graduation Restriction: Only one of MATH 1430 and MATH 1450 may count toward graduation. (Typically Offered: Fall, Spring)

MATH 1450: Applied Trigonometry

Credits: 3. Contact Hours: Lecture 2, Discussion 1.

Prereq: Satisfactory performance on placement assessment or MATH 1400

Mathematical ideas regarding the conception of space. General trigonometry, with an emphasis on the calculation of lengths, areas, and angles. The Law of Sines and the Law of Cosines. Polar, cylindrical, and spherical coordinate systems. Conic sections and quadric surfaces. Satisfactory placement scores can be found at <https://math.iastate.edu/academics/undergraduate/aleks/placement/>. Graduation Restriction: Only one of MATH 1430 and MATH 1450 may count toward graduation. (Typically Offered: Fall, Spring)

MATH 1490: Discrete Mathematics for Business and Social Sciences Supplement

Credits: 1. Contact Hours: Lecture 1.

Prereq: Satisfactory math placement test score (ALEKS 15+)

Math concepts to provide supplemental assistance with course topics of MATH 1500. Satisfactory placement scores can be found at <https://math.iastate.edu/academics/undergraduate/aleks/placement/>. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

MATH 1500: Discrete Mathematics for Business and Social Sciences

Credits: 3. Contact Hours: Lecture 3.

Prereq: ALEKS 39+ OR (Concurrent enrollment in MATH 1490 AND ALEKS 15+)

Linear equations and inequalities, matrix algebra, linear programming, discrete probability. Satisfactory placement scores can be found at <https://math.iastate.edu/academics/undergraduate/aleks/placement/>. (Typically Offered: Fall, Spring, Summer)

MATH 1510: Calculus for Business and Social Sciences

Credits: 3. Contact Hours: Lecture 2, Discussion 1.

Prereq: Satisfactory math placement test score (ALEKS, 51+) OR MATH 1400

Differential calculus, applications to max-min problems, integral calculus and applications. Will not serve as prerequisite for MATH 2650 or MATH 2660. Satisfactory placement scores can be found at <https://math.iastate.edu/academics/undergraduate/aleks/placement/>.

Graduation Restriction: Only one of MATH 1510, MATH 1600, or the sequence MATH 1650-MATH 1660 may be counted towards graduation. Credits Earned In MATH 1510 Cannot Be Applied Toward Graduation By Math Majors. (Typically Offered: Fall, Spring, Summer)

MATH 1600: Survey of Calculus

Credits: 4. Contact Hours: Lecture 4.

Prereq: Satisfactory performance on placement assessment or minimum of C- in (MATH 1400 or MATH 1430)

Analytic geometry, derivatives and integrals of elementary functions, simple differential equations, and applications. Will not serve as a prerequisite for MATH 2650 or MATH 2660. Satisfactory placement scores can be found at <https://math.iastate.edu/academics/undergraduate/aleks/placement/>. Graduation Restriction: Only one of MATH 1510, MATH 1600, or the sequence MATH 1650-MATH 1660 may be counted towards graduation. (Typically Offered: Fall, Spring)

MATH 1630X: Elements of Calculus

Credits: 4. Contact Hours: Lecture 4.

Preparation for MATH 1600 and MATH 1650. Functions, graphing, basic trigonometry, logarithms, exponentials, limits, continuity, basics of differentiation. Graduation Restriction: Only one of MATH 1630 and MATH 1650 may count toward graduation. Also, only one of MATH 1430 and MATH 1630 may count toward graduation. (Typically Offered: Fall)

MATH 1640X: Advanced Elements of Calculus

Credits: 3. Contact Hours: Lecture 4.

Prereq: Credit or enrollment in MATH 1630X

Advanced differentiation, applications of the derivative, introduction to integral calculus. Graduation Restriction: Only one of MATH 1510 or MATH 1600 or MATH 1640 or MATH 1650 may be counted towards graduation. (Typically Offered: Spring)

MATH 1650: Calculus I

Credits: 4. Contact Hours: Lecture 3, Discussion 1.

Prereq: Minimum C- in MATH 1430 or satisfactory score on placement exam

Differential calculus, applications of the derivative, introduction to integral calculus. Satisfactory placement scores can be found at <https://math.iastate.edu/academics/undergraduate/aleks/placement/>. Graduation Restriction: Only one of MATH 1510, MATH 1600, or the sequence MATH 1650-MATH 1660 may be counted towards graduation. (Typically Offered: Fall, Spring, Summer)

MATH 1660: Calculus II

Credits: 4. Contact Hours: Lecture 3, Discussion 1.

Prereq: Minimum C- in MATH 1650 or satisfactory placement on ALEKS (80+) and Canvas Calculus placement exam (by advisor permission)

Integral calculus, applications of the integral, parametric curves and polar coordinates, power series and Taylor series. Satisfactory placement scores can be found at <https://math.iastate.edu/academics/undergraduate/aleks/placement/>. Graduation Restriction: Only one of MATH 1510, MATH 1600, or the sequence MATH 1650-MATH 1660 may be counted towards graduation. (Typically Offered: Fall, Spring, Summer)

MATH 1660H: Calculus II: Honors

Credits: 4. Contact Hours: Lecture 4.

Prereq: Minimum C- in MATH 1650 or satisfactory placement on ALEKS (80+) and Canvas Calculus placement exam (by advisor permission); Membership in University Honors Program

Integral calculus, applications of the integral, parametric curves and polar coordinates, power series and Taylor series. Additional material of a theoretical, conceptual, computational, or modeling nature. Some of the work may require more ingenuity than is required for MATH 1660. Preference will be given to students in the University Honors Program. Satisfactory placement scores can be found at <https://math.iastate.edu/academics/undergraduate/aleks/placement/>. Graduation restriction: Only one of MATH 1510 or MATH 1600, or the sequence MATH 1650-MATH 1660 may be counted towards graduation. (Typically Offered: Fall)

MATH 1950: Mathematics for Elementary Education I

Credits: 3.

Prereq: Satisfactory performance on placement assessment; Early or Elementary Education major

Whole number operations through analysis of properties, theoretical and hands-on models, mathematical analysis of elementary students' thinking; standard and non-standard algorithms; structure of the decimal system; linear measurement; two- and three-dimensional measurement, shapes and spatial sense; number theory; algebra as it relates to elementary curricula/teaching profession. Satisfactory placement scores can be found at <https://math.iastate.edu/academics/undergraduate/aleks/placement/>. Graduation Restriction: Students in the College of Liberal Arts and Sciences may not count MATH 1950 toward General Education Requirements. (Typically Offered: Fall, Spring)

MATH 1960: Mathematics for Elementary Education II

Credits: 3.

Prereq: Minimum of C- in MATH 1950 and enrollment in elementary education or early childhood education.

Integer, fraction and decimal operations through analysis of properties, theoretical and hands-on models, mathematical analysis of elementary students' thinking; standard and non-standard algorithms; continuation of two- and three-dimensional measurement, shapes and spatial sense; probability and statistics; proportional reasoning; algebra as it relates to elementary curricula/teaching profession. Credits Earned In MATH 1960 Cannot Be Applied Toward Graduation By Math Majors. (Typically Offered: Fall, Spring)

MATH 2010: Introduction to Proofs

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 1660 or MATH 1660H

Transition to advanced mathematics. Communicating mathematics. Logical arguments; techniques of proofs regarding sets, numbers (natural and real), functions, relations, and limits. (Typically Offered: Fall, Spring)

MATH 2020: Career Development in Math and Statistics

(Cross-listed with STAT 2020).

Credits: 1. Contact Hours: Laboratory 2.

Career development in the mathematics and statistics disciplines with an emphasis on contemporary social issues. Presentations by professionals in STEM fields about occupations, decision-making strategies, and career goal implementation; development of job searching, resume writing, negotiating, and interviewing techniques. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

MATH 2070: Matrices and Linear Algebra

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 1660 or MATH 1660H

Systems of linear equations, determinants, vector spaces, linear transformations, orthogonality, least-squares methods, eigenvalues and eigenvectors. Emphasis on applications and techniques. Graduation Restriction: Only one of MATH 2070 and MATH 3170 may be counted toward graduation. (Typically Offered: Fall, Spring, Summer)

MATH 2300: Discrete Computational Structures

(Cross-listed with COMS 2300).

Credits: 3. Contact Hours: Lecture 3, Discussion 1.

Prereq: Minimum of C- in COMS 2270 and MATH 1650; ENGL 1500

Concepts in discrete mathematics as applied to computer science. Logic, set theory, functions, relations, cardinality of sets, combinatorics, graph theory and number theory. Proof techniques, induction and recursion. (Typically Offered: Fall, Spring, Summer)

MATH 2400: Mathematics of Investment and Credit

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 1660 or MATH 1660H

Interest rates, time value of money, annuities. Loans, bonds, yield rates. Term structure of interest rates, asset and liability management. Duration, convexity, immunization. (Typically Offered: Fall, Spring)

MATH 2650: Calculus III

Credits: 4. Contact Hours: Lecture 3, Discussion 1.

Prereq: Minimum of C- in MATH 1660 or MATH 1660H

Geometry of space and vectors, multivariable differential calculus, multivariable integral calculus, vector calculus. (Typically Offered: Fall, Spring, Summer)

MATH 2650H: Calculus III: Honors

Credits: 4. Contact Hours: Lecture 4.

Prereq: Permission of the instructor; and minimum of C- in MATH 1660 or MATH 1660H; Membership in the University Honors Program

Geometry of space and vectors, multivariable differential calculus, multivariable integral calculus, vector calculus. Additional material of a theoretical, conceptual, computational, or modeling nature. Some of the work may require more ingenuity than is required in MATH 2650. Preference will be given to students in the University Honors Program. (Typically Offered: Fall, Spring)

MATH 2660: Elementary Differential Equations

Credits: 3. Contact Hours: Lecture 3.

Prereq: Minimum of C- in MATH 1660 or MATH 1660H

Solution methods for ordinary differential equations. First order equations, linear equations, constant coefficient equations. Eigenvalue methods for systems of first order linear equations. Introduction to stability and phase plane analysis. Graduation Restriction: Credit for either MATH 2670 or the MATH 2660, 2680 pair of courses, but not both, may be applied toward graduation. Credit for only one of the following courses may be applied toward graduation: MATH 2670, MATH 2660, MATH 2690. (Typically Offered: Fall, Spring, Summer)

MATH 2670: Elementary Differential Equations and Laplace Transforms

Credits: 4. Contact Hours: Lecture 3, Discussion 1.

Prereq: Minimum of C- in MATH 1660 or MATH 1660H

Same as MATH 2660 but also including Laplace transforms and power series solutions to ordinary differential equations. Graduation Restriction: Credit for either MATH 2670 or the MATH 2660, 2680 pair of courses, but not both, may be applied toward graduation. Credit for only one of the following courses may be applied toward graduation: MATH 2670, MATH 2660, MATH 2690. (Typically Offered: Fall, Spring, Summer)

MATH 2680: Laplace Transforms

Credits: 1. Contact Hours: Lecture 1.

Prereq: MATH 2660; Department Permission

Laplace transforms and power series solutions to ordinary differential equations. Graduation Restriction: Credit for either MATH 2670 or the MATH 2660, 2680 pair of courses, but not both, may be applied toward graduation. (Typically Offered: Fall, Spring, Summer)

MATH 2690: Systems of Differential Equations

Credits: 1. Contact Hours: Lecture 1.

Prereq: Department Permission for Course

Systems portion of MATH 2660 and MATH 2670: Eigenvalue methods for systems of first order linear equations. Introduction to stability and phase plane analysis. For students supplementing transfer courses in differential equations in order to earn credit in MATH 2660 or 2670. Familiarity with ordinary differential equations of first and second order required. Graduation Restriction: Students with credit in MATH 2660 or MATH 2670 may not earn credit in MATH 2690. (Typically Offered: Fall, Spring, Summer)

MATH 2900: Independent Study

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Independent study.

MATH 2900H: Independent Study: Honors

Credits: 1-3. Repeatable.

Prereq: Permission of Instructor; Membership in the University Honors Program

Independent study.

MATH 2970: Intermediate Topics for School Mathematics

Credits: 3.

Prereq: Minimum of C- in MATH 1960; Early or Elementary Education major
Mathematical reasoning and topics in Euclidean and non-Euclidean geometry, including transformations, congruence, and similarity; exploration of probability with simulations; linearity and connections to Calculus; fractals and fractal dimension. (Typically Offered: Fall)

MATH 3010: Abstract Algebra I

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 1660 or MATH 1660H, MATH 3170, and grade of C- or better in MATH 2010

Basic properties of integers, divisibility and unique factorization. Polynomial rings over a field. Congruence. Introduction to abstract rings, homomorphisms, ideals. Roots and irreducibility of polynomials. Introduction to groups. Emphasis on proofs. (Typically Offered: Fall, Spring)

MATH 3040: Combinatorics

Credits: 3. Contact Hours: Lecture 3.

Prereq:

(MATH 1660 or MATH 1660H); (MATH 2010 or COMS 2300 or CPRE 3100)

Enumeration strategies involving permutations, combinations, partitions, binomial coefficients, inclusion-exclusion principle, recurrence relations, generating functions. Additional topics selected from probability, algebraic combinatorics, and applications. (Typically Offered: Fall)

MATH 3140: Graph Theory

Credits: 3. Contact Hours: Lecture 3.

Prereq:

(MATH 1660 or MATH 1660H); (MATH 2010 or COMS 2300 or CPRE 3100)

Structure and extremal properties of graphs. Topics are selected from: trees, networks, colorings, paths and cycles, connectivity, planarity, directed graphs, matchings, Ramsey theory, forbidden structures, enumeration, applications. (Typically Offered: Spring)

MATH 3170: Theory of Linear Algebra

Credits: 4. Contact Hours: Lecture 4.

Prereq: Credit or concurrent enrollment in MATH 2010 or COMS 2300 or CPRE 3100

Systems of linear equations, determinants, vector spaces, inner product spaces, linear transformations, eigenvalues and eigenvectors. Emphasis on writing proofs and results. Graduation Restriction: Only one of MATH 2070 and MATH 3170 may be counted toward graduation. (Typically Offered: Fall, Spring)

MATH 3410: Introduction to the Theory of Probability and Statistics I

(Cross-listed with STAT 3410).

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: MATH 2650 or MATH 2650H

Probability; distribution functions and their properties; classical discrete and continuous distribution functions; multivariate probability distributions and their properties; moment generating functions; transformations of random variables; simulation of random variables and use of the R statistical package. Graduation Restriction: Credit for only one of the following courses may be applied toward graduation: STAT 3410, STAT 3470, STAT 5147. (Typically Offered: Fall, Spring)

MATH 3420: Introduction to the Theory of Probability and Statistics II

(Cross-listed with STAT 3420).

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: (MATH 2070 or MATH 3170); (STAT 1010 or STAT 1040 or STAT 1050 or STAT 2010 or STAT 2260 or STAT 2310 or STAT 3050 or STAT 3220 or STAT 3300); STAT 3410

Sampling distributions; confidence intervals and hypothesis testing; theory of estimation and hypothesis tests; linear model theory; resampling methods; introduction to Bayesian inference; use of the R statistical package for simulation and data analysis. (Typically Offered: Fall, Spring)

MATH 3500: Number Theory

(Cross-listed with COMS 3500).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 2300 or CPRE 3100 or MATH 2010

Divisibility, integer representations, primes and divisors, linear diophantine equations, congruences, and multiplicative functions. Applications to cryptography. Additional topics, chosen at the discretion of the instructor. (Typically Offered: Spring)

MATH 3650: Complex Variables with Applications

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 2650

Functions of a complex variable, including differentiation, integration, series, residues, and conformal mappings. (Typically Offered: Spring)

MATH 3730: Introduction to Scientific Computing

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 2650

Vector and matrix programming and graphing in MATLAB for scientific applications. Polynomial interpolation and approximation. Systems of linear equations and numerical linear algebra. Numerical differentiation and integration. Root-finding methods for solving nonlinear equations and optimization in one and several variables. Fast Fourier transform. Emphasis on effective use of mathematical software and understanding of its strengths and limitations. (Typically Offered: Fall)

MATH 3850: Introduction to Partial Differential Equations

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 2650 and one of MATH 2660, MATH 2670

Method of separation of variables for linear partial differential equations, including heat equation, Poisson equation, and wave equation. Topics from Fourier series, Sturm-Liouville theory, Bessel functions, spherical harmonics, and method of characteristics. (Typically Offered: Fall, Spring)

MATH 3920X: Mathematical Communication

Credits: 3. Contact Hours: Lecture 3.

Principles of mathematical communication. How to create convincing logical arguments in written, oral, and visual formats. Using LaTeX for document preparation. (Typically Offered: Fall)

MATH 3970: Teaching Secondary Mathematics Using University Mathematics

Credits: 3.

Prereq: MATH 2010 and MATH 3010

Coursework in university mathematics including calculus, abstract algebra, discrete mathematics, geometry, and other topics as it relates to teaching mathematics in grades 5-12. (Typically Offered: Spring)

MATH 3980: Cooperative Education

Credits: Required. Repeatable, maximum of 2 times.

Prereq: Permission of Department Cooperative Education Coordinator; Junior classification

Required of all cooperative education students. Students must register for this course prior to commencing each work period. (Typically Offered: Fall, Spring, Summer)

MATH 4030: Intermediate Abstract Algebra

(Dual-listed with MATH 5030).

Credits: 3. Contact Hours: Lecture 3.

Prereq: C or better in MATH 3010

Properties of groups and rings, subgroups, ideals, and quotients, homomorphisms, structure theory for finite groups. PIDs, UFDs, and Euclidean Domains. Field extensions and finite fields. Selected applications. (Typically Offered: Spring)

MATH 4070: Applied Linear Algebra

(Dual-listed with MATH 5070).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 3170 or (MATH 2070; MATH 2010)

Advanced topics in applied linear algebra including eigenvalues, eigenvalue localization, singular value decomposition, symmetric and Hermitian matrices, nonnegative and stochastic matrices, matrix norms, canonical forms, matrix functions. Applications to mathematical and physical sciences, engineering, and other fields. (Typically Offered: Fall)

MATH 4140: Analysis I

Credits: 3. Contact Hours: Lecture 3.

Prereq: Minimum of C- in COMS 2300 or CPRE 3100 or MATH 2010

A rigorous development of calculus of functions of one real variable: real number properties and topology, limits, continuity, differentiation, integration, series. (Typically Offered: Fall, Spring, Summer)

MATH 4150: Analysis II

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 4140; MATH 2650; and MATH 3170 or MATH 4070

Sequences and series of functions of a real variable, uniform convergence, power series, metric spaces, calculus of functions of two or more real variables. (Typically Offered: Spring)

MATH 4210: Logic for Mathematics and Computer Science

(Cross-listed with COMS 4210).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 2300 or CPRE 3100 or MATH 2070 or MATH 3010 or MATH 3170

Propositional and predicate logic. Topics selected from Horn logic, equational logic, resolution and unification, foundations of logic programming, reasoning about programs, program specification and verification, model checking and binary decision diagrams, temporal logic and modal logic.

MATH 4220X: Mathematical Principles of Data Science

(Cross-listed with DS 4220X).

Credits: 3. Contact Hours: Lecture 3.

Mathematical foundations of algorithms in data science. Topics include Riemann-Stieltjes integration, Riesz-Markov theorem, Stone-Weierstrass theorem, Universal Approximation theorem, reproducing kernel Hilbert spaces, Cauchy and Fourier kernels, convergence of clustering algorithms, and topological persistence. (Typically Offered: Spring)

MATH 4230: Mathematical Modeling in Biology

(Dual-listed with MATH 5230/ BCB 5230). (Cross-listed with BCBIO 4230).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 2660 or MATH 2670

Introduction to mathematical techniques for modeling and simulation, parameter identification, and analysis of biological systems. Applications drawn from many branches of biology and medicine. Apply differential equations, difference equations, and dynamical systems theory to a wide array of biological problems. MATH 2650 or equivalent recommended. (Typically Offered: Fall)

MATH 4240: Introduction to High Performance Computing

(Cross-listed with COMS 4240/ CPRE 4240).

Credits: 3.

Prereq: (MATH 2650; [MATH 2070 OR MATH 3170]) or permission of instructor

Unix, serial programming of scientific applications, OpenMP for shared-memory parallelization. No Unix, Fortran or C experience required. (Typically Offered: Fall)

MATH 4350: Geometry I

Credits: 3. Contact Hours: Lecture 3.

Prereq: (COMS 2300 or CPRE 3100 or MATH 2010); (MATH 2070 or MATH 3170)

Euclidean geometry of triangles, circles, and parallelograms, studied from several points of view, chosen from: synthetic, analytic, axiomatic, transformational, complex numbers, or vector methods. Possible and impossible constructions with compass and straightedge. (Typically Offered: Fall)

MATH 4360: Geometry II

Credits: 3. Contact Hours: Lecture 3.

Prereq: (COMS 2300 or CPRE 3100 or MATH 2010); (MATH 2070 or MATH 3170)

Foundations of Euclidean geometry and the axiomatic method, including the use of models. The history, logical consistency, and basic theorems of non-Euclidean geometries, such as hyperbolic, elliptic, and projective geometry. (Typically Offered: Spring)

MATH 4410: Life Contingencies I

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 2400, credit or coenrollment in MATH 2650

Topics in life insurance for the Actuarial Sciences I: single life annuities, benefits premiums and reserves. (Typically Offered: Fall)

MATH 4420: Life Contingencies II

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 4410

Topics in life insurance for the Actuarial Sciences II: multiple life functions, multiple decrement models, pension plan valuation, insurance models, applications. (Typically Offered: Spring)

MATH 4430X: Introduction to Mathematical Finance

(Cross-listed with FIN 4430X).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 2650 and (MATH 2070 or MATH 3170)

Mathematics of financial engineering. Topics covered will include arbitrage principles, Capital Asset Pricing Model (CAPM) model and portfolio theory, futures and options contracts, and binomial asset pricing model. Introduction to some continuous time models, stochastic processes, and the Black-Scholes partial differential equation (PDE). Some background in differential equations (MATH 2660 or MATH 2670) is recommended. (Typically Offered: Spring)

MATH 4690: Introduction to Discrete Mathematics

(Dual-listed with MATH 5690).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 2070 or MATH 3170; and MATH 3040 or MATH 3140

Combinatorial counting, double-counting, generating functions, graph structure, planar graphs, probabilistic proofs, points in general positions, polytopes, Farkas lemma, linear programming and duality. (Typically Offered: Spring)

MATH 4810: Numerical Methods for Differential Equations

(Dual-listed with MATH 5810). (Cross-listed with COMS 4810).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 2650 and one of MATH 2660, MATH 2670

First order Euler method, high order Runge-Kutta methods, and multistep methods for solving ordinary differential equations. Finite difference and finite element methods for solving partial differential equations. Local truncation error, stability, and convergence for finite difference method. Numerical solution space, polynomial approximation, and error estimate for finite element method. Computer programming required. (Typically Offered: Spring)

MATH 4900: Independent Study

Credits: 1-3. Repeatable, maximum of 9 credits.

Prereq: Instructor Permission for Course

Graduation Restriction: No more than 9 credits of MATH 4900 or MATH 4900H may be counted toward graduation.

MATH 4900H: Independent Study: Honors

Credits: 1-3. Repeatable, maximum of 9 credits.

Prereq: Permission of Instructor; Membership in the University Honors Program

Graduation Restriction: No more than 9 credits of MATH 4900 or MATH 4900H may be counted toward graduation.

MATH 4910: Undergraduate Thesis

Credits: 2-3.

Writing and presenting a formal mathematics paper. Upon approval by the department, the paper will satisfy the departmental advanced English requirement.

MATH 4920: Undergraduate Seminar

Credits: 2. Contact Hours: Lecture 2.

Prereq: MATH 3170 or MATH 4070

Introduction to independent mathematical thought, with emphasis on oral communication of an advanced topic. Seminar content varies. (Typically Offered: Fall, Spring)

MATH 4950: Special Topics

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable, maximum of 9 credits.

Prereq: Instructor Permission for Course

Topics of current interest.

MATH 4970: Teaching Secondary School Mathematics

(Cross-listed with EDUC 4970).

Credits: 3. Contact Hours: Lecture 3.

Develop an understanding of instructional planning, lesson implementation, and assessment in grades 5-12 mathematics, with a focus on reform-based mathematics, equity, and conceptual understanding. (Typically Offered: Fall)

Courses primarily for graduate students, open to qualified undergraduates:

MATH 5010: Introduction to Real Analysis

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Department

A development of the real numbers. Study of metric spaces, completeness, compactness, sequences, and continuity of functions. Differentiation and integration of real-valued functions, sequences of functions, limits and convergence, equicontinuity. (Typically Offered: Fall)

MATH 5020: Topology

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to general topology. Topological spaces, continuous functions, connectedness, compactness. Topics selected from countability and separation axioms, metrization, and complete metric spaces. Topics in algebraic topology. (Typically Offered: Spring)

MATH 5030: Intermediate Abstract Algebra

(Dual-listed with MATH 4030).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Properties of groups and rings, subgroups, ideals, and quotients, homomorphisms, structure theory for finite groups. PIDs, UFDs, and Euclidean Domains. Field extensions and finite fields. Selected applications. (Typically Offered: Spring)

MATH 5040: Abstract Algebra I

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Algebraic systems and their morphisms, with emphasis on groups and rings. (Typically Offered: Fall)

MATH 5050: Abstract Algebra II

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Continuation of MATH 5040. Algebraic systems and their morphisms, with emphasis on modules and fields. (Typically Offered: Spring)

MATH 5060X: Algebraic Topology

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: MATH 3010, MATH 4140 and MATH 5020

Topological spaces, singular homology and cohomology, homotopy. Topics selected from cup products, simplicial and CW complexes, fundamental groups, homotopy theory, Poincare duality, homological algebra. Offered even-numbered years. (Typically Offered: Fall)

MATH 5070: Applied Linear Algebra

(Dual-listed with MATH 4070).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Advanced topics in applied linear algebra including eigenvalues, eigenvalue localization, singular value decomposition, symmetric and Hermitian matrices, nonnegative and stochastic matrices, matrix norms, canonical forms, matrix functions. Applications to mathematical and physical sciences, engineering, and other fields. (Typically Offered: Fall)

MATH 5100: Linear Algebra

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Advanced topics in linear algebra including canonical forms; unitary, normal, Hermitian and positive-definite matrices; variational characterizations of eigenvalues. (Typically Offered: Spring)

MATH 5110: Functions of a Single Complex Variable

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Theory of analytic functions, integration, topology of the extended complex plane, singularities and residue theory, maximum principle, conformal mapping, meromorphic functions, argument principle. (Typically Offered: Spring)

MATH 5150: Real Analysis I

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Lebesgue measure and Lebesgue integral, one variable differentiation theory, Fubini and Tonelli theorems in $\mathbb{R}^n$, L_p spaces. (Typically Offered: Fall)

MATH 5160: Real Analysis II

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Metric spaces, topological spaces, compactness, abstract theory of measure and integral, differentiation of measures, Banach spaces. (Typically Offered: Spring)

MATH 5170: Finite Difference Methods

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Finite difference methods for partial differential equations. Methods for elliptic equations; explicit and implicit methods for parabolic and hyperbolic equations; stability, accuracy, and convergence theory, including von Neumann analysis, modified equations, and the Courant-Friedrichs-Lewy condition. (Typically Offered: Spring)

MATH 5180: Mathematical Modeling and Differential Equations

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Basic theory of ordinary differential equations, existence and uniqueness theorems, linear systems, linearization and stability, mathematical models in biology and physics, modeling with ordinary and partial differential equations, dynamical systems techniques. (Typically Offered: Spring)

MATH 5190: Methods of Applied Mathematics I

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Techniques of classical and functional analysis with applications to differential equations and integral equations. Vector spaces, metric spaces, Hilbert and Banach spaces, Sobolev spaces and other function spaces, contraction mapping theorem, distributions, Fourier series and Fourier transform. (Typically Offered: Fall)

MATH 5200: Methods of Applied Mathematics II

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Continuation of MATH 5190. Linear operators, spectral theory of differential and integral operators, Green's functions and boundary value problems, weak solutions of partial differential equations and variational methods, calculus in Banach spaces and applications. (Typically Offered: Spring)

MATH 5220X: Mathematical Principles of Data Science

(Dual-listed with DS 4220X/ MATH 4220).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Mathematical foundations of algorithms in data science. Topics include Riemann-Stieltjes integration, Riesz-Markov theorem, Stone-Weierstrass theorem, Universal Approximation theorem, reproducing kernel Hilbert spaces, Cauchy and Fourier kernels, convergence of clustering algorithms, and topological persistence. (Typically Offered: Spring)

MATH 5230: Mathematical Modeling in Biology

(Dual-listed with MATH 4230/ BCBIO 4230). (Cross-listed with BCB 5230/ BCBIO 5230).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 2660 or MATH 2670 or Graduate Classification

Introduction to mathematical techniques for modeling and simulation, parameter identification, and analysis of biological systems. Applications drawn from many branches of biology and medicine. Apply differential equations, difference equations, and dynamical systems theory to a wide array of biological problems. MATH 2650 or equivalent recommended. (Typically Offered: Fall)

MATH 5250: Numerical Analysis of High Performance Computing

(Cross-listed with COMS 5250/ CPRE 5250).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to parallelization techniques and numerical methods for distributed memory high performance computers. A semester project in an area related to each student's research interests is required. (Typically Offered: Spring)

MATH 5330: Cryptography

(Cross-listed with CYBSC 5330/ CPRE 5330).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 3010 OR CPRE 310 OR COMS 230

Basic concepts of secure communication, DES and AES, public-key cryptosystems, elliptic curves, hash algorithms, digital signatures, applications. Relevant material on number theory and finite fields. (Typically Offered: Spring)

MATH 5350: Steganography and Digital Image Forensics

(Cross-listed with CPRE 5350/ CYBSC 5350).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Basic principles of covert communication, steganalysis, and forensic analysis for digital images. Steganographic security and capacity, matrix embedding, blind attacks, image forensic detection and device identification techniques. Related material on coding theory, statistics, image processing, pattern recognition. (Typically Offered: Spring)

MATH 5540: Stochastic Process Models

(Cross-listed with STAT 5540).

Credits: 3. Contact Hours: Lecture 3.

Markov chains on discrete spaces in discrete and continuous time (random walks, Poisson processes, birth and death processes) and their long-term behavior. Optional topics may include branching processes, renewal theory, introduction to Brownian motion. (Typically Offered: Fall)

MATH 5570: Ordinary Differential Equations and Dynamical Systems

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

The initial-value problem, existence and uniqueness theorems, continuous dependence on parameters, linear systems, stability and asymptotic behavior of solutions, linearization, dynamical systems, bifurcations, and chaotic behavior. Offered irregularly. (Typically Offered: Fall)

MATH 5610: Numerical Analysis I

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Approximation theory, including polynomial interpolation, spline interpolation and best approximation; numerical differentiation and integration; numerical methods for ordinary differential equations. (Typically Offered: Fall)

MATH 5620: Numerical Analysis II

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Numerical linear algebra including LU factorization, QR factorization, linear least squares, singular value decomposition, eigenvalue problems, and iterative methods for large linear systems. (Typically Offered: Spring)

MATH 5650: Continuous Optimization

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Theory and methods for constrained and unconstrained optimization. Steepest-descent, conjugate gradient, Newton and quasi-Newton, line search and trust-region, first and second order necessary and sufficient conditions, linear, quadratic and general nonlinear programming. (Typically Offered: Spring)

MATH 5660: Discrete Optimization

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Algorithms for linear programming, integer and combinatorial optimization. Linear programming, duality theory, simplex algorithm; the solution of the shortest-path, minimum spanning tree, max-flow/min-cut, minimum cost flow, maximum matching, and traveling salesman problems; integer linear programming, branch-and-bound, local and global search algorithms; matroids and greedy algorithms. (Typically Offered: Fall)

MATH 5670: Graph Theory

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Structural theory of graphs. Topics include basic structures (trees, paths, cycles and matchings), networks, colorings, connectivity, topological graph theory, Ramsey and Turan theory, spectral graph theory, introduction to probabilistic methods. (Typically Offered: Fall)

MATH 5680: Enumerative Combinatorics and Ordered Sets

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Enumeration methods. Generating functions and sieve methods. Partially ordered sets, lattices, and Moebius inversion. Extremal set theory. (Typically Offered: Spring)

MATH 5690: Introduction to Discrete Mathematics

(Dual-listed with MATH 4690).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (MATH 2070 or MATH 3170) and (MATH 3040 or MATH 3140) or Graduate Classification

Combinatorial counting, double-counting, generating functions, graph structure, planar graphs, probabilistic proofs, points in general positions, polytopes, Farkas lemma, linear programming and duality. (Typically Offered: Spring)

MATH 5770: Linear Systems

(Cross-listed with AERE 5770/ ME 5770/ EE 5770).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Linear algebra review. Least square method and singular value decomposition. State space modeling of linear continuous-time systems. Solution of linear systems. Controllability and observability. Canonical description of linear equations. Stability of linear systems. State feedback and pole placements. Observer design for linear systems. (Typically Offered: Fall)

MATH 5780: Nonlinear Systems

(Cross-listed with AERE 5780/ ME 5780/ EE 5780).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Linear vs nonlinear systems. Phase plane analysis. Bifurcation and center manifold theory. Lyapunov stability. Absolute stability of feedback systems. Input-output stability. Passivity theory and feedback linearization. Nonlinear control design techniques. (Typically Offered: Spring)

MATH 5810: Numerical Methods for Differential Equations

(Dual-listed with MATH 4810/ COMS 4810).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

First order Euler method, high order Runge-Kutta methods, and multistep methods for solving ordinary differential equations. Finite difference and finite element methods for solving partial differential equations. Local truncation error, stability, and convergence for finite difference method. Numerical solution space, polynomial approximation, and error estimate for finite element method. Computer programming required. (Typically Offered: Spring)

MATH 5900: Independent Study

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

MATH 5910: Orientation for Mathematics Graduate Students I

Credits: 0.5. Contact Hours: Lecture 0.5.

Prereq: Graduate Standing or Permission of Instructor

Fall semester orientation seminar. Required for graduate students in Mathematics and Applied Mathematics. Topics include teaching at the university level and communication of mathematics. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

MATH 5920: Orientation for Mathematics Graduate Students II

Credits: 0.5. Contact Hours: Lecture 0.5.

Prereq: Graduate Standing or Permission of Instructor

Spring semester orientation seminar. Required for graduate students in Mathematics and Applied Mathematics. Topics include teaching at the university level and communication of mathematics. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

MATH 5950: Special Topics

Credits: 1-30. Repeatable.

*Prereq: Graduate Standing or Permission of Instructor***MATH 5990: Creative Component**

Credits: 1-30. Repeatable.

*Prereq: Instructor Permission for Course***Courses for graduate students:****MATH 6010: Mathematical Logic**

Credits: 3. Contact Hours: Lecture 3.

Model theory of propositional and predicate logic, the Soundness Theorem, the Compactness Theorem, the Goedel-Henkin Completeness Theorem, the Incompleteness Theorem, computability theory. As time permits: modal and temporal logic, set theory (the continuum hypothesis). Emphasis on the relationship between 'provable' and 'true' and the relationship between 'computable' and 'definable'. Offered odd-numbered years. (Typically Offered: Fall)

MATH 6030: Mathematical Logic II

Credits: 3. Contact Hours: Lecture 3.

Topics in model theory, computability theory, and set theory such as infinitary logic, non-standard models of arithmetic, ultraproducts, and independence results. Offered even-numbered years. (Typically Offered: Spring)

MATH 6050: Design Theory and Association Schemes

Credits: 3. Contact Hours: Lecture 3.

Combinatorial designs and algebraic codes. Construction methods including finite fields. Error-correcting codes. Adjacency matrices and algebraic combinatorics. Offered odd-numbered years. (Typically Offered: Spring)

MATH 6080: Extremal Graph Theory

Credits: 3. Contact Hours: Lecture 3.

Study of extremal graph problems and methods. Topics include probabilistic methods, generalizations of Turan's theorem, Szemerédi's regularity lemma, random graph theory. Offered even-numbered years. (Typically Offered: Spring)

MATH 6100: Seminar

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

Seminar.

MATH 6170: Category Theory

Credits: 3. Contact Hours: Lecture 3.

Categories and functors and their applications. Offered even-numbered years. (Typically Offered: Fall)

MATH 6180: Representation Theory

Credits: 3. Contact Hours: Lecture 3.

Representations of algebraic structures. Content varies by semester. Offered odd-numbered years. (Typically Offered: Spring)

MATH 6190: Commutative Algebra

Credits: 3. Contact Hours: Lecture 3.

Detailed study of commutative rings with applications to number theory and algebraic geometry, including prime ideals, Going Up and Going Down theorems, exact sequences, Ext and Tor, modules of fractions, primary decomposition, rings of integers, dimension theory. Offered odd-numbered years. (Typically Offered: Fall)

MATH 6200: Lie Algebras and Their Representations

Credits: 3. Contact Hours: Lecture 3.

Nilpotent and solvable Lie algebras. Root systems and the classification of finite-dimensional complex semi-simple Lie algebras. The universal enveloping algebra. Representation theory including Weyl's theorem, Verma modules, highest weight theory. Offered even-numbered years. (Typically Offered: Fall)

MATH 6230: High-Dimensional Probability and Linear Algebra for Machine Learning

(Cross-listed with EE 6230).

Credits: 3. Contact Hours: Lecture 3.

Key topics from non-asymptotic random matrix theory: Bounds on minimum and maximum singular values of many classes of high-dimensional random matrices, and on sums of a large number of random matrices. Chaining. Other linear algebra and probability concepts commonly used in Theoretical Machine Learning research. Discussion of recent papers in this area.

MATH 6240: Manifolds, Tensors and Differential Geometry

Credits: 3. Contact Hours: Lecture 3.

Topics selected from: Geometry of curves and surfaces. Manifolds, coordinate systems. Tangent and cotangent vectors, vector fields. Tensors, differential forms, Riemannian metrics. Connections, covariant differentiation, curvature tensors. Applications to physics and engineering. Offered odd-numbered years. (Typically Offered: Spring)

MATH 6310: Harmonic Analysis

Credits: 3. Contact Hours: Lecture 3.

Fourier Series on an interval, approximate identities and summation, Gibb's phenomenon, Fourier transform on the line, uncertainty principle. Additional topics may include distributions, Hardy-Littlewood maximal function, boundedness of singular integral operators, arithmetic combinatorics, wavelet theory. Offered even-numbered years. (Typically Offered: Fall)

MATH 6330: Functional Analysis

Credits: 3. Contact Hours: Lecture 3.

Fundamental theory of normed linear spaces and algebras, such as topology and continuity, duality and spectral theory, emphasizing aspects that provide a framework for the study of the spectrum of an operator, analytic function theory, and modern operator theory. Offered odd-numbered years. (Typically Offered: Fall)

MATH 6410: Foundations of Probability Theory

(Cross-listed with STAT 6410).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 4140 or MATH 5010 or Graduate Classification

Sequences and set theory; Lebesgue measure, measurable functions. Absolute continuity of functions, integrability and the fundamental theorem of Lebesgue integration. General measure spaces, probability measure, extension theorem and construction of Lebesgue-Stieljes measures on Euclidean spaces. Measurable transformations and random variables, induced measures and probability distributions. General integration and expectation, L_p -spaces and integral inequalities. Uniform integrability and absolute continuity of measures. Probability densities and the Radon-Nikodym theorem. Product spaces and Fubini-Tonelli theorems. (Typically Offered: Fall)

MATH 6420: Advanced Probability Theory

(Cross-listed with STAT 6420).

Credits: 3. Contact Hours: Lecture 3.

Probability spaces and random variables. Kolmogorov's consistency theorem. Independence, Borel-Cantelli lemmas and Kolmogorov's 0 - 1 Law. Types and characterizations of convergence for random variables. Sums of independent random variables, empirical distributions, weak and strong laws of large numbers. Convergence in distribution and its formulations, tightness, characteristic functions, central limit theorems and Lindeberg-Feller conditions. Conditional probability and expectation, discrete parameter martingales. (Typically Offered: Spring)

MATH 6450: Advanced Stochastic Processes

(Cross-listed with STAT 6450).

Credits: 3. Contact Hours: Lecture 3.

Weak convergence. Random walks and Brownian motion. Martingales. Stochastic integration and Ito's Formula. Stochastic differential equations and applications. (Typically Offered: Spring)

MATH 6460: Mathematical Modeling of Complex Physical Systems

(Cross-listed with PHYS 6460).

Credits: 3. Contact Hours: Lecture 3.

Modeling of the dynamics of complex systems on multiple scales: Classical and dissipative molecular dynamics, stochastic modeling and Monte-Carlo simulation; coarse grained nonlinear dynamics, interface propagation and spatial pattern formation. (Typically Offered: Spring)

MATH 6550: Partial Differential Equations I

Credits: 3. Contact Hours: Lecture 3.

Study of model problems of elliptic, parabolic and hyperbolic types, first order equations, conservation laws, transform methods, introduction to linear partial differential equations of arbitrary order, fundamental solutions. (Typically Offered: Fall)

MATH 6560: Partial Differential Equations II

Credits: 3. Contact Hours: Lecture 3.

Sobolev spaces, general theory of second order linear elliptic, parabolic and hyperbolic partial differential equations, first order linear hyperbolic systems, variational methods, fixed point methods. (Typically Offered: Spring)

MATH 6660: Finite Element Methods

Credits: 3. Contact Hours: Lecture 3.

Weak and variational formulations of elliptic problems; weak derivatives and Sobolev spaces; Lax-Milgram theorem, Bramble-Hilbert lemma; examples of finite element spaces; polynomial approximation theory; error estimates for finite element methods; implementation issues; mixed finite element methods for Stokes problems; applications. Offered even-numbered years. (Typically Offered: Fall)

MATH 6670: Computational Methods for Hyperbolic Partial Differential Equations (PDE)

Credits: 3. Contact Hours: Lecture 3.

Mathematical theory of weak/entropy solutions of nonlinear hyperbolic conservation laws; shock speed and Riemann problems; numerical methods for scalar equations and systems including Euler equations; conservative methods; approximate Riemann solvers; total variation stability; DG method. Offered odd-numbered years. (Typically Offered: Fall)

MATH 6730X: Nonlinear Estimation in Astrodynamic

(Cross-listed with ECPE 6730X/ STAT 6730X/ AERE 6730X).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (AERE 5730 or EE 5080 or STAT 5440) or (two of the following: STAT 3050, STAT 5000, STAT 5100, STAT 5200, MATH 5540)

Transformation and propagation of random variables. Understanding and developing linear and nonlinear filters. Covering Gaussian Multiple Models, Particle Filtering, Particle Flow, and Polynomial Update. Applications to navigation and estimation in astrodynamics, such as orbit determination, station keeping, attitude determination, and relative pose estimation.

MATH 6800A: Advanced Topics: Algebra

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

MATH 6800B: Advanced Topics: Analysis

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

MATH 6800C: Advanced Topics: Applied Mathematics

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

MATH 6800D: Advanced Topics: Combinatorics

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

MATH 6800E: Advanced Topics: Differential Equations

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

MATH 6800F: Advanced Topics: Linear Algebra

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

MATH 6800G: Advanced Topics: Logic and Foundations

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

MATH 6800H: Advanced Topics: Number Theory

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

MATH 6800I: Advanced Topics: Numerical Analysis

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

MATH 6800J: Advanced Topics: Optimization

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

MATH 6800K: Advanced Topics: Probability

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

MATH 6800L: Advanced Topics: Topology

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

MATH 6990: Research

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Mechanical Engineering (ME)

Courses primarily for undergraduates:

ME 1600: Mechanical Engineering Problem Solving with Computer Applications

Credits: 3.

Prereq: ME majors only. MATH 1430 or MATH 1450; credit or enrollment in MATH 1650.

Introduction to the field of Mechanical Engineering through problem-solving in a range of topics including statics, mechanics of materials and thermo-fluids. Techniques to professionally present and communicate solutions. Use of Python computer programming to aid problem solving, including curve fitting and graphing. Graduation Restriction: Only one of ENGR 1600, ABE 1600, AERE 1600, CE 1600, CHE 1600, CPRE 1850, EE 1850, IE 1480, ME 1600, and SE 1850 may count toward graduation. (Typically Offered: Fall, Spring)

ME 1700: Engineering Graphics and Introductory Design

Credits: 3.

Prereq: Credit or concurrent enrollment in MATH 1430 or MATH 1450 (or satisfactory scores on mathematics placement assessments)

Integration of fundamental graphics, computer modeling, and engineering design. Applications of multiview drawings and dimensioning. Techniques for visualizing, analyzing, and communicating 3-D geometries. Application of the design process including written and oral reports. Freehand and computer methods. Satisfactory placement scores can be found at: <https://math.iastate.edu/academics/undergraduate/aleks/placement/>. (Typically Offered: Fall, Spring)

ME 1900: Learning Communities

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Enrollment in ME learning communities. (Typically Offered: Fall, Spring)

ME 2020: Mechanical Engineering - Professional Planning

Credits: Required. Contact Hours: Lecture 1.

Prereq: Credit or Enrollment in ME 2310

Preparation for a career in mechanical engineering; discussion of opportunities for leadership, undergraduate research, experiential learning. (Typically Offered: Fall, Spring)

ME 2200: Globalization and Sustainability

(Cross-listed with ANTHR 2200/ ENVS 2200/ GLOBE 2200/ SOC 2200/ MATE 2200).

Credits: 3. Contact Hours: Lecture 3.

An introduction to understanding the key global issues in sustainability. Focuses on interconnected roles of energy, materials, human resources, economics, and technology in building and maintaining sustainable systems. Applications discussed will include challenges in both the developed and developing world and will examine the role of technology in a resource-constrained world. Graduation Restriction: Cannot be used for technical elective credit in any engineering department. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

ME 2310: Engineering Thermodynamics I

Credits: 3. Contact Hours: Lecture 3.

Prereq: CHEM 1670; MATH 1660 or MATH 1660H; PHYS 2310 or PHYS 2310H; PHYS 2310L

Fundamental concepts based on zeroth, first and second laws of thermodynamics. Properties and processes for ideal gases and solid-liquid-vapor phases of pure substances. Applications to vapor power cycles. (Typically Offered: Fall, Spring, Summer)

ME 2700: Introduction to Mechanical Engineering Design

Credits: 3.

Prereq: ME 1600 or (ABE 1600, AERE 1600, BME 1600, CE 1600, CHE 1600, CPRE 1850, EE 1850, ENGR 1600, IE 1480, or SE 1850); ME 1700 or ENGR 1700; PHYS 2310; PHYS 2310L

Overview of mechanical engineering design with applications to thermal and mechanical systems. Introduction to current design practices used in industry. Semester-long team project focused on addressing societal needs. Past projects include designing human powered charging systems and products for developing nations. (Typically Offered: Fall, Spring)

ME 2800: Design and Analysis of Cyber-Physical Systems

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGR 1600 or equivalent; PHYS 2310

Introduction to the basic concepts of cyber-physical systems (CPS); physical and cyber considerations and constraints for design, analysis, performance monitoring and control of human-engineered physical systems; basic concepts of sensing, information processing and feedback actuation. Substantial hands-on computer programming and project activity relevant to CPS applications. (Typically Offered: Fall)

ME 3000 M 00: Mechanical Engineering Military Transfer Credit

Credits: 0-99. Contact Hours: Lecture 0.

Repeatable.

(Typically Offered: Fall, Spring, Summer)

ME 3240: Manufacturing Engineering

Credits: 3. Contact Hours: Lecture 3.

Prereq: ME 2700 OR [ABE 2180 AND PHYS 2310 AND PHYS 2310L]; EM 3240; MATE 2730; ME 3240L

Fundamentals of manufacturing processes including forming, machining, casting and welding with emphasis on design considerations in manufacturing. Mechanical behavior of metallic materials. Modern manufacturing practices. (Typically Offered: Fall, Spring, Summer)

ME 3240L: Manufacturing Engineering Laboratory

Credits: 1. Contact Hours: Laboratory 2.

Prereq: ENGL 2500; MATE 2730; ME 2700

Laboratory exercises in metrology, mechanical testing (tensile/compression and hardness tests), computer aided design (CAD), machining operations, metal welding, metal casting, and bulk/sheet metal forming. (Typically Offered: Fall, Spring)

ME 3250: Mechanical Component Design

Credits: 3. Contact Hours: Lecture 3.

Prereq: EM 3240; ME 1700 or ENGR 1700; STAT 3050

Philosophy of design and design methodology. Consideration of stresses and failure models useful for static and fatigue loading. Analysis, selection and synthesis of machine elements. (Typically Offered: Fall, Spring)

ME 3320: Engineering Thermodynamics II

Credits: 3. Contact Hours: Lecture 3.

Prereq: ME 2310

Gas power cycles. Fundamentals of gas mixtures, psychrometry, and thermochemistry. Applications to one-dimensional compressible flow, refrigeration, air conditioning and combustion processes. (Typically Offered: Fall, Spring, Summer)

ME 3350: Fluid Flow

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: MATH 2650; (MATH 2660 or MATH 2670); (credit or concurrent enrollment in ME 3320); ME 3450

Incompressible and compressible fluid flow fundamentals. Dimensional analysis and similitude. Internal and external flow applications. Lab experiments emphasizing concepts in thermodynamics and fluid flow. Written reports are required. (Typically Offered: Fall, Spring, Summer)

ME 3450: Engineering Dynamics

Credits: 3. Contact Hours: Lecture 3.

Prereq: CE 2740 AND (credit or concurrent enrollment in MATH 2660 or MATH 2670)

Particle and rigid body kinematics, Newton's laws of motion, kinetics of plane motion, rigid body problems using work-energy, linear, and angular impulse-momentum principles, vibrations. (Typically Offered: Fall, Spring)

ME 3700: Engineering Measurements

Credits: 3. Contact Hours: Laboratory 2, Lecture 2.

Prereq: EE 4420 and STAT 3050

Fundamentals of design, selection, and operation of components of measuring systems. Measurement processes, data acquisition systems, analysis of data, and propagation of measurement uncertainty. (Typically Offered: Fall, Spring)

ME 3730: Science and Practice of Brewing

(Cross-listed with FSHN 3730).

Credits: 3. Contact Hours: Lecture 1.5, Laboratory 4.5.

Introduction to brewing science and technology. Understanding the role of malts, hops, water, and yeast in production of ale and lager beers. Unit operations in brewing. Health, safety, and environmental sustainability in alcohol production and consumption. Weekly laboratory in practical aspects of beer production. (Typically Offered: Fall, Spring)

ME 4010: Human Centered Design, Pre-Departure Course.

Credits: 1. Contact Hours: Lecture 1.

A pre-departure course for ME 4020. Safety and health issues while on site; travel logistics; required travel documents and deadlines; cultural norms. Offered irregularly. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

ME 4020: Field Engineering: Human Centered Design Concepts.

Credits: 3.

Prereq: ME 4010

Design methodology and field engineering principles for use in engineering problem solving in developing nations; application of principals will be on site. Awareness of culture, use of local artisans, crafts people and engineers will be emphasized for the purpose of ensuring sustainable and appropriate technology. Offered irregularly. Meets International Perspectives Requirement. (Typically Offered: Summer)

ME 4100: Mechanical Engineering Applications of Mechatronics

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: EE 4420, EE 4480 and Credit or concurrent enrollment in ME 4210

Fundamentals of sensor characterization, signal conditioning and motion control, coupled with concepts of embedded computer control. Digital and analog components used for interfacing with computer controlled systems. Mechanical system analysis combined with various control approaches. Focus on automation of hydraulic actuation processes. Laboratory experiences provide hands-on development of mechanical systems. Offered irregularly. (Typically Offered: Spring)

ME 4110: Automatic Controls

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: ME 3700 or (credit or concurrent enrollment in ME 4210)

Methods and principles of automatic control. Pneumatic, hydraulic, and electrical systems. Representative applications of automatic control systems. Mathematical analysis of control systems. (Typically Offered: Fall)

ME 4120: Ethical Responsibilities of a Practicing Engineer

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or enrollment in ME 3250

The study of ethics in engineering design and the engineering profession. A comprehensive look at when ethical decisions must be made and an approach to make them. The approach takes into account moral, legal, technical, experiential, and standards to aid in ethical decision making. Each area will be studied through lectures, debates, guest speakers, class discussion, and case studies. (Typically Offered: Fall)

ME 4130: Fluid Power Engineering

(Cross-listed with ABE 4130).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: ABE 2160 or ME 2700 and Credit or concurrent enrollment in EM 3780 or ME 3350

Fundamental fluid power principles, symbols and schematics. Hydraulic fluid properties. Function and performance of components such as connections and fittings, filtration, pumps, valves, actuators, hydrostatic transmissions. Hydraulic system dynamics. Modeling and simulation of circuits. Analysis and design of hydraulic systems. Hydrostatic transmission design. Hands-on construction of circuits, measurement of system variables, and electrohydraulic control. (Typically Offered: Fall)

ME 4150: Mechanical Systems Design

Credits: 3. Contact Hours: Laboratory 6.

Prereq: ME 3240, ME 3250

Mechanical Engineering Capstone Design course. Team approach to solving design problems involving mechanical systems. Teams will use current design practices they will encounter in industry. Document decisions concerning form and function, material specification, manufacturing methods, safety, cost, and conformance with codes and standards. Solution description includes oral and written reports. Projects often worked with industry sponsors. (Typically Offered: Fall, Spring)

ME 4160: Mechanism Design and Analysis

Credits: 3. Contact Hours: Lecture 3.

Prereq: ME 3250

An introduction to the design and analysis of mechanisms and the use of prescribed design methodologies to identify design requirements and achieve desired motion profiles. Topics include fundamental mechanism kinematics; graphical and analytical mechanism synthesis methods; velocity and acceleration analysis; and the design of linkages, cams and gear trains. Significant amount of team-based problem solving and the development of physical and computational models to assist in the design process. (Typically Offered: Spring)

ME 4170: Advanced Machine Design

(Dual-listed with ME 5170).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ME 3250, MATE 2730

Stress life, strain life, and fracture mechanics approaches to fatigue life and design with metals, polymers and ceramics. Introduction to material selection in design of machine components. Thermal and structural considerations in design of machine components and hybrid materials. Course project and relevant literature review required for graduate credit. (Typically Offered: Fall)

ME 4180: Mechanical Considerations in Robotics

(Dual-listed with ME 5180).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or enrollment in ME 4210

Three dimensional kinematics, dynamics, and control of robot manipulators, hardware elements and sensors. Laboratory experiments using industrial robots. (Typically Offered: Spring)

ME 4190: Computer-Aided Design

Credits: 3. Contact Hours: Lecture 3.

Prereq: ME 3250

Theory and applications of computer-aided design. Computer graphics programming, solid modeling, assembly modeling, and finite element modeling. Mechanical simulation, process engineering, rapid prototyping and manufacturing integration. (Typically Offered: Fall, Spring)

ME 4210: System Dynamics and Control

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: EE 4420, EE 4480, ME 3450, and MATH 2670

Modeling and simulation of mechanical, electrical, fluid, and/or thermal systems. Development of equations of motion and dynamic response characteristics in time and frequency domains. Fundamentals of classical control applications, including mathematical analysis and design for closed loop control systems. Introduction to computer interfacing for simulation, data acquisition, and control. Laboratory exercises for hands-on system investigation and control implementation. (Typically Offered: Fall, Spring, Summer)

ME 4250: Optimization Methods for Complex Designs

(Dual-listed with ME 5250/ HCI 5250). (Cross-listed with HCI 4250).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 2650; ME 1600

Optimization involves finding the 'best' according to specified criteria. Review of a range of optimization methods from traditional nonlinear to modern evolutionary methods such as Genetic algorithms. Examination of how these methods can be used to solve a wide variety of design problems across disciplines, including mechanical systems design, biomedical device design, biomedical imaging, and interaction with digital medical data. Students will gain knowledge of numerical optimization algorithms and sufficient understanding of the strengths and weaknesses of these algorithms to apply them appropriately in engineering design. Experience includes code writing and off-the-shelf routines. Numerous case-studies of real-world situations in which problems were modeled and solved using advanced optimization techniques. (Typically Offered: Fall)

ME 4270: Vehicle Dynamics and Suspension Design

Credits: 3. Contact Hours: Lecture 3.

Prereq: ME 3450

Analysis and evaluation of the performance of cars, trucks and other surface vehicles. Computer simulation of ride, braking, and directional response. Considerations in the design and fabrication of suspension systems. (Typically Offered: Spring)

ME 4330: Alternative Energy

Credits: 3. Contact Hours: Lecture 3.

Prereq: CHEM 1670; PHYS 2320 or PHYS 2320H; PHYS 2320L

Basic principles, performance, and cost analysis of alternative energy systems including biofuels, bioenergy, wind, solar, fuel cells, storage and other alternative energy systems. Performance analysis and operating principles of systems and components, and economic analysis for system design and operation will be taught. Emphasis is on alternative energy technologies needed to meet our future energy needs at various scales ranging from household to city to national levels. (Typically Offered: Fall)

ME 4360: Heat Transfer

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: ME 3350

Heat transfer by conduction, convection, and radiation. Similarity concepts in heat, mass, and momentum transfer. Methods for determination of heat transfer coefficients. Combined modes of heat transfer. Heat exchangers. Lab experiments emphasizing concepts in thermodynamics and heat transfer. Written reports are required. (Typically Offered: Fall, Spring, Summer)

ME 4370: Introduction to Combustion Engineering

Credits: 3. Contact Hours: Lecture 3.

Prereq: ME 3320

Introduction to the fundamentals of combustion and the analysis of combustion systems for gaseous, liquid, and solid fuels-including biomass fuels. Combustion fundamentals are applied to the analysis of engines; turbines, biomass cookstoves; suspension, fixed-bed, and fluidized-bed furnaces; and other combustion devices. (Typically Offered: Spring)

ME 4410: Fundamentals of Heating, Ventilating, and Air Conditioning

Credits: 3. Contact Hours: Lecture 3.

Prereq: ME 3320

Space conditioning and moist air processes. Application of thermodynamics, heat transfer, and fluid flow principles to the analysis of heating, ventilating, and air conditioning components and systems. Performance and specification of components and systems. (Typically Offered: Fall)

ME 4420: Heating and Air Conditioning Design

Credits: 3.

Prereq: (ME 4410; credit or concurrent enrollment in ME 4360) or Permission of Instructor

Design criteria and assessment of building environment and energy requirements. Design of heating, ventilating, and air conditioning systems. System control and economic analysis. Oral and written reports required. (Typically Offered: Spring)

ME 4440: Elements and Performance of Power Plants

Credits: 3. Contact Hours: Lecture 3.

Prereq: ME 3320, credit or enrollment in ME 3350

Basic principles, thermodynamics, engineering analysis of power plant systems. Topics include existing power plant technologies, the advanced energyplex systems of the future, societal impacts of power production, and environmental and regulatory concerns. (Typically Offered: Spring)

ME 4480: Fluid Dynamics of Turbomachinery

(Cross-listed with AERE 4480).

Credits: 3. Contact Hours: Lecture 3.

Prereq: AERE 3110 or ME 3350

Applications of principles of fluid mechanics and thermodynamics in performance analysis and design of turbomachines. Conceptual and preliminary design of axial and radial flow compressors and turbines using velocity triangles and through-flow approaches. (Typically Offered: Spring)

ME 4490: Internal Combustion Engines

Credits: 3. Contact Hours: Lecture 3, Laboratory 1.

Prereq: ME 3250

Basic principles, thermodynamics, combustion, and exhaust emissions of spark-ignition and compression-ignition engines. Laboratory determination of fuel properties and engine performance. Effects of engine components and operating conditions on performance. Written reports required. (Typically Offered: Fall)

ME 4510: Engineering Acoustics

(Cross-listed with EM 4510/ EE 4510).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 2660 or MATH 2670; PHYS 2310 and 2310L

The basics of acoustic wave propagation in fluids with an emphasis on sound propagation in air. Topics include transmission and reflection of sound at a boundary; role of acoustic sources in directing sound fields; diffraction of sound around solid objects; reverberation of sound in a room; and the measurement of sound fields. (Typically Offered: Fall)

ME 4560: Machine Vision

(Dual-listed with ME 5560).

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: MATH 2070 or MATH 3170 or Permission of Instructor

Practical imaging processing techniques, geometric optics, and mathematics behind machine vision, as well as the most advanced 3D vision techniques. Experience with practical vision system development and analysis. Assignments include individual bi-weekly homework; weekly readings and lectures; and a semester-long research project on design and experiment vision systems. (Typically Offered: Fall)

ME 4750: Modeling and Simulation

Credits: 3. Contact Hours: Lecture 3.

Prereq: ME 4210, credit or enrollment in ME 4360

Introduction to computer solution techniques required to simulate flow, thermal, and mechanical systems. Methods of solving ordinary and partial differential equations and systems of algebraic equations; interpolation, numerical integration; finite difference and finite element methods. (Typically Offered: Spring)

ME 4840: Technology, Globalization and Culture

(Dual-listed with WLC 5840/ ME 5840/ MKT 5840). (Cross-listed with WLC 4840/ MKT 4840).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior or Senior Classification

Cross-disciplinary examination of the present and future impact of globalization with a focus on preparing students for leadership roles in diverse professional, social, and cultural contexts. Facilitate an understanding of the threats and opportunities inherent in the globalization process as they are perceived by practicing professionals and articulated in debates on globalization. Use of a digital forum for presenting and analyzing globalization issues by on-campus and off-campus specialists. Meets International Perspectives Requirement. (Typically Offered: Fall)

ME 4900H: Independent Study: Honors

Credits: 1-6. Repeatable.

Prereq: Department Permission for Course; Membership in the University Honors Program

Investigation of topics holding special interest of students and faculty. Election of course and topic must be approved in advance by supervising faculty.

ME 4900N: Independent Study: Non Technical Elective

Credits: 1-6. Repeatable.

Prereq: Department Permission for Course

Investigation of topics holding special interest of students and faculty. Election of course and topic must be approved in advance by supervising faculty.

ME 4900T: Independent Study: Technical Elective

Credits: 1-6. Repeatable.

Prereq: Department Permission for Course

Investigation of topics holding special interest of students and faculty. Election of course and topic must be approved in advance by supervising faculty.

ME 4910: Laboratory Component

Credits: 1-3. Contact Hours: Laboratory 6.

Repeatable.

This course is designed specifically for transfer and study abroad students who need to make up a lab to fulfill course requirements. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

ME 5010: Fundamentals of Biorenewable Resources

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to the science and engineering of converting biorenewable resources into bioenergy and biobased products. Survey of biorenewable resource base and properties; description of biofuels and biobased products; production of biorenewable resources; processing technologies for fuels, chemicals, materials, and energy; environmental impacts; technoeconomic analysis of production and processing; and biofuels policy. (Typically Offered: Spring)

ME 5020: Microfluidics and Nanofluidics: Theory, Design and Devices

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Analysis of transport phenomena and its application to the field of microfluidics. Conservation equations of mass, momentum and energy are derived from first principles and applied to contemporary topics in microfluidics such as organs-on-a-chip, point-of-care and separation processes. The conservation equations are used to model hydrodynamics and random walk diffusion of multiphase microfluidic systems. Advanced microfluidic topics, such as interfacial transport involving capillary interactions, electrostatic forces, and chemical gradients are discussed into order to describe a variety of phenomena observed in microfluidic devices. Numerical models based on finite element modeling and molecular dynamic simulation techniques are discussed as one approach to designing microfluidic devices such as pumps, micromixers, actuators, and filters. Offered even-numbered years. (Typically Offered: Spring)

ME 5100: Economics and Policy of Engineered Energy Systems

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Economics and policy for U.S. energy systems, with an emphasis on connections to engineering. Topics include: economic analysis of conventional energy commodity markets and technologies, deregulated electricity markets, and emerging energy technologies; demand forecasting; economic and environmental policy in energy; integrated assessment; and semester-specific contemporary issues. Graduation Restriction: Economics majors may not apply this course towards graduation. Offered even-numbered years. (Typically Offered: Fall)

ME 5110: Advanced Control Design

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Application of control design methods using continuous, discrete, and frequency-based models. Approaches include classical, pole assignment, model reference, internal model, and adaptive control methods. Mechanical design projects. Offered odd-numbered years. (Typically Offered: Fall)

ME 5170: Advanced Machine Design

(Dual-listed with ME 4170).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Stress life, strain life, and fracture mechanics approaches to fatigue life and design with metals, polymers and ceramics. Introduction to material selection in design of machine components. Thermal and structural considerations in design of machine components and hybrid materials. Course project and relevant literature review required for graduate credit. (Typically Offered: Fall)

ME 5180: Mechanical Considerations in Robotics

(Dual-listed with ME 4180).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior, Senior, or Graduate Standing

Three dimensional kinematics, dynamics, and control of robot manipulators, hardware elements and sensors. Laboratory experiments using industrial robots. (Typically Offered: Spring)

ME 5200: Materials and Processing Considerations in Additive Manufacturing

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior, Senior, or Graduate Standing

Additive manufacturing (AM) or 3D printing is a technique to fabricate three dimensional objects with select shape or design from computer aided design files. This course will focus on AM techniques to fabricate metallic parts using various AM processes-in particular, material extrusion, binder jetting, sheet lamination, vat photopolymerization, material jetting, directed energy deposition (DED) and powder bed fusion (PBF). The course will critically assess several applications of metal AM with relevant advantages and disadvantages. Specific additional topics will include feedstock materials, heat transfer and solidification, defect formation mechanisms, microstructure evolution, process-microstructure-property relationships, post-processing strategies, recent advances in metal AM and the future of this technology. (Typically Offered: Fall)

ME 5210: Mechanical Behavior and Manufacturing of Polymers and Composites

(Cross-listed with MSE 5210).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior, Senior, or Graduate Standing

Effect of chemical structure and morphology on properties. Linear viscoelasticity, damping and stress relaxation phenomena. Structure and mechanics of filler and fiber reinforced composites. Mechanical properties and failure mechanisms. Material selection and designing with polymers. Processing of polymer and composite parts. (Typically Offered: Spring)

ME 5250: Optimization Methods for Complex Designs

(Dual-listed with ME 4250). (Cross-listed with HCI 5250).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior, Senior, or Graduate Standing

Optimization involves finding the 'best' according to specified criteria. Review of a range of optimization methods from traditional nonlinear to modern evolutionary methods such as Genetic algorithms. Examination of how these methods can be used to solve a wide variety of design problems across disciplines, including mechanical systems design, biomedical device design, biomedical imaging, and interaction with digital medical data. Students will gain knowledge of numerical optimization algorithms and sufficient understanding of the strengths and weaknesses of these algorithms to apply them appropriately in engineering design. Experience includes code writing and off-the-shelf routines. Numerous case-studies of real-world situations in which problems were modeled and solved using advanced optimization techniques. (Typically Offered: Fall)

ME 5270: Mechanics of Machining and Finishing Processes

Credits: 3. Contact Hours: Lecture 3.

Prereq: ME 3240 or graduate standing

Mechanics of material removal for ductile materials. Shear zone theory. Oblique cutting. Heat transfer in machining. Milling and grinding. Mechanics of material removal for brittle materials. Optimal selection and design of cutting parameters. Control of machining processes. Principles of precision finishing. Design considerations for machining and finishing processes. Offered Fall even-numbered years. (Typically Offered: Fall)

ME 5280: Micro/Nanomanufacturing

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Concepts and applications of micro/nanotechnology appropriate to the manufacturing field. An overview of micro/nano-fabrication techniques including mechanical, EDM, laser and lithography. MEMS device fabrication. Scaling laws. Top down and bottom up approaches of nanomanufacturing. Experimental or theoretical project leading to potential submission of a manuscript for journal or conference. Offered odd-numbered years. (Typically Offered: Fall)

ME 5300: Advanced Thermodynamics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Fundamentals of thermodynamics from the classical viewpoint with emphasis on the use of the first and second laws for analysis of thermal systems. Generalized thermodynamic relationships. Computer applications of thermodynamic properties and system analysis. Selected topics. (Typically Offered: Fall)

ME 5310: Advanced Energy Systems and Analysis

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior, Senior, or Graduate Standing

Introduction to energy systems including economic and thermodynamic principles. Various production systems will be analyzed. Application to transportation and building systems will be emphasized. Sustainability, climate change and other current energy system topics. (Typically Offered: Spring)

ME 5320: Compressible Fluid Flow

(Cross-listed with AERE 5320).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Thermodynamics of compressible flow. Viscous and inviscid compressible flow equations. One dimensional steady flow; isentropic flow, shocks, expansions. Multidimensional compressible flow aspects. Linear and nonlinear wave analysis and method of characteristics. Subsonic, transonic, supersonic and hypersonic flows. (Typically Offered: Spring)

ME 5340: Energetic Materials Combustion and Systems

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to energetic materials (classes of energetics, their use, safety, analysis of multiphase deflagration/detonation reaction wave structures), their application (e.g. pyrotechnics, chemical propulsion systems, explosives), system performance analysis, common measurement techniques, and societal/environmental implications. Offered even-numbered years. (Typically Offered: Spring)

ME 5350: Thermochemical Processing of Biomass

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Thermochemistry and transport theory applied to combustion. Gas phase equilibrium. Energy balances. Reaction kinetics. Flame temperatures, speed, ignition, and extinction. Premixed and diffusion flames. Combustion aerodynamics. Mechanisms of air pollution. Offered odd-numbered years. (Typically Offered: Fall)

ME 5360: Advanced Heat Transfer

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior, Senior, or Graduate Standing

Advanced treatment of heat transmission by conduction, convection, and radiation. (Typically Offered: Spring)

ME 5380: Advanced Fluid Flow

Credits: 3. Contact Hours: Lecture 3.

Prereq: ME 4360 or graduate standing

Detailed analysis of incompressible/compressible, viscous/inviscid, laminar/turbulent, and developing fluid flows on a particle/point control volume basis. (Typically Offered: Fall)

ME 5420: Advanced Combustion

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Thermochemistry and transport theory applied to combustion. Gas phase equilibrium. Energy balances. Reaction kinetics. Flame temperatures, speed, ignition, and extinction. Premixed and diffusion flames. Combustion aerodynamics. Mechanisms of air pollution. Offered odd-numbered years. (Typically Offered: Spring)

ME 5430: Introduction to Random Vibrations and Nonlinear Dynamics

(Cross-listed with EM 5430).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Vibrations of continuous systems. Nonlinear vibration phenomena, perturbation expansions; methods of multiple time scales and slowly-varying amplitude and phase. Characteristics of random vibrations; random processes, probability distributions, spectral density and its significance, the normal or Gaussian random process. Transmission of random vibration, response of simple single and two-degree-of-freedom systems to stationary random excitation. Fatigue failure due to random excitation. Offered odd-numbered years. (Typically Offered: Spring)

ME 5450: Thermal Systems Design

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Integrating thermodynamics, fluid mechanics, and heat transfer to model thermal equipment and to simulate thermal systems. Second law and parametric analysis; cost estimation, life cycle analysis and optimization. Some computer programming required. Offered odd-numbered years. (Typically Offered: Spring)

ME 5460: Computational Fluid Mechanics and Heat Transfer I

(Cross-listed with AERE 5460).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Basic concepts of discretization, consistency, and stability. Explicit and implicit methods for ordinary differential equations. Methods for each type of partial differential equation. Iterative solution methods; curvilinear grids. Students will program basic algorithms. (Typically Offered: Fall)

ME 5470: Computational Fluid Mechanics and Heat Transfer II

(Cross-listed with AERE 5470).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Application of computational methods to current problems in fluid mechanics and heat transfer. Methods for solving the Navier-Stokes and reduced equation sets such as the Euler, boundary layer, and parabolized forms of the conservation equations. Introduction to relevant aspects of grid generation and turbulence modeling. (Typically Offered: Spring)

ME 5480: Fundamentals of Laser and Optical Measurements in Thermofluid Systems

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Fundamentals of lasers and optical techniques for application in measurements of thermo-fluid systems. Rigorous diffraction theory, theory of laser operation, and applications of theory to measurements using optics and lasers will be covered. The principles of measurement using linear scattering techniques (absorption, Rayleigh and Raman scattering) as well as nonlinear techniques (CARS and multiphoton absorption) will be discussed. Offered even-numbered years. (Typically Offered: Spring)

ME 5500: Advanced Biosensors: Fundamentals and Applications

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior, Senior, or Graduate Standing

Extensive overview of biosensors including biological/biomedical microelectromechanical (Bio-MEMs) systems and bioanalytical devices with an introduction to fundamental principles, detection methods, and miniaturization techniques. Fundamental biosensor theory including biorecognition, transduction, signal acquisition, and post processing/data analysis will be discussed. Distinct sensing modalities (e.g., electrochemical, optical, thermal and mass based), biorecognition agents (e.g., enzymes, antibodies, aptamers, whole cells/tissues, genetically engineered proteins) and advanced transduction materials (e.g., carbon nanotubes, graphene, quantum/carbon dots, and polymers/hydrogels) and their use in the context of specific applications (e.g., biomedical, environmental, food safety) will be reviewed in detail. Additionally, students will design a theoretical biosensor and present their design in a written proposal and oral presentation. Offered even-numbered years. (Typically Offered: Fall)

ME 5560: Machine Vision

(Dual-listed with ME 4560).

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Practical imaging processing techniques, geometric optics, and mathematics behind machine vision, as well as the most advanced 3D vision techniques. Experience with practical vision system development and analysis. Assignments include individual bi-weekly homework; weekly readings and lectures; and a semester-long research project on design and experiment vision systems. Offered odd-numbered years. (Typically Offered: Fall)

ME 5570: Computer Graphics and Geometric Modeling

(Cross-listed with COMS 5570/ CPRE 5570).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Fundamentals of computer graphics technology. Data structures. Parametric curve and surface modeling. Solid model representations. Applications in engineering design, analysis, and manufacturing. Offered odd-numbered years. (Typically Offered: Fall)

ME 5610: Scanning Probe Microscopy

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Introduction to the scanning probe microscope (SPM, also known as atomic force microscope or AFM) and associated measurement techniques. Overview of instrumentation system, basic principles of operation, probe-sample interaction and various operational modes to obtain micro/nanoscale structure and force spectroscopy of material surfaces. Examples of SPM significance and applications in science and engineering research, nanotechnology and other industries. Laboratory work involving use of a scanning probe microscope system is an integral part of the course. (Typically Offered: Fall)

ME 5630: Micro and Nanoscale Mechanics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior, Senior, or Graduate Standing

Review of Fundamentals: (Elasticity, Electromagnetism, Mechanical response), Mechanics of thermally, electrostatically and magnetically actuated microsystems, Mechanics and design of nanostructured materials, mechanics of surface stress engineering and its implications to sensors and thin film structures. Offered odd-numbered years. (Typically Offered: Spring)

ME 5640: Fracture and Fatigue

(Cross-listed with AERE 5640/ EM 5640/ MSE 5640).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Materials and mechanics approach to fracture and fatigue.

Fracture mechanics, brittle and ductile fracture, fracture and fatigue characteristics, fracture of thin films and layered structures. Fracture and fatigue tests, mechanics and materials designed to avoid fracture or fatigue. Offered even-numbered years. (Typically Offered: Fall)

ME 5660: Phase Transformation in Elastic Materials

(Cross-listed with EM 5660).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Continuum thermodynamics and kinetics approaches to phase transformations. Phase field approach to stress- and temperature-induced martensitic transformations and twinning at the nanoscale.

Nucleation and growth. Nanostructural evaluation. Analytical and numerical solutions. Surface stresses and energy. Surface-induced phase transformations. Large Strain formulation. (Typically Offered: Spring)

ME 5700: Solid Modeling and GPU Computing

Credits: 3. Contact Hours: Lecture 3.

Prereq: ME 1700 and ME 4190 or Graduate Student Status

Theory and applications of solid modeling and introduction to parallel computing using the graphic processing unit (GPU). Topics include solid modeling fundamentals, representations of solid geometry, introduction to parallel programming using CUDA, and applications of GPU algorithms. Design and analysis software include SolidWorks and programming using either C or Python, and NVIDIA CUDA. Offered even-numbered years. (Typically Offered: Fall)

ME 5730: Random Signal Analysis and Kalman Filtering

(Cross-listed with EE 5730/ AERE 5730).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Elementary notions of probability. Random processes. Autocorrelation and spectral functions. Estimation of spectrum from finite data. Response of linear systems to random inputs. Discrete and continuous Kalman filter theory and applications. Smoothing and prediction. Linearization of nonlinear dynamics. (Typically Offered: Fall)

ME 5740: Optimal Control

(Cross-listed with AERE 5740/ EE 5740).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

The optimal control problem. Variational approach. Pontryagin's principle, Hamilton-Jacobi equation. Dynamic programming. Time-optimal, minimum fuel, minimum energy control systems. The regulator problem. Structures and properties of optimal controls. (Typically Offered: Spring)

ME 5750: Introduction to Robust Control

(Cross-listed with AERE 5750/ EE 5750).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to modern robust control. Model and signal uncertainty in control systems. Uncertainty description. Stability and performance robustness to uncertainty. Solutions to the H₂, H_∞, and L₁ control problems. Tools for robustness analysis and synthesis.

ME 5760: Digital Feedback Control Systems

(Cross-listed with AERE 5760/ EE 5760).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Sampled data, discrete data, and the z-transform. Design of digital control systems using transform methods: root locus, frequency response and direct design methods. Design using state-space methods. Controllability, observability, pole placement, state estimators. Digital filters in control systems. Microcomputer implementation of digital filters. Finite wordlength effects. Linear quadratic optimal control in digital control systems. Simulation of digital control systems. (Typically Offered: Fall)

ME 5770: Linear Systems

(Cross-listed with AERE 5770/ EE 5770/ MATH 5770).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Linear algebra review. Least square method and singular value decomposition. State space modeling of linear continuous-time systems. Solution of linear systems. Controllability and observability. Canonical description of linear equations. Stability of linear systems. State feedback and pole placements. Observer design for linear systems. (Typically Offered: Fall)

ME 5780: Nonlinear Systems

(Cross-listed with AERE 5780/ EE 5780/ MATH 5780).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Linear vs nonlinear systems. Phase plane analysis. Bifurcation and center manifold theory. Lyapunov stability. Absolute stability of feedback systems. Input-output stability. Passivity theory and feedback linearization. Nonlinear control design techniques. (Typically Offered: Spring)

ME 5800: Virtual Environments, Virtual Worlds, and Application

(Cross-listed with HCI 5800).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

A systematic introduction to the underpinnings of Virtual Environments (VE), Virtual Worlds, advanced displays and immersive technologies; and an overview of some of the applications areas particularly virtual engineering. Offered even-numbered years. (Typically Offered: Spring)

ME 5840: Technology, Globalization and Culture

(Dual-listed with WLC 4840/ ME 4840/ MKT 4840). (Cross-listed with WLC 5840/ MKT 5840).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate classification

Cross-disciplinary examination of the present and future impact of globalization with a focus on preparing students for leadership roles in diverse professional, social, and cultural contexts. Facilitate an understanding of the threats and opportunities inherent in the globalization process as they are perceived by practicing professionals and articulated in debates on globalization. Use of a digital forum for presenting and analyzing globalization issues by on-campus and off-campus specialists. Meets International Perspectives Requirement. (Typically Offered: Fall)

ME 5850: Fundamentals of Predictive Plant Phenomics

(Cross-listed with BCB 5850/ GDCB 5850).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Principles of engineering, data analysis, and plant sciences and their interplay applied to predictive plant phenomics. Transport phenomena, sensor design, image analysis, graph models, network data analysis, fundamentals of genomics and phenomics. Multidisciplinary laboratory exercises. (Typically Offered: Fall)

ME 5900Q: Special Topics: Independent Literature Investigation

Credits: 1-8. Repeatable.

Prereq: Department Permission for Course

Investigation of advanced topics of special interest to graduate students in mechanical engineering.

ME 5900T: Special Topics: Biological and Nanoscale Sciences

Credits: 1-8. Repeatable.

Prereq: Department Permission for Course

ME 5900U: Special Topics: Complex Fluid Systems

Credits: 1-8. Repeatable.

Prereq: Department Permission for Course

ME 5900V: Special Topics: Clean Energy Technologies

Credits: 1-8. Repeatable.

Prereq: Department Permission for Course

ME 5900W: Special Topics: Design and Manufacturing Innovation

Credits: 1-8. Repeatable.

Prereq: Department Permission for Course

ME 5900Z: Special Topics: Simulation and Visualization

Credits: 1-8. Repeatable.

Prereq: Department Permission for Course

ME 5910: Probabilistic Engineering Analysis and Design

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Applications of probabilistic and statistical methods to engineering system design and post-design failure prognostics. Hands-on learning of various probabilistic and statistical design methods, such as design of experiments, surrogate modeling, uncertainty quantification, reliability-based design, and robust design. It also covers Bayesian estimation and machine learning methods for post-design failure prognostics. Offered even-numbered years. (Typically Offered: Spring)

ME 5920: Data Analytics and Machine Learning for Cyber-Physical Systems Applications

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior, Senior, or Graduate Standing

In this course, several data analytics techniques and Machine Learning algorithms will be explored with a strong focus on various applications to cyber-physical systems. The students will have hands-on experience with various analytics tools and data-driven decision-making techniques applied to a diverse set of spatial, temporal and spatiotemporal data emanating from real-life cyber-physical systems such as robots, energy & power systems, design & manufacturing systems, self-driving cars and agricultural systems. Among various machine learning techniques, special emphasis will be given on deep learning, reinforcement learning and probabilistic graphical models. A key highlight of this course is that the assignments and class projects will be designed for individual students or groups based on their specific applications or data sets of interest. (Typically Offered: Spring)

ME 5990: Creative Component

Credits: 1-30. Repeatable.

Prereq: Department Permission for Course

Courses for graduate students:**ME 6000: Seminar**

Credits: Required. Repeatable.

Seminar.

ME 6250: Surface Modeling

Credits: 3. Contact Hours: Lecture 3.

Theory and implementation of contemporary parametric sculptured surface modeling technology. Non-uniform rational B-spline (NURBS) curves and surfaces. Fundamental computational algorithms. Construction techniques. Advanced modeling topics. Computer projects. Offered odd-numbered years. (Typically Offered: Fall)

ME 6320: Multiphase Flow

(Cross-listed with CHE 6320).

Credits: 3. Contact Hours: Lecture 3.

Single particle, multiparticle and two-phase fluid flow phenomena (gas-solid, liquid-solid and gas-liquid mixtures); particle interactions, transport phenomena, wall effects; bubbles, equations of multiphase flow. Dense phase (fluidized and packed beds) and ducted flows; momentum, heat and mass transfer. Computer solutions. Offered even-numbered years. (Typically Offered: Spring)

ME 6370: Convection Heat Transfer

Credits: 3. Contact Hours: Lecture 3.

Convection heat transfer to internal or external flows under laminar or turbulent conditions. Dimensionless parameters. Classical solutions of Newtonian viscous flows. Forced and free convection. Special topics. Offered irregularly. (Typically Offered: Fall)

ME 6380: Radiation Heat Transfer

Credits: 3. Contact Hours: Lecture 3.

Techniques for analysis of radiation in enclosures. Radiative properties of surfaces. Radiative transfer in participating media. Combined modes of transfer. Approximate methods of analysis. (Typically Offered: Fall)

ME 6470: Advanced Computational Fluid Dynamics

(Cross-listed with AERE 6470).

Credits: 3. Contact Hours: Lecture 3.

An examination of current methods in computational fluid dynamics. Differencing strategies. Advanced solution algorithms for unstructured meshes. Grid generation. Construction of higher-order CFD algorithms. Parallel computing. Current applications. Use of state of the art CFD codes. (Typically Offered: Spring)

ME 6900G: Advanced Topics: Advanced Machine Design

Credits: 1-30. Repeatable.

Prereq: Department Permission for Course

Investigation of advanced topics of special interest to graduate students in mechanical engineering.

ME 6900O: Advanced Topics: Engineering Computation

Credits: 1-30. Repeatable.

Prereq: Department Permission for Course

Investigation of advanced topics of special interest to graduate students in mechanical engineering.

ME 6900Q: Advanced Topics: Independent Literature Investigation

Credits: 1-30. Repeatable.

Prereq: Department Permission for Course

Investigation of advanced topics of special interest to graduate students in mechanical engineering.

ME 6900T: Advanced Topics: Biological and Nanoscale Sciences

Credits: 1-30. Repeatable.

Prereq: Department Permission for Course

Investigation of Special Topics: Biological and Nanoscale Sciences of special interest to graduate students in mechanical engineering. (Typically Offered: Fall, Spring, Summer)

ME 6900U: Advanced Topics: Complex Fluid Systems

Credits: 1-30. Repeatable.

Prereq: Department Permission for Course

Investigation of Special Topics: Complex Fluid Systems of special interest to graduate students in mechanical engineering. (Typically Offered: Fall, Spring, Summer)

ME 6900V: Advanced Topics: Clean Energy Technologies

Credits: 1-30. Repeatable.

Prereq: Department Permission for Course

Investigation of Special Topics: Clean Energy Technologies of special interest to graduate students in mechanical engineering. (Typically Offered: Fall, Spring, Summer)

ME 6900W: Advanced Topics: Design and Manufacturing Innovation

Credits: 1-30. Repeatable.

Prereq: Department Permission for Course

Investigation of Design & Manufacturing Innovation of special interest to graduate students in mechanical engineering.

ME 6900Z: Advanced Topics: Simulation and Visualization

Credits: 1-30. Repeatable.

Prereq: Department Permission for Course

Investigation of Special Topics: Simulation and Visualization of special interest to graduate students in mechanical engineering. (Typically Offered: Fall, Spring, Summer)

ME 6930: Entrepreneurship for Graduate Students in Science and Engineering

(Cross-listed with AGRON 6930/ BCB 6930/ ENGR 6930/ GENET 6930/ EE 6930).

Credits: 1. Contact Hours: Lecture 3.

Repeatable, maximum of 2 credits.

Understanding key topics of starting a technology based company, from development of technology-led idea to early-stage entrepreneurial business. Concepts discussed include: entrepreneurship basics, starting a business, funding your business, protecting your technology/business IP. Subject matter experts and successful, technology-based entrepreneurs will provide real world examples from their experience with entrepreneurship. Learn about the world class entrepreneurship ecosystem at ISU and Central Iowa. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

ME 6970: Engineering Internship

Credits: Required. Repeatable.

Prereq: Department Permission for Course

One semester and one summer maximum per academic year professional work period. Offered on a satisfactory-fail basis only.

ME 6990: Research

Credits: 1-30. Repeatable.

Prereq: Department Permission for Course

Offered on a satisfactory-fail basis only.

ME ME/HCI 5400X: Internet-based Methods, Extended Reality, and Machine Learning for use in Engineering Design and Data Analysis

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior, Senior, or Graduate Standing

With the continuing growth of computational power, the use of Internet-based methods, Extended Reality (XR), and Machine Learning (ML) has expanded beyond the traditional bounds of narrow disciplinary boundaries. Engineering companies are increasingly relying on engineers to develop tools to improve the efficiency of the design process and reduce design cycle time. Engineers with an understanding of Internet-based methods, XR, and ML are in a unique position to use their in-depth knowledge of a specific discipline to develop applications that can help the day-to-day product design process. Internet-based Methods, Extended Reality, and Machine Learning for use in Engineering Design and Analysis will familiarize students with several state-of-the-art techniques that allow an engineer to take advantage of the computational resources available in these different areas. Geographical and platform independent tool development will be discussed, including hands on development of web-based engineering applications. The infrastructure supporting the development of engineering tools will also be covered, including relational databases, the development of middleware to allow different engineering software (i.e. CAD and FEM) to interact, and the benefits and requirements when incorporating extended reality (XR) technologies and machine learning / artificial intelligence into a design and/or analysis process. (Typically Offered: Fall)

Meteorology (MTEOR)

Courses primarily for undergraduates:

MTEOR 1070: Severe and Hazardous Weather

Credits: 1. Contact Hours: Lecture 1.

Understanding of atmospheric processes that play a role in creating severe and hazardous weather. Focus on thunderstorms, tornadoes, hurricanes, floods, blizzards, ice storms, and temperature extremes. Impacts on lives and property. (Typically Offered: Fall)

MTEOR 1110: Synoptic Applications

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Prereq: Credit or Enrollment in MATH 1650

Current weather discussions and introduction to synoptic-scale interpretation of meteorology. Application and use of calculus in meteorology. Course restricted to majors. Others with permission of instructor. (Typically Offered: Fall, Spring, Summer)

MTEOR 1120: Geoscience Orientation

(Cross-listed with GEOL 1120).

Credits: 1. Contact Hours: Lecture 1.

Orientation course for students enrolled in the Earth, Wind and Fire Learning Community. Provides an introduction to Iowa State University and meteorology, geology, and Earth science programs for students enrolled in the department's learning community. Activities include academic and social activities, talks and presentations on academic success, resume writing, and study abroad, as well as research talks by faculty members. (Typically Offered: Fall)

MTEOR 1130: Spring Geoscience Orientation for Earth, Wind and Fire Learning Community

(Cross-listed with GEOL 1130).

Credits: 1. Contact Hours: Lecture 1.

Spring orientation course for students enrolled in the 'Earth, Wind and Fire' Learning Community. Develop and apply quantitative, data-analysis, management, and communication skills on an authentic research project in a team to focus on professionalism and resilience. Introduction to interview strategies and the importance of creating a professional image on social media. Academic and social events, plus two field trips. (Typically Offered: Spring)

MTEOR 1400: Climate and Society

(Cross-listed with AGRON 1400/ ENVS 1400/ GEOL 1400/ CLSCI 1400).

Credits: 3. Contact Hours: Lecture 3.

The climate system of our planet. How nature and our actions alter the existing energy balance leading to climate change. Past climates on our planet. The influence of climate on society and resource availability during the Holocene (~ 11,000 years ago to present) with focus on changes post industrial revolution. Significant climate events that have altered our way of life in the past. Projected changes in future climate and potential impacts on society, environment and resources. Adaption to and mitigation of climate change. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

MTEOR 1600: Water Resources of the World

(Cross-listed with AGRON 1600/ ENVS 1600/ GEOL 1600).

Credits: 3. Contact Hours: Lecture 3.

Study of the occurrence, history, development, and management of world water resources. Basic hydrologic principles including climate, surface water, groundwater, and water quality. Historical and current perspectives on water policy, use, and the role of water in society and the environment. Meets International Perspectives Requirement. (Typically Offered: Spring)

MTEOR 2010: Introductory Seminar

Credits: Required. Contact Hours: Lecture 1.

Prereq: Credit or enrollment in PHYS 2310 or 2310H

An overview of the atmospheric sciences, the meteorology program at Iowa State, and the major research journals used in the discipline. (Typically Offered: Fall)

MTEOR 2060: Introduction to Weather and Climate

(Cross-listed with AGRON 2060).

Credits: 3. Contact Hours: Lecture 3.

Basic concepts in weather and climate, including atmospheric measurements, radiation, stability, precipitation, winds, fronts, forecasting, and severe weather. Applied topics include global warming, ozone depletion, world climates and weather safety. (Typically Offered: Fall, Spring)

MTEOR 2270: Computational Meteorology I

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Credit or concurrent enrollment in MTEOR 2060; Credit or concurrent enrollment in PHYS 2310

An introduction to computer programming using FORTRAN and Python with focus on meteorological applications. Emphasis on basics of good programming techniques and style through extensive practice in top-down design, writing, running, and debugging small programs. Topics include operations and functions, selective execution, repetitive execution, arrays, input/output, file processing, and subprograms. This course is designed for majors. (Typically Offered: Fall)

MTEOR 2900: Independent Study

Credits: 1-4. Repeatable.

Prereq: Instructor Permission for Course

Independent study for freshman and sophomore students.

MTEOR 2980: Cooperative Education

Credits: Required. Repeatable.

Prereq: Department Cooperative Education Coordinator Permission for Course

Required of all cooperative education students. Students must register for this course prior to commencing the work period. (Typically Offered: Fall, Spring, Summer)

MTEOR 3010: General Meteorology

Credits: 4. Contact Hours: Lecture 4.

Prereq: MATH 1660, credit or enrollment in PHYS 2320

Global distribution of temperature, wind, and atmospheric constituents; atmospheric thermodynamics, radiative transfer, global energy balance, storms and clouds, introductory dynamics. (Typically Offered: Spring)

MTEOR 3110: Introduction to Synoptic Meteorology

Credits: 2. Contact Hours: Lecture 1, Laboratory 2.

Prereq: MTEOR 3010

Concepts of weather map plotting and analysis. Introduction to forecasting and to the use of real-time UNIDATA computer products. (Typically Offered: Fall)

MTEOR 3210: Meteorology Internship

Credits: 1-2. Repeatable, maximum of 3 credits.

Prereq: MTEOR 3110; Permission of the Department Cooperative Education Coordinator

Supervised practical experience in a professional meteorological agency. Experiences may include providing weather information for radio, TV, utilities, government agencies, construction, or agribusiness. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

MTEOR 3240: Energy and the Environment

(Cross-listed with ENSCI 3240/ ENVS 3240/ GEOL 3240).

Credits: 3. Contact Hours: Lecture 3.

Exploration of Earth's energy resources and the environmental and climatic impacts of energy acquisition and consumption. Renewable and non-renewable energy resources within an Earth-system context. Various environmentally-relevant topics such as water quality and availability, habitat destruction, greenhouse-gas emissions, and health and safety hazards to wildlife and human communities. Designed for students with a college-level understanding of chemistry and physics. (Typically Offered: Spring)

MTEOR 3410: Atmospheric Physics I

Credits: 3. Contact Hours: Lecture 3.

Prereq: PHYS 2320, MTEOR 3010, credit or enrollment in MATH 2660 or MATH 2670

Basic laws of thermodynamics, thermodynamics of water vapor, mixtures of gases, stability, and hydrostatics. (Typically Offered: Fall)

MTEOR 3420: Atmospheric Physics II

Credits: 3. Contact Hours: Lecture 3.

Prereq: MTEOR 3410

Cloud and precipitation physics, radar meteorology, and atmospheric radiation. (Typically Offered: Spring)

MTEOR 3600: Ocean-Atmosphere Interactions

(Cross-listed with CLSCI 3600).

Credits: 3.

Prereq: MTEOR 2060

The physical interactions between the atmosphere and ocean, and their influence on weather and climate; coupled modes of climate variability and their teleconnections; air-sea feedback in the tropics and mid-latitudes. Applied topics include seasonal prediction and climate data analysis. Offered odd-numbered years. (Typically Offered: Spring)

MTEOR 3980: Cooperative Education

Credits: Required. Repeatable.

Prereq: Department Cooperative Education Coordinator Permission for Course

Required of all cooperative education students. Students must register for this course prior to commencing the work period. (Typically Offered: Fall, Spring, Summer)

MTEOR 3990: Writing for Research

Credits: 2. Contact Hours: Lecture 2.

Prereq: ENGL 2500; SPCM 2120; MTEOR 3110; MTEOR major

Principles of effective scientific writing and communication. Concepts covered are intended to be applied in MTEOR 4990: Senior Research. (Typically Offered: Spring)

MTEOR 4020: Watershed Hydrology

(Dual-listed with GEOL 5020/ ENSCI 5020/ MTEOR 5020/ NREM 5020).

(Cross-listed with ENSCI 4020/ GEOL 4020/ NREM 4020).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Examination of watersheds as systems, emphasizing the surface components of the hydrologic cycle. Combines qualitative understanding of hydrological processes and uncertainty with quantitative representation. Laboratory emphasizes field investigation and measurement of watershed processes. (Typically Offered: Fall)

MTEOR 4040: Global Change

(Dual-listed with MTEOR 5040/ AGRON 5040/ ENSCI 5040). (Cross-listed with AGRON 4040/ ENSCI 4040/ ENVS 4040/ CLSCI 4040).

Credits: 3. Contact Hours: Lecture 3.

Recent changes in global biogeochemical cycles and climate; models of future changes in the climate system; impacts of global change on agriculture, water resources and human health; ethical issues of global environmental change. (Typically Offered: Fall, Spring)

MTEOR 4050: Soil-Plant-Animal-Atmosphere Physics

(Dual-listed with AGRON 5050/ ENSCI 5050/ MTEOR 5050). (Cross-listed with ENSCI 4050/ AGRON 4050).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 1600 or MATH 1650

The movement of energy and mass among the soil, vegetation, and atmosphere. The heat and water budget of humans, other animals, plants, and plant communities. Relevance to weather and climate, the effect of climate change on organisms, and remote sensing. Some exposure to computer programming (any language) recommended. Offered odd-numbered years. (Typically Offered: Spring)

MTEOR 4060: World Climates

(Cross-listed with ENSCI 4060/ AGRON 4060).

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 2060 or MTEOR 2060

Distribution and causes of different climates around the world. Effects of climate and climate variations on human activities including society, economy and agriculture. Current issues such as climate change and international efforts to assess and mitigate the consequences of a changing climate. Semester project and in-class presentation required. Meets International Perspectives Requirement. (Typically Offered: Spring)

MTEOR 4070: Mesoscale Meteorology

(Dual-listed with MTEOR 5070/ AGRON 5070). (Cross-listed with AGRON 4070).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 1660; MTEOR 4430

Physical nature and practical consequences of mesoscale atmospheric phenomena. Mesoscale convective systems, fronts, terrain-forced circulations. Observation, analysis, and prediction of mesoscale atmospheric structure. Offered even-numbered years. (Typically Offered: Spring)

MTEOR 4080: Numerical Weather and Climate Prediction

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: MTEOR 2270 or equivalent; MTEOR 4430

Numerical solutions of the differential equations that describe weather and climate. Survey of numerical solution techniques with focus on advantages and limitations of different methods. Physical parameterizations for turbulence, clouds, and land surface processes. Forecast verification. Applications including designing and running simulations on high-performance computing systems. Offered even-numbered years. (Typically Offered: Spring)

MTEOR 4110: Synoptic Meteorology

(Dual-listed with MTEOR 5110).

Credits: 3. Contact Hours: Lecture 1, Laboratory 4.

Prereq: MTEOR 3110

Applications of atmospheric physics and dynamics to larger-scale weather systems, emphasizing forecasting of real-time weather situations. (Typically Offered: Fall)

MTEOR 4160: Hydrologic Modeling and Analysis

(Dual-listed with GEOL 5160/ ENSCI 5160/ MTEOR 5160). (Cross-listed with ENSCI 4160/ GEOL 4160).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Study of the basic principles of hydrologic modeling, including rainfall-runoff analysis, lumped and distributed modeling, conceptual and physical models, parameter estimation and sensitivity analysis, input and validation data, uncertainty analysis, and the use of models in surface water hydrology. A range of common models are applied to study hydrologic topics such as flood forecasting and land use change impacts. Previous experience with Matlab or other programming language is needed. Offered odd-numbered years. (Typically Offered: Spring)

MTEOR 4170: Mesoscale Forecasting Laboratory

Credits: 3. Contact Hours: Laboratory 6.

Prereq: Credit or concurrent enrollment in MTEOR 4110

Applications of atmospheric physics and dynamics to smaller-scale weather phenomena, emphasizing forecasting of real-time weather situations. Studies of severe weather, lake-effect snow, CSI, cold-air damming. (Typically Offered: Spring)

MTEOR 4320: Instrumentation and Measurements

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Principles of meteorological sensing and data analysis. Thermometry, barometry, hygrometry, anemometry, precipitation measurements, radiometry, radar, remote sensing, visibility, and cloud height. Calibration and measurement uncertainties. Digital signal processing. Field trip to the National Weather Service. Labs emphasize dataloggers and modern weather stations. Introductory physics and calculus 1 recommended. (Typically Offered: Spring)

MTEOR 4350: Radar Applications in Meteorology

(Dual-listed with MTEOR 5350).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or concurrent enrollment in MTEOR 3410

Fundamentals of radar meteorology with emphasis on applications. Topics presented include theory of radar, engineering principles, Doppler radar, polarimetric radar, and applications to remote sensing of clouds and precipitation. (Typically Offered: Spring)

MTEOR 4400: Tropical Meteorology

(Dual-listed with MTEOR 5400).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or concurrent enrollment in MTEOR 3410

Weather and climate of the tropical atmosphere. Weekly forecast discussions related to the development of tropical cyclones and teleconnection patterns between the tropics and higher latitudes. Topics covered include easterly waves, tropical cyclogenesis (i.e., hurricanes, typhoons, cyclones), equatorial waves, El Niño-Southern oscillation, Madden-Julian oscillation, and monsoons. Offered odd-numbered years. (Typically Offered: Fall)

MTEOR 4430: Dynamic Meteorology I

(Dual-listed with MTEOR 5430X).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MTEOR 3410

An introduction to the mathematical description and theory of atmospheric flows. Topics include coordinate systems and vectors; forces and rotating reference frames; governing equations of atmospheric motion; mass and energy conservation; force balance and stability; circulation, vorticity, and potential vorticity. (Typically Offered: Fall)

MTEOR 4520: Climate Modeling

(Dual-listed with MTEOR 5520).

Credits: 3. Contact Hours: Lecture 3.

Developing and working with climate models based on fundamental physical principles that govern the climate systems of the Earth and other planets. Emphasis on coupled, nonlinear-system interactions of physical processes such as circulation dynamics, radiative transfer, and cloud/precipitation physics, starting with fairly simple 0- and 1-dimensional analytical and numerical models based on energy, mass, and momentum conservation. Observational study of seasonally evolving weather patterns that form climates around the world. An understanding of atmospheric physics comparable to MTEOR 3010 is advantageous. Offered even-numbered years. (Typically Offered: Spring)

MTEOR 4540: Dynamic Meteorology II

(Dual-listed with MTEOR 5540).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MTEOR 4430

Planetary boundary layer, linear perturbation theory, atmospheric wave motions, baroclinic and convective instability, mesoscale circulations. (Typically Offered: Spring)

MTEOR 4600X: Atmospheric Chemistry

Credits: 3. Contact Hours: Lecture 3.

Fundamental concepts in atmospheric chemistry. Topics include: atmospheric gaseous and aerosol constituents, sources, and chemical reactions; impact of atmospheric gases and aerosols on global climate, climate change, air quality, and public health; transport of atmospheric constituents; and tropospheric and stratospheric chemistry. (Typically Offered: Spring)

MTEOR 4680: Applied Geostatistics for Geoscientists

(Dual-listed with GEOL 5680/ ENSCI 5680/ MTEOR 5680). (Cross-listed with ENSCI 4680/ GEOL 4680).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: GEOL 4520; CRP 3510; CRP 4520; (NREM 3450 or NREM 4470)

Introduction to geospatial data collection, analysis, interpretation, and presentation. Geospatial techniques including geographic information systems (GIS), remote sensing (RS), and global positioning systems (GPS). Study of applied geostatistical analysis (e.g., interpolation and spatial regression). Offered even-numbered years. (Typically Offered: Fall)

MTEOR 4890: Survey of Remote Sensing Technologies

(Dual-listed with MTEOR 5890/ EE 5890/ ENSCI 5890/ GEOL 5890/ NREM 5890). (Cross-listed with EE 4890/ ENSCI 4890/ GEOL 4890/ NREM 4890).

Credits: 3. Contact Hours: Lecture 3.

Electromagnetic-radiation principles, active and passive sensors, multispectral and hyperspectral sensors, imaging radar, SAR, thermal imaging, lidar. Examples of applications. Also offered online S. (Typically Offered: Fall)

MTEOR 4890L: Satellite Remote Sensing Laboratory

(Dual-listed with MTEOR 5890L/ EE 5890L/ GEOL 5890L/ NREM 5890L). (Cross-listed with EE 4890L/ GEOL 4890L/ NREM 4890L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Completion or concurrent enrollment in MTEOR/GEOL/NREM/ EE 4890/5890

Processing and analysis of satellite sensor data (optical and radar). Provides practical applications in an environmental context. (Typically Offered: Fall)

MTEOR 4900A: Independent Study: Synoptic Meteorology

Credits: 1-3. Repeatable, maximum of 9 credits.

Prereq: Six credits in MTEOR, Permission of Instructor

Graduation Restriction: No more than 9 credits in MTEOR 4900 may be counted toward graduation. (Typically Offered: Fall, Spring, Summer)

MTEOR 4900B: Independent Study: Dynamic Meteorology

Credits: 1-3. Repeatable, maximum of 9 credits.

Prereq: Six credits in MTEOR, Permission of Instructor

(Typically Offered: Fall, Spring, Summer)

MTEOR 4900C: Independent Study: Physical Meteorology

Credits: 1-3. Repeatable, maximum of 9 credits.

Prereq: Six credits in MTEOR, Permission of Instructor

Course will include Atmospheric Chemistry. Graduation Restriction: No more than 9 credits in MTEOR 4900 may be counted toward graduation. (Typically Offered: Fall, Spring, Summer)

MTEOR 4900D: Independent Study: Instrumentation

Credits: 1-3. Repeatable, maximum of 9 credits.

Prereq: Six credits in MTEOR, Permission of Instructor

Graduation Restriction: No more than 9 credits in MTEOR 4900 may be counted toward graduation. (Typically Offered: Fall, Spring, Summer)

MTEOR 4900E: Independent Study: Hydrology

Credits: 1-3. Repeatable, maximum of 9 credits.

Prereq: Six credits in MTEOR, Permission of Instructor

Graduation Restriction: No more than 9 credits in MTEOR 4900 may be counted toward graduation. (Typically Offered: Fall, Spring, Summer)

MTEOR 4900F: Independent Study: Climate/Atmospheric Water Cycle

Credits: 1-3. Repeatable, maximum of 9 credits.

Prereq: Six credits in MTEOR, Permission of Instructor

Graduation Restriction: No more than 9 credits in MTEOR 4900 may be counted toward graduation. (Typically Offered: Spring, Summer)

MTEOR 4900G: Independent Study: Atmosphere/Ocean Interactions

Credits: 1-3. Repeatable, maximum of 9 credits.

Prereq: Six credits in MTEOR, Permission of Instructor

Graduation Restriction: No more than 9 credits in MTEOR 4900 may be counted toward graduation.

MTEOR 4980: Cooperative Education

Credits: Required. Repeatable.

Prereq: Permission of Department Cooperative Education Coordinator; Senior classification

Required of all cooperative education students. Students must register for this course prior to commencing each work period. (Typically Offered: Fall, Spring, Summer)

MTEOR 4990: Senior Research

Credits: 2. Contact Hours: Lecture 2.

Prereq: MTEOR 3990

Required of all senior meteorology majors. Research projects in collaboration with faculty. Written and oral presentations of results at the end of the semester. (Typically Offered: Fall)

Courses primarily for graduate students, open to qualified undergraduates:

MTEOR 5020: Watershed Hydrology

(Dual-listed with GEOL 4020/ ENSCI 4020/ MTEOR 4020/ NREM 4020).

(Cross-listed with ENSCI 5020/ GEOL 5020/ NREM 5020).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Examination of watersheds as systems, emphasizing the surface components of the hydrologic cycle. Combines qualitative understanding of hydrological processes and uncertainty with quantitative representation. Laboratory emphasizes field investigation and measurement of watershed processes. (Typically Offered: Fall)

MTEOR 5040: Global Change

(Dual-listed with ENVS 4040/ MTEOR 4040/ AGRON 4040/ ENSCI 4040).

(Cross-listed with AGRON 5040/ ENSCI 5040).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Recent changes in global biogeochemical cycles and climate; models of future changes in the climate system; impacts of global change on agriculture, water resources and human health; ethical issues of global environmental change. (Typically Offered: Fall, Spring)

MTEOR 5050: Soil-Plant-Animal-Atmosphere Physics

(Dual-listed with AGRON 4050/ ENSCI 4050/ MTEOR 4050). (Cross-listed with ENSCI 5050/ AGRON 5050).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 1600 or MATH 1650 or Graduate Standing

The movement of energy and mass among the soil, vegetation, and atmosphere. The heat and water budget of humans, other animals, plants, and plant communities. Relevance to weather and climate, the effect of climate change on organisms, and remote sensing. Some exposure to computer programming (any language) recommended. Offered odd-numbered years. (Typically Offered: Spring)

MTEOR 5070: Mesoscale Meteorology

(Dual-listed with MTEOR 4070/ AGRON 4070). (Cross-listed with AGRON 5070).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 1660; MTEOR 4540 OR Graduate Classification

Physical nature and practical consequences of mesoscale atmospheric phenomena. Mesoscale convective systems, fronts, terrain-forced circulations. Observation, analysis, and prediction of mesoscale atmospheric structure. Offered even-numbered years. (Typically Offered: Spring)

MTEOR 5080X: Numerical Weather and Climate Prediction

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Numerical solutions of the differential equations that describe weather and climate. Survey of numerical solution techniques with focus on advantages and limitations of different methods. Physical parameterizations for turbulence, clouds, and land surface processes. Forecast verification. Applications including designing and running simulations on high-performance computing systems. Offered even-numbered years. (Typically Offered: Spring)

MTEOR 5110: Synoptic Meteorology

(Dual-listed with MTEOR 4110).

Credits: 3. Contact Hours: Lecture 1, Laboratory 4.

Prereq: (MTEOR 3110 and MTEOR 4540) OR Graduate Classification

Current weather forecasting and discussion. Applications of atmospheric physics and dynamics in real-time weather situations. Use of UNIDATA computer products. (Typically Offered: Fall)

MTEOR 5160: Hydrologic Modeling and Analysis

(Dual-listed with GEOL 4160/ ENSCI 4160/ MTEOR 4160). (Cross-listed with ENSCI 5160/ GEOL 5160).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Study of the basic principles of hydrologic modeling, including rainfall-runoff analysis, lumped and distributed modeling, conceptual and physical models, parameter estimation and sensitivity analysis, input and validation data, uncertainty analysis, and the use of models in surface water hydrology. A range of common models are applied to study hydrologic topics such as flood forecasting and land use change impacts. Previous experience with Matlab or other programming language is needed. Offered odd-numbered years. (Typically Offered: Spring)

MTEOR 5180: Microwave Remote Sensing

(Cross-listed with AGRON 5180/ EE 5180).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Microwave remote sensing of Earth's surface and atmosphere using satellite-based or ground-based instruments. Specific examples include remote sensing of atmospheric temperature and water vapor, precipitation, ocean salinity, and soil moisture. Offered even-numbered years. (Typically Offered: Spring)

MTEOR 5350: Radar Applications in Meteorology

(Dual-listed with MTEOR 4350).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Fundamentals of radar meteorology with emphasis on applications. Topics presented include theory of radar, engineering principles, Doppler radar, polarimetric radar, and applications to remote sensing of clouds and precipitation. (Typically Offered: Spring)

MTEOR 5400: Tropical Meteorology

(Dual-listed with MTEOR 4400).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Weather and climate of the tropical atmosphere. Weekly forecast discussions related to the development of tropical cyclones and teleconnection patterns between the tropics and higher latitudes. Topics covered include easterly waves, tropical cyclogenesis (i.e., hurricanes, typhoons, cyclones), equatorial waves, El Niño-Southern oscillation, Madden-Julian oscillation, and monsoons. Offered odd-numbered years. (Typically Offered: Fall)

MTEOR 5420: Physical Meteorology

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Basic dynamic equations, moist convection, interaction of convection with large-scale environment, parameterization of convection, and cloud-resolving models. Offered odd-numbered years. (Typically Offered: Fall)

MTEOR 5430X: Dynamic Meteorology I

(Dual-listed with MTEOR 4430).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Conservation laws, governing equations, circulation and vorticity. Development of quasi-geostrophic theory. (Typically Offered: Fall)

MTEOR 5520: Physics Of Climate

(Dual-listed with MTEOR 4520).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Developing and working with climate models based on fundamental physical principles that govern the climate systems of the Earth and other planets. Emphasis on coupled, nonlinear-system interactions of physical processes such as circulation dynamics, radiative transfer, and cloud/precipitation physics, starting with fairly simple 0- and 1-dimensional analytical and numerical models based on energy, mass, and momentum conservation. Observational study of seasonally evolving weather patterns that form climates around the world. An understanding of atmospheric physics comparable to MTEOR 3010 is advantageous. Offered even-numbered years. (Typically Offered: Spring)

MTEOR 5540: Dynamic Meteorology II

(Dual-listed with MTEOR 4540).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Planetary boundary layer, linear perturbation theory, atmospheric wave motions, baroclinic and convective instability, mesoscale circulations. (Typically Offered: Spring)

MTEOR 5680: Applied Geostatistics for Geoscientists

(Dual-listed with GEOL 4680/ ENSCI 4680/ MTEOR 4680). (Cross-listed with ENSCI 5680/ GEOL 5680).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Introduction to geospatial data collection, analysis, interpretation, and presentation. Geospatial techniques including geographic information systems (GIS), remote sensing (RS), and global positioning systems (GPS). Study of applied geostatistical analysis (e.g., interpolation and spatial regression). Offered even-numbered years. (Typically Offered: Fall)

MTEOR 5890: Survey of Remote Sensing Technologies

(Dual-listed with MTEOR 4890/ EE 4890/ ENSCI 4890/ GEOL 4890/ NREM 4890). (Cross-listed with EE 5890/ ENSCI 5890/ GEOL 5890/ NREM 5890).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Electromagnetic-radiation principles, active and passive sensors, multispectral and hyperspectral sensors, imaging radar, SAR, thermal imaging, lidar. Examples of applications. Also offered online S. (Typically Offered: Fall)

MTEOR 5890L: Satellite Remote Sensing Laboratory

(Dual-listed with MTEOR 4890L/ EE 4890L/ GEOL 4890L/ NREM 4890L). (Cross-listed with EE 5890L/ GEOL 5890L/ NREM 5890L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Processing and analysis of satellite sensor data (optical and radar). Provides practical applications in an environmental context. (Typically Offered: Fall)

MTEOR 5900A: Special Topics: Boundary-layer Meteorology

Credits: 1-3. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Topics of current interest. (Typically Offered: Fall, Spring, Summer)

MTEOR 5900B: Special Topics: Tropical Meteorology

Credits: 1-3. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Topics of current interest. (Typically Offered: Fall, Spring, Summer)

MTEOR 5900C: Special Topics: Mesoscale Meteorology

Credits: 1-3. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Topics of current interest. (Typically Offered: Fall, Spring, Summer)

MTEOR 5900D: Special Topics: Global Climate Systems

Credits: 1-3. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Topics of current interest. (Typically Offered: Fall, Spring, Summer)

MTEOR 5900E: Special Topics: Climate Modeling

Credits: 1-3. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Topics of current interest.

MTEOR 5900F: Special Topics: Numerical Weather Prediction

Credits: 1-3. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Topics of current interest. (Typically Offered: Fall, Spring, Summer)

MTEOR 5900G: Special Topics: Satellite Observations

Credits: 1-3. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Topics of current interest. (Typically Offered: Fall, Spring, Summer)

MTEOR 5900H: Special Topics: Statistical Methods in Meteorology

Credits: 1-3. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Topics of current interest. (Typically Offered: Fall, Spring, Summer)

MTEOR 5900I: Special Topics: Field Observations

Credits: 1-3. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Topics of current interest. (Typically Offered: Fall, Spring, Summer)

MTEOR 5900J: Special Topics: Low Frequency Modes

Credits: 1-3. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Topics of current interest. (Typically Offered: Fall, Spring, Summer)

MTEOR 5900K: Special Topics: Cloud Physics

Credits: 1-3. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Topics of current interest. (Typically Offered: Fall, Spring, Summer)

MTEOR 5900L: Special Topics: Atmospheric Radiation

Credits: 1-3. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Topics of current interest. (Typically Offered: Fall, Spring, Summer)

MTEOR 5900M: Special Topics: Hydrology

Credits: 1-3. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Topics of current interest. (Typically Offered: Fall, Spring, Summer)

MTEOR 5900N: Special Topics: Geophysical Fluid Dynamics

Credits: 1-3. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Topics of current interest. (Typically Offered: Fall, Spring, Summer)

MTEOR 5900O: Special Topics: Radar Meteorology

Credits: 1-3. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Topics of current interest. (Typically Offered: Fall, Spring, Summer)

MTEOR 5900P: Special Topics: Ocean Atmosphere Interactions

Credits: 1-3. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Topics include physical interactions between the atmosphere and ocean and their influence on weather and climate; coupled modes of climate variability and their teleconnections; air-sea feedbacks in the tropics and mid-latitudes. Applied topics include analysis of observations and coupled climate model data in the context of seasonal prediction.

MTEOR 5950A: Graduate Seminar: Presentation Required

(Cross-listed with GEOL 5950A).

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Weekly seminar on topics of current research interest. All students seeking a graduate degree must enroll during each semester of residence. Students pursuing a non-thesis option for the M.S. in Earth Science must enroll for one semester. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

MTEOR 5950B: Graduate Seminar: Attendance Only

(Cross-listed with GEOL 5950B).

Credits: Required. Contact Hours: Lecture 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Attendance only. Weekly seminar on topics of current research interest. All students seeking a graduate degree must enroll during each semester of residence. Students pursuing a non-thesis option for the M.S. in Earth Science must enroll for one semester. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

Courses for graduate students:**MTEOR 6050: Boundary-Layer Meteorology**

(Cross-listed with AGRON 6050).

Credits: 3. Contact Hours: Lecture 3.

Atmospheric boundary-layer structure and dynamics. Diurnal and seasonal variations, turbulent fluxes and turbulence kinetic energy. Measurements and empirical relations for wind and temperature near the ground. Numerical simulation and applications to wind energy. Offered odd-numbered years. (Typically Offered: Fall)

MTEOR 6990: Research

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

Microbiology (MICRO)

Courses primarily for undergraduates:**MICRO 1010: Microbial World**

Credits: 3. Contact Hours: Lecture 3.

Introduction to the importance of viruses, bacteria, fungi, archaea and parasites both to humans and to the biosphere. Topics include past and present microbial impact on humans and society, ecology and diversity of microbes, biotechnology and microbial impact on the biosphere. Recommended: High School Biology. (Typically Offered: Fall)

MICRO 1100: Professional and Educational Preparation in Microbiology

Credits: 1. Contact Hours: Lecture 1.

An introduction to curriculum and research opportunities in microbiology at Iowa State. Topics include: easing the transition to life as a university student, development of specific goals, strengthening interpersonal communication, professional portfolio creation and resume building. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

MICRO 1150: Phage Discovery Lab

Credits: 2.

An exploratory laboratory where students will purify phage from soil, visualize phage using electron microscopy and isolate genomic material for nucleic acid sequencing. (Typically Offered: Fall)

MICRO 1160: Phage Genome Annotation Lab

Credits: 2. Contact Hours: Laboratory 4.

An experiential microbiology laboratory where students learn to annotate and submit a complete phage genome. MICRO 1150 recommended. (Typically Offered: Spring)

MICRO 2010: Introduction to Microbiology

Credits: 2. Contact Hours: Lecture 2.

Prereq: One BIOL course except BIOL 1100, BIOL 1110, BIOL 1120, BIOL 1730, BIOL 2010, BIOL 3070

Selected topics in microbiology with emphasis on the relationship of microorganisms to human and animal health, agricultural technology, and the environment. With written petition to the chair of the supervisory committee, students who obtain a grade of B or better may substitute 2010 for MICRO 3020 in advanced courses. (Typically Offered: Fall, Spring)

MICRO 2010L: Introductory Microbiology Laboratory

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Credit or concurrent enrollment in MICRO 2010 or MICRO 3020

Basic microbiology laboratory techniques for non-microbiology majors.

Graduation Restriction: Credit for either MICRO 2010L or 3020L, but not both, may be applied toward graduation. (Typically Offered: Fall, Spring)

MICRO 2650: Predicting the Next Epidemic: Living in a One Health World

Credits: 2. Contact Hours: Lecture 2, Discussion 2.

8 week course. "One Health" concept as a relatively new approach to disease control, sustainability, and the consequences of environmental disruption. Interconnectedness of human, animal, and environmental health. Importance of scientists communicating with the general public about One Health topics, such as habitat loss, agricultural practices, and the spread of antibiotic resistant organisms. Recommended: High School Biology or Environmental Science. (Typically Offered: Fall, Spring)

MICRO 3020: Biology of Microorganisms

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or concurrent enrollment in BIOL 2110 or BIOL 2120; 3 credits of CHEM

Basic cell biology, physiology, metabolism, genetics and ecology of microorganisms, with an emphasis on prokaryotes and viruses, as well as the roles of microorganisms in the environment, disease, agriculture, and industry. (Typically Offered: Fall, Spring, Summer)

MICRO 3020L: Microbiology Laboratory

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Credit or concurrent enrollment in MICRO 2010 or MICRO 3020

Basic microbiology laboratory techniques for majors in microbiology, biological sciences and related fields. Graduation Restriction: Credit for either MICRO 2010L or 3020L, but not both, may be applied toward graduation. (Typically Offered: Fall, Spring)

MICRO 3100: Medical Microbiology

Credits: 3. Contact Hours: Lecture 3.

Prereq: MICRO 3020 (or MICRO 2010 if a B or better was obtained)

Study of infection by bacterial and viral pathogenic agents of humans with an overview of immune responses in controlling disease. (Typically Offered: Fall)

MICRO 3100L: Medical Microbiology Laboratory

Credits: 1. Contact Hours: Laboratory 3.

Prereq: (MICRO 2010 or MICRO 3020) AND (MICRO 2010L or MICRO 3020L) AND credit or concurrent enrollment in MICRO 3100

Microbiological tools and techniques to isolate, identify, and characterize medically significant microorganisms in relation to human diseases. Emphasis on the virulence factors of pathogenic organisms as compared to the normal flora. (Typically Offered: Fall)

MICRO 3200: Molecular and Cellular Bacteriology

Credits: 4. Contact Hours: Lecture 4.

Prereq: BIOL 3130; MICRO 3020; CHEM 3320

A systems perspective of bacterial growth, survival, and cellular differentiation by integrating physiological and genetic principles. Emphasis is on prokaryotes although unicellular eukaryotes are also discussed. Topics include the structure, function, and assembly of cell components, molecular and genomic techniques, bioenergetics and metabolism, regulation of gene expression, genetic adaptation, stress tolerance, biofilms, and cell-cell interactions and communications. (Typically Offered: Spring)

MICRO 3530: Introductory Parasitology

(Cross-listed with BIOL 3530/ VPTH 3530).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2120

Biology and host-parasite relationships of major groups of animal parasites, and techniques of diagnosing and studying parasites. (Typically Offered: Spring)

MICRO 3600: Global Health

(Cross-listed with GLOBE 3600/ VMPM 3600).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2110

Explores human health across the world with particular emphasis on low- and lower-middle-income countries. Attention is given to the interconnectedness of health determinants, problems, and solutions found in global health, including the role of animals and the environment. Broad in scope, highlighting different cultures and the historical foundations of global health. Topics include colonialism, poverty, emerging diseases, climate change, biodiversity, one health, maternal and child health, HIV, malaria, urbanization, noncommunicable diseases and more. Current events will be a feature of all class meetings. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

MICRO 3740: Insects and Our Health

(Cross-listed with ENT 3740).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 3 credits in Biological Sciences

Identification, biology, and significance of insects and arthropods that affect the health of humans and animals, particularly those that are vectors of disease. Meets International Perspectives Requirement. (Typically Offered: Spring)

MICRO 3740L: Insects and Our Health Laboratory

(Cross-listed with ENT 3740L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Credit or concurrent enrollment in ENT 3740 or MICRO 3740

Laboratory and field techniques for studying medical or public health entomology, including: collection, identification and maintenance of medically significant arthropods and experimental design and execution related to the biology of arthropods or arthropod-pathogen interactions. Offered even-numbered years. (Typically Offered: Spring)

MICRO 4020: Microbial Genetics and Genomics

(Dual-listed with MICRO 5020/ VMPM 5020). (Cross-listed with GEN 4020).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 3130; MICRO 3020

The fundamental concepts of bacterial and bacteriophage genetics including mutagenesis, mechanisms of vertical and horizontal genetic information transfer and gene regulation are covered, along with genetic and genomic-based approaches to study these and other cellular processes of microorganisms. Review and discussion of research literature to examine experimental design, methodology, and interpretation of both historical and contemporary relevance to microbial genetics and genomics. Offered even-numbered years. (Typically Offered: Fall)

MICRO 4070: Microbiological Safety of Foods of Animal Origins

(Dual-listed with FSHN 5070/ MICRO 5070). (Cross-listed with FSHN 4070).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MICRO 2010 or MICRO 3020

Examination of the various factors in the production of foods, from production through processing, distribution and final consumption which contribute to the overall microbiological safety of the food. Upon successful completion of this class, the student will receive both the Preventive Controls for Human Foods certificate (FDA program) and the International HACCP Alliance certificate (USDA-FSIS program). Recommended: FSHN 4200 or MICRO 4200 and one semester of Microbiology Laboratory. (Typically Offered: Fall, Spring)

MICRO 4080: Virology

Credits: 3. Contact Hours: Lecture 3.

Prereq: BBMB 3010 or BIOL 3130

The molecular virology and epidemiology of human, animal, plant and insect viruses. BIOL 3140 recommended. (Typically Offered: Fall)

MICRO 4190: Foodborne Hazards

(Cross-listed with FSHN 4190/ TOX 4190).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MICRO 2010 or MICRO 3020; 3 credits in BBMB

Pathogenesis of human microbiological foodborne infections and intoxications, principles of toxicology, major classes of toxicants in the food supply, governmental regulation of foodborne hazards. Assessed service-learning component. Offered even-numbered years. Graduation Restriction: Only one of FSHN 4190 and FSHN 5190 may count toward graduation. (Typically Offered: Spring)

MICRO 4200: Food Microbiology

(Cross-listed with FSHN 4200/ TOX 4200).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MICRO 2010 or MICRO 3020

Effects of microbial growth in foods. Methods to control, detect, and enumerate microorganisms in food and water. Foodborne infections and intoxications. (Typically Offered: Fall)

MICRO 4210: Food Microbiology Laboratory

(Cross-listed with FSHN 4210).

Credits: 3. Contact Hours: Lecture 1, Laboratory 5.

Prereq: MICRO 2010 or MICRO 3020; MICRO 2010L or MICRO 3020L. Credit or enrollment in FSHN/MICRO 4200

Standard techniques used for the microbiological examination of foods. Independent and group projects on student-generated questions in food microbiology. Emphasis on oral and written communication and group interaction. (Typically Offered: Spring)

MICRO 4280: Principles of Epidemiology and Population Health

(Dual-listed with VDPAM 5280/ VMPM 5280). (Cross-listed with VDPAM 4280/ VMPM 4280).

Credits: 3. Contact Hours: Lecture 3.

Epidemiology of disease in populations. Disease causality, observational study design and approaches to epidemiologic investigations. This course is available on campus and by distance. (Typically Offered: Spring)

MICRO 4300: Prokaryotic Diversity and Ecology

(Dual-listed with MICRO 5300). (Cross-listed with BBMB 4300).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MICRO 3020; MICRO 3020L

Survey of the diverse groups of prokaryotes emphasizing important and distinguishing metabolic, phylogenetic, morphological, and ecological features of members of those groups. Offered odd-numbered years.

(Typically Offered: Spring)

MICRO 4400: Laboratory in Microbial Physiology, Diversity, and Genetics

Credits: 4.

Prereq: MICRO 3020, MICRO 3020L, CHEM 3320, and BIOL 3130L

Fundamental techniques and theory for studying the cellular mechanisms, genetic processes and diversity of microbial life.

Experimental techniques will include isolation and physiological characterization of bacteria that inhabit different environments as well as an emphasis on genetic and molecular techniques to understand antibiotic resistance processes and mechanisms. Also included are techniques for phylogenetic characterization, measuring gene expression, and genetic manipulation of bacteria. Essential components for the effective communication of scientific results are also emphasized.

(Typically Offered: Fall, Spring)

MICRO 4500: Undergraduate Capstone Colloquium

Credits: 2. Contact Hours: Lecture 2.

Prereq: SPCM 2120; 20 credits in MICRO

Required of all undergraduate majors in microbiology. Students demonstrate mastery of core courses in microbiology through discussion of current literature in microbiology and immunology, issues in scientific conduct, and bioethics in microbiology. Students present current papers in a journal club format and gain experience in writing and reviewing grant proposals. This course is a capstone course and should be taken within the last two semesters. (Typically Offered: Spring)

MICRO 4510: Survey in Microbiology

Credits: Required. Contact Hours: Lecture 1.

Prereq: 12 credits in MICRO

Preparations for graduation. Topics include job search strategies, career information, mock interviews, graduate and professional school application processes and guidelines as well as outcomes assessment activities. (Typically Offered: Fall)

MICRO 4560: Principles of Mycology

(Cross-listed with BIOL 4560).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: 10 credits BIOL or MICRO

Morphology, diversity, and ecology of fungi; their relation to agriculture, industry, and human health. (Typically Offered: Fall)

MICRO 4750: Immunology

(Dual-listed with MICRO 5750/ VMPM 5750).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MICRO 3100

An examination of humoral and cellular immune function as well as the interaction of the cells and factors of the immune system that result in health and disease. MICRO 4750L optional. Graduation Restriction: Credit for either MICRO 4750 or VMPM 5200, but not both, may be applied to graduation. (Typically Offered: Spring)

MICRO 4750L: Immunology Laboratory

Credits: 2.

Prereq: Credits or concurrent enrollment in MICRO 3100 or MICRO 4750 or MICRO 5750

Techniques in primary culture and tumor cell growth, measures of lymphocyte function, serological techniques and flow cytometry. Half semester course. (Typically Offered: Spring)

MICRO 4770: Bacterial-Plant Interactions

(Dual-listed with MICRO 5770/ PLP 5770). (Cross-listed with PLP 4770).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 3 credits in MICRO or PLP

Overview of plant-associated bacteria including their ecology, diversity, and the physiological and molecular mechanisms involved with their interactions with plants. The course covers bacterial plant pathogens and pathogenesis, nitrogen fixation and plant symbioses, biological control and plant growth promotion, bacterial disease diagnosis and management, and approaches to the study of microbial communities in the rhizosphere and on leaves. Offered even-numbered years. (Typically Offered: Spring)

MICRO 4850: Soil and Environmental Microbiology

(Dual-listed with AGRON 5850/ ENSCI 5850/ MICRO 5850). (Cross-listed with ENSCI 4850/ AGRON 4850).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: AGRON 1820

The living organisms in the soil and what they do. Emphasis on soil biota composition, the carbon cycle and bioremediation, soil-plant-microbial relationships, and environmental issues. MICRO 2010; MICRO 2010L recommended. (Typically Offered: Fall)

MICRO 4870: Microbial Ecology

(Dual-listed with EEOB 5870/ ENSCI 5870/ GEOL 5870/ MICRO 5870).

(Cross-listed with ENSCI 4870/ GEOL 4870/ BIOL 4870).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 6 credits in Biology and 6 credits in Chemistry

Introduction to major functional groups of autotrophic and heterotrophic microorganisms and their roles in natural and environmental systems.

Consequences of microbial activity on water chemistry, weathering, and precipitation/dissolution reactions will be emphasized. (Typically Offered: Fall)

MICRO 4900A: Independent Study: Laboratory Research

Credits: 1-3. Repeatable.

Prereq: 6 credits of 3000-level credit MICRO; Permission of Instructor

Graduation Restriction: A maximum of 6 credits of MICRO 4900 may be used toward the total of 128 credits required for graduation. (Typically Offered: Fall, Summer)

MICRO 4900B: Independent Study: Literature Review

Credits: 1-3. Repeatable.

Prereq: 6 credits of 3000-level credit MICRO; Permission of Instructor

Graduation Restriction: A maximum of 6 credits of MICRO 4900 may be used toward the total of 128 credits required for graduation. (Typically Offered: Fall, Summer)

MICRO 4900C: Independent Study: Instructional Assistant

Credits: 1-3. Repeatable.

Prereq: 6 credits of 3000-level credit MICRO; Permission of Instructor

Graduation Restriction: A maximum of 6 credits of MICRO 4900 may be used toward the total of 128 credits required for graduation. (Typically Offered: Fall, Summer)

MICRO 4900G: Independent Study: General

Credits: 1-3. Repeatable.

Prereq: 6 credits of 3000-level credit MICRO; Permission of Instructor

Graduation Restriction: A maximum of 6 credits of MICRO 4900 may be used toward the total of 128 credits required for graduation. (Typically Offered: Fall, Summer)

MICRO 4900H: Independent Study: Honors

Credits: 1-5. Repeatable, maximum of 6 credits.

Prereq: 6 credits of 3000-level credit MICRO; Permission of Instructor;

Membership in the University Honors Program

Graduation Restriction: A maximum of 6 credits of MICRO 4900 may be used toward the total of 128 credits required for graduation. (Typically Offered: Fall, Spring, Summer)

MICRO 4950: Internship

Credits: 1-2. Repeatable.

Prereq: 6 credits of 3000-level credit MICRO; Permission of Instructor

Participation in the Cooperative Extension Intern Program or an equivalent work experience. Written report of activities required. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

Courses primarily for graduate students, open to qualified undergraduates:

MICRO 5020: Microbial Genetics and Genomics

(Dual-listed with MICRO 4020/ GEN 4020). (Cross-listed with VMPM 5020).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (BIOL 3130 and MICRO 3020) or Graduate Classification

The fundamental concepts of bacterial and bacteriophage genetics including mutagenesis, mechanisms of vertical and horizontal genetic information transfer and gene regulation are covered, along with genetic and genomic-based approaches to study these and other cellular processes of microorganisms. Review and discussion of research literature to examine experimental design, methodology, and interpretation of both historical and contemporary relevance to microbial genetics and genomics. Offered even-numbered years. (Typically Offered: Fall)

MICRO 5070: Microbiological Safety of Foods of Animal Origins

(Dual-listed with FSHN 4070/ MICRO 4070). (Cross-listed with FSHN 5070).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MICRO 4200 or Graduate Classification

Examination of the various factors in the production of foods, from production through processing, distribution and final consumption which contribute to the overall microbiological safety of the food. Upon successful completion of this class, the student will receive both the Preventive Controls for Human Foods certificate (FDA program) and the International HACCP Alliance certificate (USDA-FSIS program). Recommended: FSHN 4200 or MICRO 4200 and one semester of Microbiology Laboratory. (Typically Offered: Fall, Spring)

MICRO 5090: Plant Virology

(Cross-listed with PLP 5090).

Credits: 2. Contact Hours: Lecture 1, Discussion 1.

Prereq: (BBMB 3010 or BIOL 3130) or Graduate Classification

Taxonomy, molecular mechanisms, host-interactions, vector transmission, epidemiology, detection, control and exploitation of plant viruses. Course will consist of a mixture of lectures, and student-led presentations using primary literature. Offered odd-numbered years. (Typically Offered: Spring)

MICRO 5170: Gut Microbiome: Implications for Health and Diseases

(Cross-listed with ANS 5170/ FSHN 5170/ VMPM 5170).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 2-3 credits in microbiology and/or immunology.

Explore current research on gut microbiome including modern tools used to study the gut microbiome. Examine the linkages between gut microbiome and health status, diseases, and manipulation of gut microbiome to improve health. (Typically Offered: Fall)

MICRO 5250: Intestinal Microbiology

(Cross-listed with VMPM 5250).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Overview of commensal microbiota in the health and well-being of vertebrates. Topics include diversity of intestinal structure, microbial diversity/function, innate immune development, community interactions and metabolic diseases associated with alterations of the intestinal microbiome. Offered even-numbered years. (Typically Offered: Spring)

MICRO 5300: Prokaryotic Diversity and Ecology

(Dual-listed with MICRO 4300). (Cross-listed with BBMB 5300).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (MICRO 3020 and MICRO 3020L) or Graduate Classification

Survey of the diverse groups of prokaryotes emphasizing important and distinguishing metabolic, phylogenetic, morphological, and ecological features of members of those groups. Offered odd-numbered years. (Typically Offered: Spring)

MICRO 5400: Livestock Immunogenetics

(Cross-listed with ANS 5400/ VMPM 5400).

Credits: 2. Contact Hours: Lecture 2.

Prereq: ANS 5610 or MICRO 5750 or VMPM 5200 or Graduate Classification

Basic concepts and contemporary topics in genetic regulation of livestock immune response and disease resistance. Offered odd-numbered years. (Typically Offered: Spring)

MICRO 5510: Microbial Diversity and Phylogeny

Credits: 1. Contact Hours: Lecture 1.

Prereq: (BIOL 3130 and MICRO 3020) or Graduate Classification

Comparisons among the three kingdoms of life (Bacteria, Archaea, and Eukarya). Topics will include metabolism, adaptation, methods of phylogenetic analysis, and comparative genomics. (Typically Offered: Fall)

MICRO 5520: Bacterial Molecular Genetics and Physiology

Credits: 1. Contact Hours: Lecture 1.

Prereq: (BIOL 3130 and MICRO 3020) or Graduate Classification

Review of genetics and selected physiological topics of model bacteria. (Typically Offered: Fall)

MICRO 5530: Pathogenic Microorganisms

Credits: 1. Contact Hours: Lecture 1.

Prereq: (BIOL 3130 and MICRO 3020) or Graduate Classification

Review and contrast/comparison of common bacterial pathogens of plants and animals and their mechanisms of virulence, including toxins, protein secretion, host invasion and iron acquisition strategies. An overview of eukaryotic cell biology that is relevant to pathogenesis will also be included. (Typically Offered: Fall)

MICRO 5540: Virology

Credits: 1. Contact Hours: Lecture 1.

Prereq: (BIOL 3130 and MICRO 3020) or Graduate Classification

Introduction to virus life cycles including entry, gene expression strategies, replication, and mechanisms to modify and overcome host defenses. The roles of specific viruses and sub-viral agents in animal and plant disease will also be included. (Typically Offered: Spring)

MICRO 5550: Fungal Biology

Credits: 1. Contact Hours: Lecture 1.

Prereq: (GEN 3130 or GEN 3200) or Graduate Classification

Ecology, genetics, physiology and diversity of fungi, from yeasts to mushrooms, and their importance in human affairs. (Typically Offered: Spring)

MICRO 5560: Ecology of Microorganisms

Credits: 1. Contact Hours: Lecture 1.

Prereq: (BIOL 3130 and MICRO 3020) or Graduate Classification

The study of microorganisms in their natural environments, with a focus on terrestrial and aquatic ecosystems, including eukaryotic hosts; interactions within biofilms and communities, including intercellular communication and symbioses; microbial adaptations to extreme environments; and metagenomic, genomic, molecular and microscopy techniques for the study of microbes in natural systems. (Typically Offered: Spring)

MICRO 5750: Immunology

(Dual-listed with MICRO 4750). (Cross-listed with VMPM 5750).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MICRO 3100 or Graduate Classification

An examination of humoral and cellular immune function as well as the interaction of the cells and factors of the immune system that result in health and disease. MICRO 4750L optional. Graduation Restriction: Credit for either MICRO 4750 or VMPM 5200, but not both, may be applied to graduation. (Typically Offered: Spring)

MICRO 5770: Bacterial-Plant Interactions

(Dual-listed with MICRO 4770/ PLP 4770). (Cross-listed with PLP 5770).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (3 credits in MICRO or PLP) or Graduate Classification

Overview of plant-associated bacteria including their ecology, diversity, and the physiological and molecular mechanisms involved with their interactions with plants. The course covers bacterial plant pathogens and pathogenesis, nitrogen fixation and plant symbioses, biological control and plant growth promotion, bacterial disease diagnosis and management, and approaches to the study of microbial communities in the rhizosphere and on leaves. Offered even-numbered years. (Typically Offered: Spring)

MICRO 5850: Soil and Environmental Microbiology

(Dual-listed with AGRON 4850/ ENSCI 4850/ MICRO 4850). (Cross-listed with ENSCI 5850/ AGRON 5850).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: AGRON 1820 or graduate standing

The living organisms in the soil and what they do. Emphasis on soil biota composition, the carbon cycle and bioremediation, soil-plant-microbial relationships, and environmental issues. MICRO 2010; MICRO 2010L recommended. (Typically Offered: Fall)

MICRO 5860: Medical Bacteriology

(Cross-listed with VMPP 5860).

Credits: 4. Contact Hours: Lecture 4.

Prereq: MICRO 3100 or Graduate Classification

Bacteria associated with diseases of vertebrates, including virulence factors and interaction of host responses. Concurrent students need to register for 5860L. (Typically Offered: Fall)

MICRO 5870: Microbial Ecology

(Dual-listed with BIOL 4870/ ENSCI 4870/ GEOL 4870/ MICRO 4870).

(Cross-listed with ENSCI 5870/ GEOL 5870/ EEOB 5870).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to major functional groups of autotrophic and heterotrophic microorganisms and their roles in natural and environmental systems. Consequences of microbial activity on water chemistry, weathering, and precipitation/dissolution reactions will be emphasized. (Typically Offered: Fall)

MICRO 5900: Special Topics

Credits: 1-5. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

Courses for graduate students:

MICRO 6040: Seminar

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Course will expose students to the breadth of subdisciplines within microbiology, offer opportunities for direct interaction between the students and the faculty members within the Interdepartmental Microbiology Graduate Program, and promote interactions among the students within the program. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

MICRO 6080: Molecular Virology

(Cross-listed with VMPP 6080/ PLP 6080).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BBMB 4050 or GDCB 5110

Advanced study of virus host-cell interactions. Molecular mechanisms of viral replication and pathogenesis. Offered even-numbered years. (Typically Offered: Fall)

MICRO 6150: Molecular Immunology

(Cross-listed with BBMB 6150/ VMPP 6150).

Credits: 3. Contact Hours: Lecture 3.

Current topics in molecular aspects of immunology: T and B cell receptors; major histocompatibility complex; antibody structure; immunosuppressive drugs and viruses; and intracellular signaling pathways leading to expression of genes that control and activate immune function. Offered odd-numbered years. (Typically Offered: Fall)

MICRO 6250: Mechanisms of Bacterial Pathogenesis

(Cross-listed with VMPP 6250).

Credits: 3. Contact Hours: Lecture 3.

Review of current concepts in specific areas of microbial pathogenesis including the genetic basis for bacterial disease, genetic regulation and control of virulence factors and their mechanisms of action, and host-pathogen interactions at the cellular and molecular levels. The application of microbial genetics to understanding pathogenesis will be included. Offered odd-numbered years. (Typically Offered: Spring)

MICRO 6260: Advanced Food Microbiology

(Cross-listed with FSHN 6260/ TOX 6260).

Credits: 3. Contact Hours: Lecture 3.

Prereq: FSHN 4200 or FSHN 4210 or FSHN 5040

Topics of current interest in food microbiology, including new foodborne pathogens, rapid identification methods, effect of food properties and new preservation techniques on microbial growth, and mode of action of antimicrobials. Offered odd-numbered years. (Typically Offered: Spring)

MICRO 6900A: Current Topics: Microbiology

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Instructor Permission for Course

Colloquia or advanced study of specific topics in a specialized field.

(Typically Offered: Fall, Spring, Summer)

MICRO 6900B: Current Topics: Immunology

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Colloquia or advanced study of specific topics in a specialized field.

(Typically Offered: Fall, Spring, Summer)

MICRO 6900C: Current Topics: Infectious Diseases

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Colloquia or advanced study of specific topics in a specialized field.

(Typically Offered: Fall, Spring, Summer)

MICRO 6920: Molecular Biology of Plant-Pathogen Interactions

(Cross-listed with PLP 6920).

Credits: 3. Contact Hours: Lecture 3.

Seminar and current research in molecular and physiological aspects of plant interactions with pathogens, including mechanisms of pathogenesis, host-pathogen recognition and host defense, with an emphasis on critical evaluation of primary literature. Students also complete a research proposal writing and peer review exercise. Offered odd-numbered years. (Typically Offered: Spring)

MICRO 6970: Graduate Research Rotation

Credits: 1-30. Contact Hours: Laboratory 30.

Repeatable.

Graduate research projects performed under the supervision of selected faculty members in the Interdepartmental Microbiology major. (Typically Offered: Fall, Spring)

MICRO 6980: Seminar in Molecular, Cellular, and Developmental Biology

(Cross-listed with BBMB 6980/ GDCB 6980/ MCDB 6980/ VMPM 6980).

Credits: 1-2. Contact Hours: Lecture 2.

Repeatable.

Student and faculty presentations. (Typically Offered: Spring)

MICRO 6990: Research

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Military Science (MS)

Courses primarily for undergraduates:

MS 1010: Introduction to Military Science

Credits: 1. Contact Hours: Lecture 1.

Prereq: Concurrent enrollment in MS 1010L required

Examines the role of a Cadet in the Army Reserve Officer Training Corps and a Lieutenant in the United States Army. The course explores a military culture whose ultimate success is determined by the character and proficiency of its' leaders. Instruction introduces students to the cultural heritage and history of the U.S. Army. Students will begin to understand the structure of the U.S. Army and how it functions as an organization and institution. The curriculum promotes the development of students' communication skills to enhance their ability to transmit ideas. The class examines how the Army's cultural values drive the development of leadership in the Officer Corps. Hands-on activities enable students to gain insight on the skills and abilities required of cadets and officers interacting with civilians and soldiers. (Typically Offered: Fall)

MS 1010L: Basic Leadership Laboratory I

Credits: 1. Contact Hours: Laboratory 2.

Prereq: Concurrent enrollment in MS 1010 required

Uses basic military training, missions and scenarios to provide a hands-on method of developing confidence and leadership skills. Students observe and participate in the rotation through various levels of leadership positions at the platoon and squad level within the Army command structure. This concept provides a constant learning environment as they learn to communicate effectively and work as a team while assigned to positions at various levels within the organization. Marching, rifle firing, and tactical patrolling; students gain confidence through rappelling and construction/use of rope bridges; and increase professional knowledge in areas such as first aid, water survival, personal physical fitness, and land navigation. Teaching locations include the ISU Armory, Camp Dodge (National Guard Facility), Pammel Woods (ISU campus), and ISU fitness centers. Full participation in all events will be determined based on students' physical and medical eligibility. (Typically Offered: Fall)

MS 1020: Structure and Function of the U.S. Army

Credits: 1. Contact Hours: Lecture 1.

Prereq: Concurrent enrollment in MS 1020L required

Instructs students on the fundamental skills and proficiencies required of Cadets in the Army Reserve Officer Training Corps and Officers in the United States Army. Allows students to explore the Army culture whose ultimate success is determined by the character and proficiency of its' leaders. Students will gain an insight to the effects of human behavior and communication on the function of the Army's basic unit structures. Special focus is given to the emphasis the Army puts on the development and character of the leader and how that affects the culture and operation of the Army as an institution. Students will develop an understanding of the role that morals and ethics play in becoming an Army Officer and leading American Soldiers. Introduction to basic officer/soldier skills will elucidate the complex role of the Officer in the modern Army. (Typically Offered: Spring)

MS 1020L: Basic Leadership Laboratory II

Credits: 1. Contact Hours: Laboratory 2.

Prereq: Concurrent enrollment in MS 1020 required

Uses basic military training, missions and scenarios to provide a hands-on method of developing confidence and leadership skills. Rotation through various levels of leadership positions at the platoon and squad level within the Army command structure. Provides a constant learning environment as they learn to communicate effectively and work as a team while assigned to positions at various levels within the organization. Students also learn various military tasks such as marching, rifle firing, and tactical patrolling; gain confidence through rappelling and construction/use of rope bridges; and increase professional knowledge in areas such as first aid, water survival, personal physical fitness, and land navigation. Teaching locations include the ISU Armory, Camp Dodge (National Guard Facility), Pammel Woods (ISU campus), and ISU fitness centers. Full participation in all events will be determined based on students' physical and medical eligibility. (Typically Offered: Spring)

MS 1500: Army Physical Readiness

Credits: 1. Contact Hours: Laboratory 3.

Repeatable.

This lab is designed to use basic military skills and instruction to develop confidence, leadership, and physical fitness. The team approach is utilized in the instruction and application of Army physical fitness requirements. Students will learn various Army physical fitness techniques as well as how to conduct physical fitness sessions. Teaching locations include Lied Recreation Center, Beyer Hall, State Gym as well as around campus. Full participation in all events will be determined based on students' physical and medical eligibility. (Typically Offered: Fall, Spring)

MS 2010: Principles of Leadership and Communication Skills

Credits: 2. Contact Hours: Lecture 2.

Prereq: Concurrent enrollment in MS 2010L required

Explores the development of leadership and communication skills by understanding and studying the principles, traits, and dynamics of leadership and effective communication techniques. These include; leadership dimensions, human behavior, time management skills, stress management, values and ethics, decision making process, problem solving skills, team building exercises, communication techniques, briefing skills, delegating, nutrition, fitness, and counseling. Leadership assessment programs, role playing, active class participation, speeches, country briefs, and video clips are used to enhance and reinforce the instruction. (Typically Offered: Fall)

MS 2010L: Basic Leadership Laboratory III

Credits: 1. Contact Hours: Laboratory 2.

Prereq: Concurrent enrollment in MS 2010 required

Uses basic military training, missions and scenarios to provide a hands-on method of developing confidence and leadership skills. Students observe and participate in the rotation through various levels of leadership positions at the platoon and squad level within the Army command structure. Learn to communicate effectively and work as a team while assigned to positions at various levels within the organization. Students also learn various military tasks such as marching, rifle firing, and tactical patrolling; gain confidence through rappelling and construction/use of rope bridges; and increase professional knowledge in areas such as first aid, water survival, personal physical fitness, and land navigation. Teaching locations include the ISU Armory, Camp Dodge (National Guard Facility), Pammel Woods (ISU campus), and ISU fitness centers. Full participation in all events will be determined based on students' physical and medical eligibility. (Typically Offered: Fall)

MS 2020: Map Reading and Land Navigation

Credits: 2. Contact Hours: Lecture 2.

Prereq: Concurrent enrollment in MS 2020L required

Class focuses on the characteristics and features of the earth's land mass and how to apply different methods of conducting navigation on land. These methods include; by use of topographical maps, compasses, aerial photographs, military maps, symbols, and all their practical application. These navigation techniques are used in class in conjunction with patrolling techniques and squad movement exercises. Students will utilize verbal and non-verbal communication, communication techniques, and briefing techniques during this class. Students are also assigned to read one professional book from the Army Reading List and complete a written review of the book in the Army writing style. (Typically Offered: Spring)

MS 2020L: Basic Leadership Laboratory IV

Credits: 1. Contact Hours: Laboratory 2.

Prereq: Concurrent enrollment in MS 2020 required

Uses basic military training, missions and scenarios to provide a hands-on method of developing confidence and leadership skills. Students observe and participate in the rotation through various levels of leadership positions at the platoon and squad level within the Army command structure. Learn to communicate effectively and work as a team while assigned to positions at various levels within the organization. Students also learn various military tasks such as marching, rifle firing, and tactical patrolling; gain confidence through rappelling and construction/use of rope bridges; and increase professional knowledge in areas such as first aid, water survival, personal physical fitness, and land navigation. Teaching locations include the ISU Armory, Camp Dodge (National Guard Facility), Pammel Woods (ISU campus), and ISU fitness centers. Full participation in all events will be determined based on students' physical and medical eligibility. (Typically Offered: Spring)

MS 2500: Advanced Army Physical Readiness I

Credits: 2. Contact Hours: Laboratory 5.

Prereq: MS 1500

Students learn to plan and conduct physical fitness sessions, following Army physical fitness readiness requirements. Development of physical fitness plan and leadership of training sessions. Participation determined by students' physical and medical eligibility. Course for contracted AROTC cadets. (Typically Offered: Fall)

MS 2510: Advanced Army Physical Readiness II

Credits: 2. Contact Hours: Laboratory 5.

Prereq: MS 1500; MS 2500

Students learn to plan and conduct physical fitness sessions, following Army physical fitness readiness requirements. Development of physical fitness plan, and leadership of training sessions. Participation determined by students' physical and medical eligibility. (Typically Offered: Spring)

MS 2900: Independent Study: Basic Military Study

Credits: 1-3. Repeatable, maximum of 12 credits.

Investigation of an approved topic. Must result in a professional journal-worthy paper on ethics, current military issues, interpersonal communications, or leadership development. (Typically Offered: Fall, Spring, Summer)

MS 3010: Methods of Instructing Military Skills

Credits: 3. Contact Hours: Lecture 3.

Prereq: Concurrent enrollment in MS 3010L

Develops student's proficiency in analyzing, planning, and executing complex operations within a military organizational structure. Students are given situational opportunities and then measured on their leadership abilities through systematic feedback. Student's evaluations are based on sixteen leadership dimensions within the realms of values, attributes, skills, and actions. Students develop an understanding of human cultural heritage and history, as it pertains to the armed forces. Completion of the basic Military Science program required. (Typically Offered: Fall)

MS 3010L: Advanced Leadership Laboratory I

Credits: 1. Contact Hours: Laboratory 4.

Prereq: Concurrent enrollment in MS 3010

The lab compliments MS 3010 by providing opportunities to practice the lessons from class. On-the-job training and evaluation provided by the ROTC cadre. Developing training programs, structuring laboratories, presenting classes, planning various events, and accepting responsibility for the leadership labs. Participating in the Water Survival test, Army Physical Fitness test and the Land Navigation test are required. Completion of the basic Military Science program required. (Typically Offered: Fall)

MS 3020: Applied Leadership

Credits: 3. Contact Hours: Lecture 3.

Prereq: Concurrent enrollment in MS 3020L

Prepares students to attend the Leadership Develop and Assessment Course at Fort Knox, Kentucky in which they will be assigned specific and situational tasks to accomplish by providing purpose, motivation, and direction to fellow students across the nation. Students will learn how to identify sixteen leadership dimensions in the under classmen and provide specific feedback on their leadership behaviors. Students will develop their oral communication skills about the plans developed by the class, through small group presentation settings. Students will develop methods of studying human behavior. Completion of the basic Military Science program required. (Typically Offered: Fall)

MS 3020L: Advanced Leadership Laboratory II

Credits: 1. Contact Hours: Laboratory 4.

Prereq: Concurrent enrollment in MS 3020

The lab compliments MS 3020 by providing opportunities to practice the lessons from class. On-the-job training and evaluation provided by the ROTC cadre. Developing training programs, structuring laboratories, presenting classes, planning various events, and accepting responsibility for the leadership labs. Participating in the Water Survival Test, Army Physical Fitness Test and the Land Navigation test required. Completion of the basic Military Science program required. (Typically Offered: Spring)

MS 4010: Seminar: The Military Team

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or Concurrent enrollment in MS 4010L

Develops student proficiency in analyzing and evaluating leadership behaviors, such as values, attributes, skills, and actions. Students are given situational opportunities to assess leadership and provide feedback to other students placed in leadership roles. Students will be measured by their ability to both give and receive systematic and specific feedback on leadership behaviors. Students will develop their ability to communicate thoughts and ideas orally through small group presentations and group discussions. Students will supervise and evaluate the planning and execution of complex operations within a military organizational structure. Completion of the basic Military Science program required. (Typically Offered: Fall)

MS 4010L: Advanced Leadership Laboratory III

Credits: 1. Contact Hours: Laboratory 4.

Prereq: Concurrent enrollment in MS 4010

The lab compliments the instruction from class by demonstrating the indelible link between personal values and successful leadership. On-the-job training and evaluation provided by the ROTC cadre. Developing training programs, structuring laboratories, presenting classes, planning various events, and accepting responsibility for the leadership labs. Completion of the basic Military Science program required. (Typically Offered: Fall)

MS 4020: Seminar: The Professional Military Officer

Credits: 3. Contact Hours: Lecture 3.

Prereq: Concurrent enrollment in MS 4020L

Explores the dynamics of leading in the complex situations of current military operations in a contemporary world. Students will examine the differences in customs, courtesies and operational principles in the face of international terrorism. Students will also explore aspects of interaction with nongovernmental organizations, civilians and media in a war zone and foreign national governments. The course uses case studies, scenarios, and practical exercises, which prepare the student to face complex ethical and practical demands of leading soldiers within a multifaceted military organizational structure. Completion of the basic Military Science program required. (Typically Offered: Spring)

MS 4020L: Advanced Leadership Laboratory IV

Credits: 1. Contact Hours: Laboratory 4.

Prereq: Concurrent enrollment in MS 4020

The lab compliments the instruction from class by demonstrating the indelible link between personal values and successful leadership. On-the-job training and evaluation provided by the ROTC cadre. Developing training programs, structuring laboratories, presenting classes, planning various events, and accepting responsibility for the leadership labs. Completion of the basic Military Science program required. (Typically Offered: Spring)

MS 4900: Independent Study: Advanced Military Study

Credits: 1-3. Repeatable, maximum of 4 credits.

Prereq: MS 3010, MS 3020, MS 4010 and MS 4020 and permission of the Chair of the Military Science Department

Investigation of an approved topic. Must result in a professional journal-worthy paper on ethics, current military issues, interpersonal communications, or leadership development. (Typically Offered: Fall, Spring, Summer)

Molecular, Cellular and Developmental Biology (MCDB)

Courses primarily for graduate students, open to qualified undergraduates:

MCDB 5110: Advanced Molecular Genetics

(Cross-listed with GDCB 5110).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Mechanisms of molecular genetic processes in eukaryotes and prokaryotes, including DNA replication and repair, transcription, translation and regulation of gene expression. Critical evaluation and discussion of current primary literature, methodologies and experimental data. (Typically Offered: Spring)

MCDB 5280: Advances in Molecular Cell Biology

(Cross-listed with GDCB 5280).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Cell biological processes including cell signaling, cell division, intracellular trafficking, biogenesis of organelles, cell adhesion and motility. Offered even-numbered years. (Typically Offered: Fall)

MCDB 5330: Advances in Developmental Biology

(Cross-listed with GDCB 5330).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Fundamental principles in multicellular development. Emphasis on cellular and molecular regulation of developmental processes, and experimental approaches as illustrated in the current literature. Offered odd-numbered years. (Typically Offered: Fall)

MCDB 5450: Plant Molecular, Cell and Developmental Biology

(Cross-listed with GDCB 5450/ PLBIO 5450).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Plant nuclear and organelle genomes; regulation of gene expression; hormone signaling; organization, function, and development of plant cells and subcellular structures; regulation of plant growth and development. Offered odd-numbered years. (Typically Offered: Fall)

MCDB 5900: Special Topics

Credits: 1-30. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Courses for graduate students:**MCDB 6970: Graduate Research Rotation**

Credits: 1-6. Repeatable.

Graduate research projects performed under the supervision of selected faculty members in the molecular, cellular, and developmental biology program. (Typically Offered: Fall, Spring)

MCDB 6980: Seminar in Molecular, Cellular, and Developmental Biology

(Cross-listed with BBMB 6980/ GDCB 6980/ MICRO 6980/ VMPPM 6980).

Credits: 1-2. Contact Hours: Lecture 2.

Repeatable.

Student and faculty presentations. (Typically Offered: Spring)

MCDB 6990: Research

Credits: 1-30. Repeatable.

Prereq: Department Permission for Course

Music (MUSIC)

Courses primarily for undergraduates:**MUSIC 1010: Fundamentals of Music**

Credits: 2.

Notation, recognition, execution and analysis of scales, intervals, triads, and rhythm; key signatures; time signatures; transposition. Open to non-majors only. Ability to read elementary musical notation required. (Typically Offered: Fall, Spring)

MUSIC 1020: Introduction to Music Listening

Credits: 3. Contact Hours: Lecture 3.

Expansion of the music listening experiences for the general student through greater awareness of differences in techniques of listening, performance media, and materials of the art. The course focuses on the elements of music: rhythm, melody, harmony, form, and style, and how these elements are used in musics of different cultures and time periods. Ability to read or perform music not required. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

MUSIC 1050: Basic Musicianship

Credits: 3. Contact Hours: Lecture 1, Laboratory 4.

Prereq: Performing Arts major or Permission of Instructor

Beginning keyboard techniques, sight-reading, and ear training. Basic materials of music: notation, scales, intervals, key signatures, time signatures, rhythm, and harmony. (Typically Offered: Fall, Spring)

MUSIC 1110: Wind Ensemble

Credits: 1. Contact Hours: Laboratory 3.

Repeatable.

Emphasis on significant extended compositions for wind and percussion instruments. Performances include formal concerts on campus and the annual tour. Open to all students by audition. (Typically Offered: Fall, Spring)

MUSIC 1120: Concert Band

Credits: 1. Contact Hours: Laboratory 2.

Repeatable.

Repertoire includes the broad spectrum of band music. Two concerts are presented each semester. Open to students who have performed on a wind or percussion instrument in high school band or orchestra. (Typically Offered: Fall, Spring)

MUSIC 1130: Jazz Ensemble

Credits: 1. Contact Hours: Laboratory 2.

Repeatable.

Designed to explore various styles and trends in contemporary jazz. Open to all students by audition. (Typically Offered: Fall, Spring)

MUSIC 1140A: Marching and Pep Bands: Marching Band

Credits: 1. Contact Hours: Laboratory 5.

Repeatable.

Membership determined by audition and band application. Auditions held for woodwind, brass, percussion, flag, and twirler positions. Presentation of pre-game and half time shows at each home football game; additional performances are also scheduled on and off campus. Audition information is listed on the band website (www.cyclonemarchingband.iastate.edu). Students may not be concurrently enrolled in MUSIC 1140A and 1140C. (Typically Offered: Fall)

MUSIC 1140B: Marching and Pep Bands: Pep Band

Credits: 1. Contact Hours: Laboratory 5.

Repeatable.

Performances at basketball games. Students selected by audition from members of MUSIC 1140A. (Typically Offered: Fall)

MUSIC 1140C: Marching and Pep Bands: Pep Band for Wrestling and Soccer

Credits: 1. Contact Hours: Laboratory 5.

Repeatable.

Performances at wrestling and women's soccer games. Audition required.

Graduation Restriction: Students may not be concurrently enrolled in MUSIC 1140A and 1140C. (Typically Offered: Fall)

MUSIC 1150: Symphonic Band

Credits: 1. Contact Hours: Laboratory 3.

Repeatable.

Stresses high quality wind literature. Performances include formal concerts on campus. Open to all students by audition. (Typically Offered: Fall, Spring)

MUSIC 1180A: Applied Music: Non-majors: Voice

Credits: 1-2. Contact Hours: Studio 2.

Repeatable.

Prereq: Instructor Permission for Course

(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Audition required. Graduation Restriction: Will not satisfy applied music requirements for music majors. (Typically Offered: Fall, Spring)

MUSIC 1180B: Applied Music: Non-majors: Piano

Credits: 1-2. Contact Hours: Studio 2.

Repeatable.

Prereq: Instructor Permission for Course

(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Audition required. Graduation Restriction: Will not satisfy applied music requirements for music majors. (Typically Offered: Fall, Spring)

MUSIC 1180C: Applied Music: Non-majors: Organ

Credits: 1-2. Contact Hours: Studio 2.

Repeatable.

Prereq: Instructor Permission for Course

(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors. Audition required. (Typically Offered: Fall, Spring)

MUSIC 1180D: Applied Music: Non-majors: Strings

Credits: 1-2. Contact Hours: Studio 2.

Repeatable.

Prereq: Instructor Permission for Course

(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors. Audition required. (Typically Offered: Fall, Spring)

MUSIC 1180E: Applied Music: Non-majors: Carillon

Credits: 1-2. Contact Hours: Studio 2.

Repeatable.

Prereq: Instructor Permission for Course

(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors. Audition required. (Typically Offered: Fall, Spring)

MUSIC 1180F: Applied Music: Non-majors: Woodwinds

Credits: 1-2. Contact Hours: Studio 2.

Repeatable.

Prereq: Instructor Permission for Course

(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors. Audition required. (Typically Offered: Fall, Spring)

MUSIC 1180G: Applied Music: Non-majors: Brass

Credits: 1-2. Contact Hours: Studio 2.

Repeatable.

Prereq: Instructor Permission for Course

(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Audition required. Graduation Restriction: Will not satisfy applied music requirements for music majors. (Typically Offered: Fall, Spring)

MUSIC 1180I: Applied Music: Non-majors: Percussion

Credits: 1-2. Contact Hours: Studio 2.

Repeatable.

Prereq: Instructor Permission for Course

(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Audition required. Graduation Restriction: Will not satisfy applied music requirements for music majors. (Typically Offered: Fall, Spring)

MUSIC 1180K: Applied Music: Non-majors: Harpsichord

Credits: 1-2. Contact Hours: Studio 2.

Repeatable.

Prereq: Instructor Permission for Course

(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Audition required. Graduation Restriction: Will not satisfy applied music requirements for music majors. (Typically Offered: Fall, Spring)

MUSIC 1190A: Applied Music for Majors: Voice

Credits: 2-3. Contact Hours: Studio 2.

Repeatable.

Prereq: MUSIC major OR Permission of instructor.

(1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required. Audition required. (Typically Offered: Fall, Spring)

MUSIC 1190B: Applied Music for Majors: Piano

Credits: 2-3. Contact Hours: Studio 2.

Repeatable.

Prereq: MUSIC major OR Permission of instructor.

(1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required. Audition required. (Typically Offered: Fall, Spring)

MUSIC 1190C: Applied Music for Majors: Organ

Credits: 2-3. Contact Hours: Studio 2.

Repeatable.

Prereq: MUSIC major OR Permission of instructor.

(1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required. Audition required. (Typically Offered: Fall, Spring)

MUSIC 1190D: Applied Music for Majors: Strings

Credits: 2-3. Contact Hours: Studio 2.

Repeatable.

Prereq: MUSIC major OR Permission of instructor.

(1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required. Audition required. (Typically Offered: Fall, Spring)

MUSIC 1190E: Applied Music for Majors: Carillon

Credits: 2-3. Contact Hours: Studio 2.

Repeatable.

Prereq: MUSIC major OR Permission of instructor.

(1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required. Audition required. (Typically Offered: Fall, Spring)

MUSIC 1190F: Applied Music for Majors: Woodwinds

Credits: 2-3. Contact Hours: Studio 2.

Repeatable.

Prereq: MUSIC major OR Permission of instructor.

(1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required. Audition required. (Typically Offered: Fall, Spring)

MUSIC 1190G: Applied Music for Majors: Brass

Credits: 2-3. Contact Hours: Studio 2.

Repeatable.

Prereq: MUSIC major OR Permission of instructor.

(1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required. Audition required. (Typically Offered: Fall, Spring)

MUSIC 1190I: Applied Music for Majors: Percussion

Credits: 2-3. Contact Hours: Studio 2.

Repeatable.

Prereq: MUSIC major OR Permission of instructor.

(1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required. Audition required. (Typically Offered: Fall, Spring)

MUSIC 1190K: Applied Music for Majors: Harpsichord

Credits: 1-3. Contact Hours: Studio 2.

Repeatable.

Prereq: MUSIC major OR Permission of instructor.

(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required. Audition required. (Typically Offered: Fall, Spring)

MUSIC 1200: Introduction to Music Literature and Styles

Credits: 3. Contact Hours: Lecture 3.

Directed studies via aural analysis for music majors with emphasis on the materials of music, form and aesthetic issues. Introduction to style and literature of the major performance media in context of historical chronology. Fundamentals of score reading and performance terminology. Graduation Restriction: Only one of MUSIC 1200 and 3020 can count toward graduation. (Typically Offered: Spring)

MUSIC 1250: Class Voice

Credits: 1. Contact Hours: Laboratory 2.

Repeatable, maximum of 8 credits.

Individual voice study in a communal master class setting designed to introduce collegiate level singing to Performing Arts majors and non-music (voice) majors. (Typically Offered: Fall, Spring)

MUSIC 1270: Class Study in Piano I

Credits: 1. Contact Hours: Laboratory 2.

Prereq: MUSIC major or Permission of Instructor

Beginning keyboard technique, transposition, harmonization, ensemble and solo repertory, and sight-reading skills. (Typically Offered: Fall, Spring)

MUSIC 1280: Class Study in Piano II

Credits: 1. Contact Hours: Laboratory 2.

Continuation of beginning keyboard technique, transposition, harmonization, ensemble and solo repertoire, and sight-reading skills. (Typically Offered: Fall, Spring)

MUSIC 1410: Lyrica Ensemble

Credits: 1. Contact Hours: Laboratory 2.

Repeatable.

Large chorus; emphasis on wide variety of literature and singing sounds from around the world. Includes fundamental voice and choral skills.

Campus concerts each semester. Open to all treble voice students by audition. (Typically Offered: Fall, Spring)

MUSIC 1510A: University Chorus: Cantamus Women's Choir

Credits: 1. Contact Hours: Laboratory 3.

Repeatable.

Large chorus; emphasis on adventurous, contemporary programming. Advanced skills required. Campus concerts each semester, some in conjunction with orchestra. Open to all treble voice students by audition. (Typically Offered: Fall, Spring)

MUSIC 1510B: University Chorus: Statesmen Men's Choir

Credits: 1. Contact Hours: Laboratory 3.

Repeatable.

Advanced skills required, high quality literature. Campus concerts each semester, some concerts in conjunction with orchestras. Men's and women's choirs separately and in combination. Open to all students by audition. (Typically Offered: Fall, Spring)

MUSIC 1610: Iowa State Singers

Credits: 1. Contact Hours: Laboratory 5.

Repeatable.

Concert choir specializing in performance of advanced music literature, Renaissance through contemporary. Campus concerts, annual spring tour. Open to all students by audition. (Typically Offered: Fall, Spring)

MUSIC 1810: Symphony Orchestra

Credits: 1. Contact Hours: Laboratory 4.

Repeatable.

Reading, preparation, and performance of standard repertoire. Five or six concerts annually plus occasional off-campus appearances. Open to all students by audition. (Typically Offered: Fall, Spring)

MUSIC 2190A: Applied Music: Majors: Voice

Credits: 2-3. Contact Hours: Studio 2.

Repeatable.

Prereq: MUSIC major OR Permission of instructor.

(1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required. Audition required. (Typically Offered: Fall, Spring)

MUSIC 2190B: Applied Music: Majors: Piano

Credits: 1-3. Contact Hours: Studio 2.

Repeatable.

Prereq: MUSIC major OR Permission of instructor.

(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required. Audition required. (Typically Offered: Fall, Spring)

MUSIC 2190C: Applied Music: Majors: Organ

Credits: 1-3. Contact Hours: Studio 2.

Repeatable.

Prereq: MUSIC major OR Permission of instructor.

(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required. Audition required. (Typically Offered: Fall, Spring)

MUSIC 2190D: Applied Music: Majors: Strings

Credits: 2-3. Contact Hours: Studio 2.

Repeatable.

Prereq: MUSIC major OR Permission of instructor.

(1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required. Audition required. (Typically Offered: Fall, Spring)

MUSIC 2190E: Applied Music: Majors: Carillon

Credits: 1-3. Contact Hours: Studio 2.

Repeatable.

Prereq: MUSIC major OR Permission of instructor.

(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required. Audition required. (Typically Offered: Fall, Spring)

MUSIC 2190F: Applied Music: Majors: Woodwinds

Credits: 2-3. Contact Hours: Studio 2.

Repeatable.

Prereq: MUSIC major OR Permission of instructor.

(1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required. Audition required. (Typically Offered: Fall, Spring)

MUSIC 2190G: Applied Music: Majors: Brass

Credits: 2-3. Contact Hours: Studio 2.

Repeatable.

Prereq: MUSIC major OR Permission of instructor.

(1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required. Audition required. (Typically Offered: Fall, Spring)

MUSIC 2190I: Applied Music: Majors: Percussion

Credits: 2-3. Contact Hours: Studio 2.

Repeatable.

Prereq: MUSIC major OR Permission of instructor.

(1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required. Audition required. (Typically Offered: Fall, Spring)

MUSIC 2190K: Applied Music: Majors: Harpsichord

Credits: 1-3. Contact Hours: Studio 2.

Repeatable.

Prereq: MUSIC major OR Permission of instructor.

(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required. Audition required. (Typically Offered: Fall, Spring)

MUSIC 2240: Music Theory I

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: MUSIC major or Permission of Instructor

Introduction to voice-leading principles. Application of diatonic harmony in analysis and four-part writing. Introduction to notation software and other technologies used in the study of music. Specific section recommendation will be made to students based on results of diagnostic exam. (Typically Offered: Fall)

MUSIC 2250: Aural Theory I

Credits: 1. Contact Hours: Laboratory 2.

Prereq: (MUSIC major AND credit or concurrent enrollment in MUSIC 2240) or Permission of Instructor

Aural discrimination of intervals, rhythms and patterns, as demonstrated by proficiency in ear training, sight singing, and related musicianship skills. (Typically Offered: Fall)

MUSIC 2270: Class Study in Piano III

Credits: 1. Contact Hours: Laboratory 2.

Prereq: MUSIC 1280 or Permission of Instructor

Intermediate keyboard technique, transposition, harmonization, improvisation, repertory, and sight-reading skills. Introduction to score reading, hymn playing, and accompanying at the piano. (Typically Offered: Fall, Spring)

MUSIC 2280: Class Study in Piano IV

Credits: 1. Contact Hours: Laboratory 2.

Continuation of intermediate keyboard technique, transposition, harmonization, improvisation, repertory, score reading, hymn playing, and accompanying at the piano. (Typically Offered: Fall, Spring)

MUSIC 2340: Music Theory II

Credits: 3. Contact Hours: Lecture 3.

Prereq: MUSIC 2240

Harmonic and melodic materials of tonal music including chromatic secondary function chords and modulation techniques. Application of these materials in analysis, part writing, and composition. Concurrent enrollment in MUSIC 2350 recommended. (Typically Offered: Spring)

MUSIC 2350: Aural Theory II

Credits: 1. Contact Hours: Laboratory 3.

Prereq: MUSIC 2250; credit or concurrent enrollment in MUSIC 2340

Development of sight singing, ear training, and related musicianship skills with emphasis on diatonic harmonic and melodic materials as well as rhythm. (Typically Offered: Spring)

MUSIC 2460: Introduction to Creative Digital Music

Credits: 2. Contact Hours: Lecture 2.

Introduction to audio and MIDI software used in creating digital music. Includes fundamentals of audio waveform editing, processing, and mixing, MIDI data structures, practical projects in musical composition using a digital audio workstation. Ability to read traditional music notation preferred. (Typically Offered: Fall, Spring)

MUSIC 2480: Technology in Music Instruction

Credits: 2. Contact Hours: Lecture 2.

Prereq: MUSIC major or Permission of Instructor

Introduction to computer software applications used in musical arrangements and presentations, practical introduction to audio and MIDI technologies in lab-based music instruction, basic recording/sound reinforcement and music website management. Intended for Music Education Majors. (Typically Offered: Spring)

MUSIC 2650: Music in Elementary Education

Credits: 2. Contact Hours: Lecture 2.

Prereq: PSYCH 2300 or HDFS 1020

Experiencing and understanding the fundamentals of music through singing, playing classroom instruments, body movement, reading notation, listening, and creative activities. Developing lesson plan strategies and sequence, exploring multicultural musics, integrating music with other subjects in the elementary classroom, and evaluating aspects of musical learning. (Typically Offered: Fall, Spring)

MUSIC 2660: Introduction to Music Education

Credits: 2. Contact Hours: Lecture 1, Laboratory 2.

Prereq: Concurrent enrollment in MUSIC 2800K or permission of instructor

Required for first-year majors in music education. Historical, philosophical, and social foundations of music education; music curricula overview including goals of the music program, and contemporary and international curriculum development; psychology of teaching music including discipline techniques. Preparation for required observations in area schools. (Typically Offered: Spring)

MUSIC 2800K: Pre-Student Teaching Experience I: Music

(Cross-listed with EDUC 2800K).

Credits: 0.5. Repeatable.

Pre-student teaching experience in music in school settings. Permission of Music coordinator required prior to enrollment. Clinical Experience Level 1. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

MUSIC 2900A: Special Problems: Education

Credits: 1-30. Repeatable.

Prereq: 12 credits in MUSIC; Department Permission

Independent study in music education. (Typically Offered: Fall, Spring)

MUSIC 2900B: Special Problems: Theory

Credits: 1-30. Repeatable.

Prereq: 12 credits in MUSIC; Department Permission

Independent study in music theory. (Typically Offered: Fall, Spring)

MUSIC 2900C: Special Problems: Composition

Credits: 1-30. Repeatable.

Prereq: 12 credits in MUSIC; Department Permission

Independent study in music composition. (Typically Offered: Fall, Spring)

MUSIC 2900D: Special Problems: History

Credits: 1-30. Repeatable.

Prereq: 12 credits in MUSIC; Department Permission

Independent study in music history. (Typically Offered: Fall, Spring)

MUSIC 2900E: Special Problems: Literature

Credits: 1-30. Repeatable.

Prereq: 12 credits in MUSIC; Department Permission

Independent study in music literature. (Typically Offered: Fall, Spring)

MUSIC 2900F: Special Problems: Applied Music

Credits: 1-30. Repeatable.

Prereq: 12 credits in MUSIC; Department Permission

Independent study in applied music. (Typically Offered: Fall, Spring)

MUSIC 2900G: Special Problems: Conducting

Credits: 1-30. Repeatable.

Prereq: 12 credits in MUSIC; Department Permission

Independent study in conducting. (Typically Offered: Fall, Spring)

MUSIC 2900H: Special Problems: Honors

Credits: 1-30. Repeatable.

Prereq: 12 credits in MUSIC; Department Permission; Membership in the University Honors Program

Independent honors project in music. (Typically Offered: Fall, Spring, Summer)

MUSIC 2900J: Special Problems: Business

Credits: 1-30. Repeatable.

Prereq: 12 credits in MUSIC; Department Permission

Independent study in music business. (Typically Offered: Fall, Spring)

MUSIC 3010A: Opera Studio: Opera/Operetta

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Study of selected opera scenes and chamber operas. Basic stagecraft, role interpretation, production. (Typically Offered: Fall, Spring)

MUSIC 3010B: Opera Studio: Music Theater

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Study of selected works from contemporary and classical music theater. Basic stagecraft, role interpretation, production. (Typically Offered: Fall, Spring)

MUSIC 3020: Masterpieces of Music and Art in Western Culture

Credits: 3. Contact Hours: Lecture 3.

Exploration of several great works of classical music in light of the artistic culture in which they were composed; and trends in musical styles as well as individual composers' personalities over history through listening and discussion. Some concert attendance is required outside of class. An ability to read music is not required, but is recommended. Non-majors only. Only one of MUSIC 1200 and 3020 can count toward graduation. (Typically Offered: Spring)

MUSIC 3040: History of American Rock 'n' Roll

Credits: 3. Contact Hours: Lecture 3.

Rock 'n' Roll from the mid 1950s through the present, focusing on the development of rock styles from its roots in blues and folk music. Explores the various overlaps and cross-overs with other musical traditions including hip-hop, country, and pop. Expansion of listening experience through study of song forms, musical instruments of rock, and socio-political influences. Quizzes and examinations required. Ability to read or perform music not required. (Typically Offered: Fall, Spring)

MUSIC 3180A: Applied Music: Non-majors: Voice

Credits: 1-2. Contact Hours: Studio 2.

Repeatable.

Prereq: Instructor Permission for Course

(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors. Audition required. (Typically Offered: Fall, Spring)

MUSIC 3180B: Applied Music: Non-majors: Piano

Credits: 1-2. Contact Hours: Studio 2.

Repeatable.

Prereq: Instructor Permission for Course

(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors. Audition required. (Typically Offered: Fall, Spring)

MUSIC 3180C: Applied Music: Non-majors: Organ

Credits: 1-2. Contact Hours: Studio 2.

Repeatable.

Prereq: Instructor Permission for Course

(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors. Audition required. (Typically Offered: Fall, Spring)

MUSIC 3180D: Applied Music: Non-majors: Strings

Credits: 1-2. Contact Hours: Studio 2.

Repeatable.

Prereq: Instructor Permission for Course

(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors. Audition required. (Typically Offered: Fall, Spring)

MUSIC 3180E: Applied Music: Non-majors: Carillon

Credits: 1-2. Contact Hours: Studio 2.

Repeatable.

Prereq: Instructor Permission for Course

(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors. Audition required. (Typically Offered: Fall, Spring)

MUSIC 3180F: Applied Music: Non-majors: Woodwinds

Credits: 1-2. Contact Hours: Studio 2.

Repeatable.

Prereq: Instructor Permission for Course

(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors. Audition required. (Typically Offered: Fall, Spring)

MUSIC 3180G: Applied Music: Non-majors: Brass

Credits: 1-2. Contact Hours: Studio 2.

Repeatable.

Prereq: Instructor Permission for Course

(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors. Audition required. (Typically Offered: Fall, Spring)

MUSIC 3180I: Applied Music: Non-majors: Percussion

Credits: 1-2. Contact Hours: Studio 2.

Repeatable.

Prereq: Instructor Permission for Course

(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors. Audition required. (Typically Offered: Fall, Spring)

MUSIC 3180K: Applied Music: Non-majors: Harpsichord

Credits: 1-2. Contact Hours: Studio 2.

Repeatable.

Prereq: Instructor Permission for Course

(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors. Audition required. (Typically Offered: Fall, Spring)

MUSIC 3190A: Applied Music: Majors: Voice

Credits: 2-3. Contact Hours: Studio 2.

Repeatable.

Prereq: Music major; passing grade on continuation exam or Permission of Instructor

(1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required. Audition required. (Typically Offered: Fall, Spring)

MUSIC 3190B: Applied Music: Majors: Piano

Credits: 1-3. Contact Hours: Studio 2.

Repeatable.

Prereq: Music major; passing grade on continuation exam or Permission of Instructor

(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required. Audition required. (Typically Offered: Fall, Spring)

MUSIC 3190C: Applied Music: Majors: Organ

Credits: 1-3. Contact Hours: Studio 2.

Repeatable.

Prereq: Music major; passing grade on continuation exam or Permission of Instructor

(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required. Audition required. (Typically Offered: Fall, Spring)

MUSIC 3190D: Applied Music: Majors: Strings

Credits: 1-3. Contact Hours: Studio 2.

Repeatable.

Prereq: Music major; passing grade on continuation exam or Permission of Instructor

(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required. Audition required. (Typically Offered: Fall, Spring)

MUSIC 3190E: Applied Music: Majors: Carillon

Credits: 1-3. Contact Hours: Studio 2.

Repeatable.

Prereq: Music major; passing grade on continuation exam or Permission of Instructor

(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required. Audition required. (Typically Offered: Fall, Spring)

MUSIC 3190F: Applied Music: Majors: Woodwinds

Credits: 2-3. Contact Hours: Studio 2.

Repeatable.

Prereq: Music major; passing grade on continuation exam or Permission of Instructor

(1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required. Audition required. (Typically Offered: Fall, Spring)

MUSIC 3190G: Applied Music: Majors: Brass

Credits: 2-3. Contact Hours: Studio 2.

Repeatable.

Prereq: Music major; passing grade on continuation exam or Permission of Instructor

(1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required. Audition required. (Typically Offered: Fall, Spring)

MUSIC 3190I: Applied Music: Majors: Percussion

Credits: 1-3. Contact Hours: Studio 2.

Repeatable.

Prereq: Music major; passing grade on continuation exam or Permission of Instructor

(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required. Audition required. (Typically Offered: Fall, Spring)

MUSIC 3190K: Applied Music: Majors: Harpsichord

Credits: 1-3. Contact Hours: Studio 2.

Repeatable.

Prereq: Music major; passing grade on continuation exam or Permission of Instructor

(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required. Audition required. (Typically Offered: Fall, Spring)

MUSIC 3210A: Advanced Ensemble: Voice

Credits: 1. Contact Hours: Laboratory 2.

Repeatable.

Prereq: MUSIC major or Permission of Instructor

Performance in ensembles that demand high proficiency. Open to a limited number of undergraduate and graduate students. Advanced proficiency and performing ability required. (Typically Offered: Fall, Spring)

MUSIC 3210B: Advanced Ensemble: Piano

Credits: 1. Contact Hours: Laboratory 2.

Repeatable.

Prereq: MUSIC major or Permission of Instructor

Performance in ensembles that demand high proficiency. Open to a limited number of undergraduate and graduate students. Advanced proficiency and performing ability required. (Typically Offered: Fall, Spring)

MUSIC 3210C: Advanced Ensemble: Organ

Credits: 1. Contact Hours: Laboratory 2.

Repeatable.

Prereq: MUSIC major or Permission of Instructor

Performance in ensembles that demand high proficiency. Open to a limited number of undergraduate and graduate students. Advanced proficiency and performing ability required. (Typically Offered: Fall, Spring)

MUSIC 3210D: Advanced Ensemble: Strings

Credits: 1. Contact Hours: Laboratory 2.

Repeatable.

Prereq: MUSIC major or Permission of Instructor

Performance in ensembles that demand high proficiency. Open to a limited number of undergraduate and graduate students. Advanced proficiency and performing ability required. (Typically Offered: Fall, Spring)

MUSIC 3210F: Advanced Ensemble: Woodwinds

Credits: 1. Contact Hours: Laboratory 2.

Repeatable.

Prereq: MUSIC major or Permission of Instructor

Performance in ensembles that demand high proficiency. Open to a limited number of undergraduate and graduate students. Advanced proficiency and performing ability required. (Typically Offered: Fall, Spring)

MUSIC 3210G: Advanced Ensemble: Brass

Credits: 1. Contact Hours: Laboratory 2.

Repeatable.

Prereq: MUSIC major or Permission of Instructor

Performance in ensembles that demand high proficiency. Open to a limited number of undergraduate and graduate students. Advanced proficiency and performing ability required. (Typically Offered: Fall, Spring)

MUSIC 3210I: Advanced Ensemble: Percussion

Credits: 1. Contact Hours: Laboratory 2.

Repeatable.

Prereq: MUSIC major or Permission of Instructor

Performance in ensembles that demand high proficiency. Open to a limited number of undergraduate and graduate students. Advanced proficiency and performing ability required. (Typically Offered: Fall, Spring)

MUSIC 3210J: Advanced Ensemble: Mixed instruments/voice

Credits: 1. Contact Hours: Laboratory 2.

Repeatable.

Prereq: MUSIC major or Permission of Instructor

Performance in ensembles that demand high proficiency. Open to a limited number of undergraduate and graduate students. Advanced proficiency and performing ability required. (Typically Offered: Fall, Spring)

MUSIC 3240: English and Italian Diction for Singing

Credits: 2. Contact Hours: Lecture 2.

Prereq: Credit or enrollment in MUSIC 1180A or MUSIC 1190A

The international phonetic alphabet and its application to correct pronunciation of English and Italian in singing. Offered even-numbered years. (Typically Offered: Fall).

MUSIC 3250: French and German Diction for Singing

Credits: 2. Contact Hours: Lecture 2.

Prereq: Credit or enrollment in MUSIC 1180A or MUSIC 1190A

The international phonetic alphabet and its application to correct pronunciation of French and German in singing. Offered odd-numbered years. (Typically Offered: Spring)

MUSIC 3270A: Functional Piano: Keyboard majors

Credits: 2.

Prereq: MUSIC 2280 or Permission of Instructor

Emphasis on sight reading, three and four-part score reading, improvisation, accompanying, and advanced harmonization.

MUSIC 3270B: Functional Piano: Voice Majors

Credits: 2.

Prereq: MUSIC 2280 or Permission of Instructor

Emphasis on sight reading, three and four-part score reading, improvisation, accompanying, and advanced harmonization. (Typically Offered: Spring)

MUSIC 3340: Music Theory III

Credits: 3. Contact Hours: Lecture 3.

Prereq: MUSIC 2340

Characteristics of common practice chromatic harmony and analytical techniques addressing stylistic practices of music since 1900.

Application of these materials to analysis, part writing, and composition.

Concurrent enrollment in MUSIC 3350 recommended. (Typically Offered: Fall)

MUSIC 3350: Aural Theory III

Credits: 1. Contact Hours: Laboratory 2.

Prereq: MUSIC 2350; credit or concurrent enrollment in MUSIC 3340

Development of sight singing, ear training, and related musical skills with emphasis on melodic, harmonic and rhythmic materials from the eighteenth and nineteenth centuries. (Typically Offered: Fall)

MUSIC 3440: Music Theory IV

Credits: 3. Contact Hours: Lecture 3.

Prereq: MUSIC 3340

Improvisation on existing materials in a variety of styles and arranging for vocal and instrumental ensembles while learning the characteristics of each instrument including voice. Concurrent enrollment in MUSIC 3450 recommended. (Typically Offered: Spring)

MUSIC 3450: Aural Theory IV

Credits: 1. Contact Hours: Laboratory 2.

Prereq: MUSIC 3350; credit or concurrent enrollment in MUSIC 3440

Development of sight singing, ear training, and related musical skills with emphasis on melodic, harmonic and rhythmic materials from the nineteenth and twentieth centuries. (Typically Offered: Spring)

MUSIC 3460: Computer Music Programming Design

Credits: 3. Contact Hours: Lecture 3.

Prereq: MUSIC 2460 or Permission of Instructor

Programming and interface design for creative musical applications. Includes computer generation of music data, advanced MIDI data processing, practical projects in musical composition and performance using a visual programming language. (Typically Offered: Spring)

MUSIC 3500: Instrumental Techniques: Strings

Credits: 1. Contact Hours: Laboratory 2.

Prereq: Music major; concurrent enrollment in MUSIC 3580B or MUSIC 3580C

Techniques and skills required for teaching of instruments. Examination of materials for school use. Intended for instrumental music education students. (Typically Offered: Fall)

MUSIC 3510: Instrumental Techniques: Clarinet, Flute, Saxophone

Credits: 2.

Prereq: Music major; concurrent enrollment in MUSIC 3580B or MUSIC 3580C

Techniques and skills required for teaching of instruments. Examination of materials for school use. Intended for instrumental music education students. (Typically Offered: Spring)

MUSIC 3520: Instrumental Techniques: Oboe, Bassoon

Credits: 1. Contact Hours: Laboratory 2.

Prereq: Music major; concurrent enrollment in MUSIC 3580B or MUSIC 3580C

Techniques and skills required for teaching of instruments. Examination of materials for school use. Intended for instrumental music education students. (Typically Offered: Fall)

MUSIC 3530: Instrumental Techniques: Trumpet, Horn

Credits: 1.

Prereq: Music major; concurrent enrollment in MUSIC 3580B or MUSIC 3580C

Techniques and skills required for teaching of instruments. Examination of materials for school use. Intended for instrumental music education students. (Typically Offered: Fall)

MUSIC 3540: Instrumental Techniques: Trombone, Baritone, Tuba

Credits: 1.

Prereq: Music major; concurrent enrollment in MUSIC 3580B or MUSIC 3580C

Techniques and skills required for teaching of instruments. Examination of materials for school use. Intended for instrumental music education students. (Typically Offered: Spring)

MUSIC 3550: Instrumental Techniques: Percussion

Credits: 1.

Prereq: Music major; concurrent enrollment in MUSIC 3580B or MUSIC 3580C

Techniques and skills required to teach percussion instruments in the schools. Techniques for performing and teaching snare drum, keyboard percussion instruments, timpani, band and orchestral hand instruments, drum set, and Latin percussion. Intended for instrumental music education students. (Typically Offered: Spring)

MUSIC 3580A: Lab Ensemble: Choral

Credits: Required. Contact Hours: Laboratory 1.

Repeatable.

Sight singing, conducting, and accompanying experience in conjunction with 3620A and 4650. Required of all vocal music education majors. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

MUSIC 3580B: Lab Ensemble: Instrumental

Credits: Required. Contact Hours: Laboratory 1.

Repeatable.

Performance on secondary instruments and conducting. Includes experiences with wind, string, and percussion instruments and techniques. Required of all instrumental music education majors. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

MUSIC 3600: Voice Pedagogy

Credits: 2.

Prereq: Credit or concurrent enrollment in MUSIC 2190A

Physical, acoustical, and musical properties of the vocal instrument, including a survey of important texts and articles on singing and voice production. Offered even-numbered years. (Typically Offered: Spring)

MUSIC 3610: Conducting I

Credits: 2.

Prereq: (MUSIC 2340; MUSIC 2350; Music major) or Permission of Instructor

Introduction to conducting; score reading and analysis. Conveying musical ideas through appropriate gestures. Leadership role of the conductor. (Typically Offered: Fall)

MUSIC 3620A: Conducting II: Choral Conducting Techniques

Credits: 2.

Prereq: MUSIC major; MUSIC 3610; concurrent enrollment in MUSIC 3580A; concurrent enrollment in (MUSIC 1410, MUSIC 1510, or MUSIC 1610)

Advanced baton technique, score preparation and interpretation of choral repertoire. Offered odd-numbered years. (Typically Offered: Spring)

MUSIC 3620B: Conducting II: Instrumental Conducting Techniques

Credits: 2.

Prereq: MUSIC major; MUSIC 3610; concurrent enrollment in MUSIC 3580B

Advanced baton technique. Score preparation. Specific problems of large instrumental ensembles. (Typically Offered: Spring)

MUSIC 3660: Methods of Music Education

Credits: 2. Contact Hours: Lecture 2.

Prereq: MUSIC major; MUSIC 2660; concurrent enrollment in MUSIC 4800K

Music education strategies and materials including development of appropriate objectives and plans for general music classes utilizing traditional and multicultural musics, evaluating musical learning; overview of Orff Schulwerk, Kodaly, and Dalcroze approaches; music in special education; required teaching in lab settings and observations in area schools. Admission to Education Preparation Program required. (Typically Offered: Fall)

MUSIC 3670: Choral Literature

Credits: 2. Contact Hours: Lecture 2.

Overview of choral repertoire from the sixteenth century to the present, including accessible works for the young conductor. MUSIC 3610 recommended. Offered even-numbered years. (Typically Offered: Spring)

MUSIC 3680: Marching Band and Jazz Ensemble Techniques

Credits: 2. Contact Hours: Lecture 2.

Prereq: Restricted to music majors

Techniques and materials for teaching marching band in the high school; philosophy, computer assisted drill design, music analysis, band set up, and other related skills. Jazz style, articulation, phrasing, materials and teaching techniques for secondary school jazz ensembles. Credit or enrollment in MUSIC 3620B recommended. Offered odd-numbered years. (Typically Offered: Spring)

MUSIC 3690: String Pedagogy

Credits: 1. Contact Hours: Laboratory 2.

Prereq: Restricted to music majors

Practical examination of current teaching methods and materials. Intended for string instrumental music education majors. Offered odd-numbered years. (Typically Offered: Spring)

MUSIC 3740: Instrumental Methods for Vocalists

Credits: 1. Contact Hours: Lecture 1.

Repeatable, maximum of 15 credits.

Prereq: MUSIC major; MUSIC 2800K

Techniques and skills required to teach instrumental music in K-12 schools. Introduction of instruments, score reading and transposition, rehearsal techniques, literature, resources and other related skills. Intended for vocal music education majors and required for Iowa teaching license. Admission to Education Preparation Program required. (Typically Offered: Fall)

MUSIC 3750: Choral Methods for Instrumentalists

Credits: 1. Contact Hours: Lecture 1.

Prereq: (Admitted to the Educator Preparation Program and Music major) or permission of instructor

Techniques and skills required to teach vocal/choral music in K-12 schools. Vocal production and health, rehearsal techniques, repertoire, resources and other related skills. Intended for instrumental music education majors and required for Iowa teaching license. Admission to Educator Preparation Program required. (Typically Offered: Spring)

MUSIC 3800K: Pre-Student Teaching Experience II: Music

(Cross-listed with EDUC 3800K).

Credits: 1-2. Contact Hours: Lecture 1, Studio 8.

Prereq: Admitted to the Educator Preparation Program

Participation in a K-12 school setting. Permission of Music coordinator required prior to enrollment. Clinical Experience Level 2. Offered on a satisfactory-fail basis only.

MUSIC 3830: History of Music I

Credits: 3. Contact Hours: Lecture 3.

Prereq: (MUSIC 1200; Music major) or Permission of Instructor

History of the stylistic and cultural development of music: Middle Ages through Baroque. Meets International Perspectives Requirement. (Typically Offered: Fall)

MUSIC 3840: History of Music II

Credits: 3. Contact Hours: Lecture 3.

Prereq: (MUSIC 1200; Music major) or Permission of Instructor

History of the stylistic and cultural development of music: Classical through contemporary music. Meets International Perspectives Requirement. (Typically Offered: Spring)

MUSIC 4150A: Literature and Pedagogy in Applied Music: Voice

Credits: 1-4. Repeatable.

Prereq: MUSIC major OR Permission of instructor.

Includes experience in technology relative to the particular discipline. (Typically Offered: Fall, Spring)

MUSIC 4150B: Literature and Pedagogy in Applied Music: Piano

Credits: 1-4. Repeatable.

Prereq: MUSIC major OR Permission of instructor.

Includes experience in technology relative to the particular discipline. (Typically Offered: Fall, Spring)

MUSIC 4150C: Literature and Pedagogy in Applied Music: Organ

Credits: 1-4. Repeatable.

Prereq: MUSIC major OR Permission of instructor.

Includes experience in technology relative to the particular discipline. (Typically Offered: Fall, Spring)

MUSIC 4150D: Literature and Pedagogy in Applied Music: Strings

Credits: 1-4. Repeatable.

Prereq: MUSIC major OR Permission of instructor.

Includes experience in technology relative to the particular discipline.

(Typically Offered: Fall, Spring)

MUSIC 4150E: Literature and Pedagogy in Applied Music: Carillon

Credits: 1-4. Repeatable.

Prereq: MUSIC major OR Permission of instructor.

Includes experience in technology relative to the particular discipline.

(Typically Offered: Fall, Spring)

MUSIC 4150F: Literature and Pedagogy in Applied Music: Woodwinds

Credits: 1-4. Repeatable.

Prereq: MUSIC major OR Permission of instructor.

Includes experience in technology relative to the particular discipline.

(Typically Offered: Fall, Spring)

MUSIC 4150G: Literature and Pedagogy in Applied Music: Brass

Credits: 1-4. Repeatable.

Prereq: MUSIC major OR Permission of instructor.

Includes experience in technology relative to the particular discipline.

(Typically Offered: Fall, Spring)

MUSIC 4150I: Literature and Pedagogy in Applied Music: Percussion

Credits: 1-4. Repeatable.

Prereq: MUSIC major OR Permission of instructor.

Includes experience in technology relative to the particular discipline.

(Typically Offered: Fall, Spring)

MUSIC 4150J: Literature and Pedagogy in Applied Music: Jazz Pedagogy and Performance

Credits: 1-4. Repeatable.

Prereq: Instructor Permission for Course

Includes experience in technology relative to the particular discipline.

(Typically Offered: Fall, Spring)

MUSIC 4170R: Student Teaching: Music-Elementary

(Dual-listed with EDUC 5170R/ MUSIC 5170R). (Cross-listed with EDUC 4170R).

Credits: 1-30. Repeatable.

Prereq: Admitted to the Educator Preparation Program

Evaluation of instruction, lesson planning, and teaching in the liberal arts and sciences. (Typically Offered: Fall, Spring)

MUSIC 4170S: Student Teaching: Music-Secondary

(Dual-listed with EDUC 5170S/ MUSIC 5170S). (Cross-listed with EDUC 4170S).

Credits: 1-30. Repeatable.

Prereq: Admitted to the Educator Preparation Program

Evaluation of instruction, lesson planning, and teaching in the liberal arts and sciences. (Typically Offered: Fall, Spring)

MUSIC 4190A: Applied Music: Voice

Credits: 2-3. Contact Hours: Studio 2.

Repeatable.

Prereq: MUSIC major OR Permission of instructor.

(1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required. Audition required. (Typically Offered: Fall, Spring)

MUSIC 4190B: Applied Music: Piano

Credits: 1-3. Contact Hours: Studio 2.

Repeatable.

Prereq: MUSIC major OR Permission of instructor.

(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required. Audition required. (Typically Offered: Fall, Spring)

MUSIC 4190C: Applied Music: Organ

Credits: 1-3. Contact Hours: Studio 2.

Repeatable.

Prereq: MUSIC major OR Permission of instructor.

(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required. Audition required. (Typically Offered: Fall, Spring)

MUSIC 4190D: Applied Music: Strings

Credits: 1-3. Contact Hours: Studio 2.

Repeatable.

Prereq: MUSIC major OR Permission of instructor.

(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required. Audition required. (Typically Offered: Fall, Spring)

MUSIC 4190E: Applied Music: Carillon

Credits: 1-3. Contact Hours: Studio 2.

Repeatable.

Prereq: MUSIC major OR Permission of instructor.

(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required. Audition required. (Typically Offered: Fall, Spring)

MUSIC 4190F: Applied Music: Woodwinds

Credits: 2-3. Contact Hours: Studio 2.

Repeatable.

Prereq: MUSIC major OR Permission of instructor.

(1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required. Audition required. (Typically Offered: Fall, Spring)

MUSIC 4190G: Applied Music: Brass

Credits: 2-3. Contact Hours: Studio 2.

Repeatable.

Prereq: MUSIC major OR Permission of instructor.

(1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required. Audition required. (Typically Offered: Fall, Spring)

MUSIC 4190I: Applied Music: Percussion

Credits: 1-3. Contact Hours: Studio 2.

Repeatable.

Prereq: MUSIC major OR Permission of instructor.

(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required. Audition required. (Typically Offered: Fall, Spring)

MUSIC 4190K: Applied Music: Harpsichord

Credits: 1-3. Contact Hours: Studio 2.

Repeatable.

Prereq: MUSIC major OR Permission of instructor.

(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required. Audition required. (Typically Offered: Fall, Spring)

MUSIC 4200: Junior/Senior Recital

Credits: Required. Contact Hours: Laboratory 1.

Repeatable.

Prereq: Concurrent enrollment in MUSIC 2190, MUSIC 3190, or MUSIC 4190

Performance of advanced repertory in a public concert. Preparation of program notes. Advanced performing ability required. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

MUSIC 4340: Applied Theory: Improvising and Arranging

Credits: 3. Contact Hours: Lecture 3.

Prereq: MUSIC 3440 and MUSIC 3450

Practical uses for music theory. Emphasis on arranging for vocal and instrumental ensembles and creating improvisations on existing materials in a variety of styles. (Typically Offered: Spring)

MUSIC 4400: Seminar in Music Theory

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: MUSIC 3440 and MUSIC 3450

Various topics in music theory including analysis, counterpoint, arranging, pedagogy, and psychology of music. Content will vary. Contact the Department of Music for the current year offering. Offered even-numbered years. (Typically Offered: Fall)

MUSIC 4460: Sound Synthesis Design for Electronic Music

Credits: 3. Contact Hours: Lecture 3.

Prereq: MUSIC 2460 or Permission of Instructor

Digital sound synthesis structures for creative musical applications. Includes modular sound synthesis techniques, software synthesizer design, and practical projects in electronic music composition. (Typically Offered: Fall)

MUSIC 4640: Instrumental Administration, Materials, and Methods

Credits: 2. Contact Hours: Lecture 2.

Prereq: (Credit or concurrent enrollment in MUSIC 3340; Admitted to the Educator Preparation Program; Music major) or permission of instructor

Instructional materials and methods appropriate for teaching instrumental music in elementary, middle school, and high school music programs. Required observations in area schools. Intended for instrumental music education students. Credit or enrollment in MUSIC 3620B recommended. Offered even-numbered years. (Typically Offered: Spring)

MUSIC 4650: Choral Materials and Methods

Credits: 2. Contact Hours: Lecture 2.

Prereq: MUSIC major; credit or concurrent enrollment in MUSIC 3580A and 3660

Instructional materials and methods appropriate for teaching choral music in the secondary school. Emphasis on pedagogy and rehearsal techniques. Required observations in area schools. Intended for vocal music education students. (Typically Offered: Fall)

MUSIC 4660: Program Development and Evaluation in Music Education

Credits: 2. Contact Hours: Lecture 2.

Prereq: credit or concurrent enrollment in MUSIC 3660; concurrent enrollment in MUSIC 4800K

Developing a rationale for music education; music program development; evaluation of music curricula, programs and facilities; professional growth of the teacher; preparation for student teaching and the job market. Required observations in area schools. (Typically Offered: Fall)

MUSIC 4720: History of American Music

Credits: 3. Contact Hours: Lecture 3.

Prereq: MUSIC 1010 or MUSIC 2240

History and development of the sacred and secular music in North America from approximately 1600 to the present, exploring the diverse cultural backgrounds that have contributed to the variety of contemporary musical styles. Ability to read music required. Meets U.S. Cultures and Communities Requirement.

MUSIC 4730: Topics in Advanced Music History

Credits: 3. Contact Hours: Lecture 3.

Prereq: MUSIC 3830, MUSIC 3840

Detailed topic-based study of major composers and compositions from 1600 to the present with a strong research component.

MUSIC 4740: Music and Neuroscience

(Cross-listed with KIN 4740).

Credits: 3. Contact Hours: Lecture 3.

Understanding how music is processed in the brain and the implications for healthy care and education. Online discussions about how music changes all aspects of the brain from neurotransmitters to cortical reorganization. (Typically Offered: Fall)

MUSIC 4750: Music of the Romantic Era

Credits: 3. Contact Hours: Lecture 3.

Prereq: MUSIC 3830, MUSIC 3840

Offered F. 2012. Detailed survey of instrumental, vocal, choral, and keyboard music from 1825 to 1910.

MUSIC 4760: Music of the Twentieth Century

Credits: 3. Contact Hours: Lecture 3.

Prereq: MUSIC 3830, MUSIC 3840

Detailed survey of instrumental, vocal, choral, and keyboard music from 1900 to the present.

MUSIC 4800K: Pre-Student Teaching Experience III: Music

(Cross-listed with EDUC 4800K).

Credits: 1-2. Repeatable.

Prereq: Admitted to the Educator Preparation Program

Participation in a K-12 school setting. Permission of Music coordinator required prior to enrollment. Clinical Experience Level 3. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

MUSIC 4900A: Independent Study: Education

(Cross-listed with EDUC 4900A).

Credits: 1-30. Repeatable.

Prereq: 12 credits in MUSIC; Department Permission

Music. (Typically Offered: Fall, Spring, Summer)

MUSIC 4900B: Independent Study: Theory

Credits: 1-30. Repeatable.

Prereq: 12 credits in MUSIC; Department Permission

(Typically Offered: Fall, Spring, Summer)

MUSIC 4900C: Independent Study: Composition

Credits: 1-30. Repeatable.

Prereq: 12 credits in MUSIC; Department Permission

(Typically Offered: Fall, Spring, Summer)

MUSIC 4900D: Independent Study: History

Credits: 1-30. Repeatable.

Prereq: 12 credits in MUSIC; Department Permission

(Typically Offered: Fall, Spring, Summer)

MUSIC 4900E: Independent Study: Literature

Credits: 1-30. Repeatable.

Prereq: 12 credits in MUSIC; Department Permission

(Typically Offered: Fall, Spring, Summer)

MUSIC 4900F: Independent Study: Applied Music

Credits: 1-30. Repeatable.

Prereq: 12 credits in MUSIC; Department Permission

(Typically Offered: Fall, Spring, Summer)

MUSIC 4900G: Independent Study: Conducting

Credits: 1-30. Repeatable.

Prereq: 12 credits in MUSIC; Department Permission

(Typically Offered: Fall, Spring, Summer)

MUSIC 4900H: Independent Study

Credits: 1-30. Repeatable.

Prereq: 12 credits in MUSIC; Department Permission; Membership in the University Honors Program

(Typically Offered: Fall, Spring, Summer)

MUSIC 4900I: Independent Study: Electronic Music

Credits: 1-30. Repeatable.

Prereq: 12 credits in MUSIC; Department Permission

(Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

MUSIC 5170R: Student Teaching: Music-Elementary

(Dual-listed with EDUC 4170R/ MUSIC 4170R). (Cross-listed with EDUC 5170R).

Credits: 1-30. Repeatable.

Prereq: Admitted to the Educator Preparation Program

Evaluation of instruction, lesson planning, and teaching in the liberal arts and sciences. (Typically Offered: Fall, Spring)

MUSIC 5170S: Student Teaching: Music-Secondary

(Dual-listed with EDUC 4170S/ MUSIC 4170S). (Cross-listed with EDUC 5170S).

Credits: 1-30. Repeatable.

Prereq: Admitted to the Educator Preparation Program

Evaluation of instruction, lesson planning, and teaching in the liberal arts and sciences. (Typically Offered: Fall, Spring)

MUSIC 5900A: Special Topics: Education

Credits: 1-30. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

(Typically Offered: Fall, Spring, Summer)

MUSIC 5900B: Special Topics: Theory

Credits: 1-30. Repeatable.

Prereq: Permission of Instructor; Permission of Department Chair

(Typically Offered: Fall, Spring, Summer)

MUSIC 5900C: Special Topics: Composition

Credits: 1-30. Repeatable.

Prereq: Permission of Instructor; Permission of Department Chair

(Typically Offered: Fall, Spring, Summer)

MUSIC 5900D: Special Topics: History

Credits: 1-30. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

(Typically Offered: Fall, Spring, Summer)

MUSIC 5900E: Special Topics: Literature

Credits: 1-30. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

(Typically Offered: Fall, Spring, Summer)

MUSIC 5900F: Special Topics: Applied Music

Credits: 1-30. Repeatable.

Prereq: Permission of Instructor; Permission of Department Chair

(Typically Offered: Fall, Spring, Summer)

MUSIC 5900G: Special Topics: Conducting

Credits: 1-30. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

(Typically Offered: Fall, Spring, Summer)

MUSIC 5900I: Special Topics: Electronic Music

Credits: 1-30. Repeatable.

Prereq: Permission of Instructor; Permission of Department Chair

(Typically Offered: Fall, Spring, Summer)

NREM 1040: Practical Work Experience

Credits: Required.

Three months of relevant work experience in natural resources, animal ecology, or forestry. Study at a summer biological station may be applicable. See advisor for specific requirements and approval process.

NREM 1100: Orientation in Natural Resource Ecology and Management

Credits: 1. Contact Hours: Lecture 1.

Orientation to the University and to the Department of Natural Resource Ecology and Management. Discussion of departmental learning outcomes, strategies for academic success and academic planning.

Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

NREM 1110: NREM Transitions Learning Community Seminar

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Enrollment limited to members of the NREM Transitions Learning Community. Designed to assist new transfer students and continuing sophomore students with their transition to the academic expectations and professional development aspects of the natural resource program. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

NREM 1150: Explorations in Natural Resource Ecology & Management

Credits: 1. Contact Hours: Lecture 1.

Prereq: (Animal Ecology or Forestry major); Permission of Instructor

Interact with faculty in the Department of Natural Resource Ecology and Management through lectures, discussions, and field experiences. Offered during the second half of Spring semester. (Typically Offered: Spring)

NREM 1200: Introduction to Renewable Resources

(Cross-listed with AGRON 1200/ ENVS 1200).

Credits: 3. Contact Hours: Lecture 3.

Overview of soil, water, plants, and animals as renewable natural resources in an ecosystem context. History and organization of resource management. Concepts of integrated resource management. (Typically Offered: Fall, Spring)

NREM 1300: Natural Resources and Agriculture

(Cross-listed with ENVS 1300).

Credits: 3. Contact Hours: Lecture 3.

Survey of the ecology and management of fish, forest, and wildlife resources in areas of intensive agriculture, with emphasis on Iowa. Conservation and management practices for private agricultural lands. Designed for nonmajors. (Typically Offered: Spring)

Natural Resource Ecology and Management (NREM)

Courses primarily for undergraduates:

NREM 2070: Natural Resource Management under the North American Model of Conservation

Credits: 1. Contact Hours: Lecture 1.

Introduction to North American model of conservation, current funding for natural resource management, role of hunting and angling in the North American model, critique and refinement of the model for the 21st century, and introduction to natural resource leadership, and outdoor skills and recreation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

NREM 2110: Careers in Natural Resources

Credits: 1. Contact Hours: Lecture 1.

Prereq: Sophomore classification

Career planning exploration in natural resources. Discussion of the job application process, including techniques for successful interviewing and development of an effective resume. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

NREM 2400: Quantitative Problem Solving in Natural Resources

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: (STAT 1010 or STAT 1040) or Permission of Instructor

Applied quantitative problem-solving skills for natural resource management. Focus on group and individual exercises, with practical problems in geography, hydrology, forestry and ecology. Laboratory includes field data collection and computer data processing and modeling. (Typically Offered: Spring)

NREM 2500: Environmental Geography

(Cross-listed with AGRON 2500/ ENVS 2500/ ENSCI 2500).

Credits: 3. Contact Hours: Lecture 3.

The distribution, origins and functions of the earth's physical systems and the spatial relationship between human activity and the natural world. (Typically Offered: Fall)

NREM 2700: Foundations in Natural Resource Policy and History

(Cross-listed with ENVS 2700/ LA 2700).

Credits: 3. Contact Hours: Lecture 3.

The development of natural resource conservation philosophy and policy from the Colonial Era to the present. North American wildlife, forestry, and environmental policy; national parks and other protected lands; federal and state agencies. Relationship to cultural contexts, including urban reform and American planning movement. Discussion of common pool resources, public and private lands. (Typically Offered: Fall)

NREM 3010: Natural Resource Ecology and Soils

(Cross-listed with ENSCI 3010).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: BIOL 2110, BIOL 2110L; FOR 2010 or a second course in biology

Effects of environmental factors on ecosystem structure and function using forest, prairie and agricultural ecosystems as models. Special emphasis is given to soil-forming factors and the role of soil in nutrient and water cycling and ecosystem dynamics. Additional emphasis is given to human influences on natural ecosystems and the role of perennial plant communities in agricultural landscapes. (Typically Offered: Fall)

NREM 3030: Internship

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: Permission of Instructor; Sophomore classification

Placement with county conservation boards, camps, zoos, parks, etc., for experience as interpreters, rangers, and technicians. (Typically Offered: Fall, Spring, Summer)

NREM 3050: Seminar

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Current topics in natural resources or related issues. (Typically Offered: Fall, Spring)

NREM 3110: Field Ecology in Montana

Credits: 4. Contact Hours: Lecture 2, Laboratory 6.

Prereq: (BIOL 2110; BIOL 2110L; BIOL 2120; BIOL 2120L); Permission of Instructor

Fundamental concepts and principles of ecology dealing with organisms, populations, communities, and ecosystems. Taught at NREM's Rod and Connie French Conservation Education Camp in western Montana. Emphasizes hands-on learning of principles and methods in the field. (Typically Offered: Summer)

NREM 3130: Native Land, Water, and Resources

(Cross-listed with AMIN 3130).

Credits: 3. Contact Hours: Lecture 3.

Examines Native land rights, water rights, and natural resources.

Topics may include Native relations to landscapes, cultural resources and infrastructure projects, land rights, water usage agreements, and resource policies as they apply to on- and off-reservation Native communities. AMIN 2100 recommended. Offered even-numbered years. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Spring)

NREM 3150: Genetics for Natural Resource Managers

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2110 and BIOL 2120

Introduction into how genetic techniques and technologies can aid the management of the earth's biotic resources. Topics include an overview of DNA structure, function and inheritance; tools and techniques for measuring genetic diversity; genetic management of wild and captive populations: DNA forensics as management tool. The goal of this course is to prepare managers/biologists to interpret genetic data as they relate to natural resource conservation. (Typically Offered: Fall)

NREM 3180: Introduction to Ecosystems

(Cross-listed with AGRON 3180/ BIOL 3180/ ENSCI 3180).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 12 credits in AECL, AGRON, BIOL, CHEM, FOR, GEOL, NREM

Biological and physical processes affecting material and energy flows in natural and managed ecosystems. Understanding and predicting climate and management impacts on ecosystem services and sustainability. (Typically Offered: Spring)

NREM 3300: Principles of Interpretation

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: 6 credits in BIOL

History, objectives, forms, and techniques of interpretation in the settings of county, state, national parks, and zoos. Principles of effective communication as they apply to natural resource fields including wildlife management, forestry, and wildlife rehabilitation. Planning and use of effective communications and outreach campaigns to manage and conserve natural resources. (Typically Offered: Spring)

NREM 3450: Natural Resource Photogrammetry and Geographic Information Systems

(Cross-listed with ENSCI 3450).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Junior classification

Measurement and interpretation of aerial photos in resource management. Introduction to Geographic Information Systems (GIS) using ArcGIS including digitizing, development and query of attribute tables, georeferencing, and use of multiple GIS layers in simple spatial analyses. (Typically Offered: Spring)

NREM 3570: Midwestern Prairie Plants

Credits: 1.

Offered 1st half semester only. Survey of the major plant families, genera, and representative species of Midwestern prairies with emphasis on plant identification. Prairie management for multiple species of plants and wildlife. (Typically Offered: Fall)

NREM 3750X: Environmentalism in Music

Credits: 1. Contact Hours: Lecture 1.

Environmentalism (environmental or ecological activism) is a common topic in popular music. In this seminar, students choose recorded music with an environmental or ecological theme, present their piece to the class, and lead a discussion focused on interpreting lyrics and sound. Through analysis of music from diverse eras, genres, and cultures, students learn about historical events, evaluate attitudes and actions regarding natural resource stewardship and biodiversity preservation, and explore concepts of environmental justice and human dependence on healthy ecosystems for physical and emotional well-being. (Typically Offered: Spring)

NREM 3800: Field Ecology Research and Teaching

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: BIOL 2110 or Department Permission

Students work in teams to conduct ecological research projects at a local field site, and develop related teaching modules/lesson plans. Research and teaching activity objectives, methods, and results are shared with diverse audiences as presentations, written reports, and web-based documents, and used to engage K-12 students and community members via field days and visits to schools and other institutions. (Typically Offered: Fall)

NREM 3850: Natural Resource Policy

(Dual-listed with NREM 5850).

Credits: 3. Contact Hours: Lecture 3.

Development, theory and practice of natural resource policy. Integrative approach with topical policy studies in North American wildlife, forestry, and water. Policy formation, the role of science, introduction to federal law compliance. (Typically Offered: Spring)

NREM 3900: Fire Ecology and Management

Credits: 3. Contact Hours: Lecture 3.

Characteristics and role of fire in forest ecosystems. Major topics covered include fuels, fire weather, fire behavior, fire danger rating systems, fire control, prescribed burning, and fire dynamics in major ecosystem types. (Typically Offered: Fall)

NREM 4020: Watershed Hydrology

(Dual-listed with GEOL 5020/ ENSCI 5020/ MTEOR 5020/ NREM 5020).

(Cross-listed with ENSCI 4020/ MTEOR 4020/ GEOL 4020).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Examination of watersheds as systems, emphasizing the surface components of the hydrologic cycle. Combines qualitative understanding of hydrological processes and uncertainty with quantitative representation. Laboratory emphasizes field investigation and measurement of watershed processes. (Typically Offered: Fall)

NREM 4070: Watershed Management

(Dual-listed with NREM 5070/ ENSCI 5070). (Cross-listed with ENSCI 4070/ ENVS 4070).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: 1 course in BIOL

Managing human impacts on the hydrologic cycle. Field and watershed level best management practices for modifying the impacts on water quality, quantity and timing are discussed. Field project includes developing a management plan using landscape buffers. (Typically Offered: Spring)

NREM 4460: Integrating GPS and GIS for Natural Resource Management

(Dual-listed with NREM 5460/ ENSCI 5460). (Cross-listed with ENSCI 4460).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: 12 credits in student's major (AECL/FOR) at 3000 level or above

Emphasis on the use of GPS as a data collection tool for GIS. Basic theory of GPS. Use of Global Positioning System technology for spatial data collection and navigation. Post-processing and real-time correction of GPS data. GPS data transfer to GIS for mapping applications. Use of GIS to construct waypoints for use in GPS navigation. (Typically Offered: Fall)

NREM 4520: Ecosystem Management: Integrating Ecology, Society, and Policy

(Dual-listed with FOR 5520/ NREM 5520). (Cross-listed with FOR 4520).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Junior or Senior classification; (NREM 1200 or BIOL 1730)

Principles of planning, regulating, and decision-making associated with public and private lands, with consideration of forest, grassland, wetland, and freshwater aquatic ecosystems. Integrated natural resources management within ecological, social, economic and policy constraints. (Typically Offered: Spring)

NREM 4550: Stream Restoration

(Dual-listed with NREM 5550). (Cross-listed with GEOL 4550).

Credits: 3. Contact Hours: Laboratory 3, Lecture 2.

Prereq: CE 3720 or GEOL 4020 or NREM 4070 or AECL 4180 or ABE 4310

Interdisciplinary introduction to the science and practice of stream restoration, with emphasis on restoring physical and biological integrity and ecosystem services to streams and riparian corridors. Offered odd-numbered years. (Typically Offered: Fall)

NREM 4600: Controversies in Natural Resource Management

(Cross-listed with ENVS 4600).

Credits: 3. Contact Hours: Lecture 3.

Prereq: AECL 3120 or NREM 3010, NREM 1200, and Junior classification

Analysis of controversial natural resource issues using a case approach that considers uncertainty and adequacy of information and scientific understanding. Ecological, social, political, economic, and ethical implications of issues will be analyzed. (Typically Offered: Fall, Spring)

NREM 4660: Ecosystem Services

(Dual-listed with ENSCI 5660/ NREM 5660). (Cross-listed with ENSCI 4660).

Credits: 3. Contact Hours: Lecture 2, Discussion 1.

Prereq: 15 credits in AECL, AGRON, BIOL, CHEM, FOR, GEOL, NREM

Ecosystem services are the societal benefits provided by natural and managed ecosystems. Benefits such as provision of food, purification of air and water, and regulation of climate are essential to human survival and prosperity, but rely upon maintenance of healthy ecosystems. This course will cover the science, policy, and practice of ecosystem services assessment and management, with a special focus on biodiversity, water quality, food production, and climate. Offered odd-numbered years. (Typically Offered: Spring)

NREM 4710: Agroforestry Systems

(Dual-listed with NREM 5710/ SUSAG 5710).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 6 credits in biological science at 3000 level or above

Concepts of sustainable land use, agroecological dynamics, and component interactions of agroforestry systems. Agroforestry systems in temperate and tropical regions. Design and evaluation techniques for agroforestry systems. Ecological, socioeconomic and political aspects of agroforestry. Offered even-numbered years. Meets International Perspectives Requirement. (Typically Offered: Spring)

NREM 4830: Science + Design: Interpretation of Natural Resources in Montana

(Dual-listed with NREM 5830/ ARTGR 5830). (Cross-listed with ARTGR 4830).

Credits: 3. Contact Hours: Lecture 1, Studio 4.

Prereq: Enrollment in ARTGR major; ARTGR 2710 or BIOL 2110; Permission of Instructor.

Interdisciplinary service-learning. Design and production of natural resource related interpretive signs for Montana natural areas. Field-work experience followed by on-campus studio. (Typically Offered: Fall)

NREM 4850: Undergraduate Seminar

Credits: 1. Contact Hours: Lecture 1.

Repeatable, maximum of 2 times.

Prereq: Major in Animal Ecology or Forestry; Junior or Senior classification; Permission of Instructor

Weekly seminars on current research topics in natural resource ecology and management. Style and best practice in oral research communication. Skills and principles for evaluating research merit and quality of technical communication. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

NREM 4890: Survey of Remote Sensing Technologies

(Dual-listed with MTEOR 5890/ EE 5890/ ENSCI 5890/ GEOL 5890/ NREM 5890). (Cross-listed with EE 4890/ ENSCI 4890/ GEOL 4890/ MTEOR 4890).

Credits: 3. Contact Hours: Lecture 3.

Electromagnetic-radiation principles, active and passive sensors, multispectral and hyperspectral sensors, imaging radar, SAR, thermal imaging, lidar. Examples of applications. Also offered online S. (Typically Offered: Fall)

NREM 4890L: Satellite Remote Sensing Laboratory

(Dual-listed with MTEOR 5890L/ EE 5890L/ GEOL 5890L/ NREM 5890L). (Cross-listed with EE 4890L/ GEOL 4890L/ MTEOR 4890L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Completion or concurrent enrollment in MTEOR/GEOL/NREM/ EE 4890/5890

Processing and analysis of satellite sensor data (optical and radar). Provides practical applications in an environmental context. (Typically Offered: Fall)

NREM 4900A: Independent Study: Animal Ecology

Credits: 1-4. Repeatable, maximum of 4 credits.

Prereq: Restricted to Junior or Senior classifications, Instructor permission required

Offered on a satisfactory-fail basis only.

NREM 4900B: Independent Study: Forestry

Credits: 1-4. Repeatable, maximum of 4 credits.

Prereq: Restricted to Junior or Senior classifications, Instructor permission required

Offered on a satisfactory-fail basis only.

NREM 4900E: Independent Study: Entrepreneurship

Credits: 1-4. Repeatable, maximum of 4 credits.

Prereq: Restricted to Junior or Senior classifications, Instructor permission required

NREM 4900H: Independent Study

Credits: 1-4. Repeatable, maximum of 4 credits.

Prereq: Junior or Senior classification; Instructor Permission; Membership in the University Honors Program

Offered on a satisfactory-fail basis only.

NREM 4960A: Travel Course: International

(Dual-listed with NREM 5960A).

Credits: 1-5. Repeatable, maximum of 3 times.

Limited enrollment. Extended field trips to study ecological and management topics in varied environments. Location and duration of trips will vary. Pre-trip sessions arranged. Trip expenses paid by students. Meets International Perspectives Requirement.

NREM 4960B: Travel Course: Domestic

(Dual-listed with NREM 5960B).

Credits: 1-5. Repeatable, maximum of 3 times.

Prereq: Instructor Permission for Course

Limited enrollment. Extended field trips to study ecological and management topics in varied environments. Location and duration of trips will vary. Pre-trip sessions arranged. Trip expenses paid by students.

NREM 4980: Cooperative Education

Credits: 1-3. Repeatable.

Prereq: Department Chair Permission for Course

Required of all cooperative education students. Students must register prior to commencing each work period. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

NREM 5020: Watershed Hydrology

(Dual-listed with GEOL 4020/ ENSCI 4020/ MTEOR 4020/ NREM 4020).

(Cross-listed with ENSCI 5020/ MTEOR 5020/ GEOL 5020).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Examination of watersheds as systems, emphasizing the surface components of the hydrologic cycle. Combines qualitative understanding of hydrological processes and uncertainty with quantitative representation. Laboratory emphasizes field investigation and measurement of watershed processes. (Typically Offered: Fall)

NREM 5040: Forest Landscapes, Wildlife, and Silviculture

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Desired forest habitat conditions for fish and wildlife. Silvicultural approaches to protecting/improving such habitats. Focus on key forest elements related to animal species, groups and overall diversity. The lab focuses on team observations and discussions of diverse habitats including one weekend field trip. Offered odd-numbered years. (Typically Offered: Fall)

NREM 5050: Seminar

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable, maximum of 3 times.

Prereq: Graduate Standing or Permission of Instructor

Current topics in natural resources research and management. (Typically Offered: Fall, Spring)

NREM 5070: Watershed Management

(Dual-listed with ENVS 4070/ NREM 4070/ ENSCI 4070). (Cross-listed with ENSCI 5070).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Managing human impacts on the hydrologic cycle. Field and watershed level best management practices for modifying the impacts on water quality, quantity and timing are discussed. Field project includes developing a management plan using landscape buffers. (Typically Offered: Spring)

NREM 5330: Erosion and Sediment Transport

(Cross-listed with ABE 5330/ ENSCI 5330/ GEOL 5330).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Soil erosion processes, soil loss equations and their application to conservation planning, sediment properties, initiation of sediment motion and over land flow, flow in alluvial channels and theory of sediment transport, channel stability, reservoir sedimentation, wind erosion, BMPs for controlling erosion. Offered even-numbered years. (Typically Offered: Fall)

NREM 5350: Restoration Ecology

(Cross-listed with EEOB 5350/ ENSCI 5350).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Theory and practice of restoring animal and plant diversity, structure and function of disturbed ecosystems. Restored freshwater wetlands, forests, prairies and reintroduced species populations will be used as case studies. Offered even-numbered years. (Typically Offered: Fall)

NREM 5420A: Introduction to Molecular Biology Techniques: DNA Techniques

(Cross-listed with BMS 5420A/ EEOB 5420A/ FSHN 5420A/ GDCB 5420A/ HORT 5420A/ BBMB 5420A/ NUTRS 5420A/ VDPAM 5420A/ VMPPM 5420A).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes genetic engineering procedures, sequencing, PCR, and genotyping. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

NREM 5420B: Introduction to Molecular Biology Techniques: Protein

(Cross-listed with BMS 5420B/ EEOB 5420B/ FSHN 5420B/ GDCB 5420B/ HORT 5420B/ BBMB 5420B/ NUTRS 5420B/ VDPAM 5420B).

Credits: 1. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. Offered on a satisfactory-fail basis only. (Typically Offered: Spring, Summer)

NREM 5420C: Introduction to Molecular Biology Techniques: Cell Techniques

(Cross-listed with BMS 5420C/ EEOB 5420C/ FSHN 5420C/ GDCB 5420C/ HORT 5420C/ BBMB 5420C/ NUTRS 5420C/ VMPPM 5420C/ VDPAM 5420C).

Credits: 1. Contact Hours: Laboratory 2.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. ular biology techniques and related procedures. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

NREM 5420D: Introduction to Molecular Biology Techniques: Plant Transformation

(Cross-listed with BMS 5420D/ EEOB 5420D/ FSHN 5420D/ GDCB 5420D/ HORT 5420D/ BBMB 5420D/ NUTRS 5420D/ VMPPM 5420D/ VDPAM 5420D).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: Agrobacterium and particle gun-mediated transformation of tobacco, Arabidopsis, and maize, and analysis of tranformants. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

NREM 5420E: Introduction to Molecular Biology Techniques: Proteomics

(Cross-listed with BMS 5420E/ EEOB 5420E/ FSHN 5420E/ GDCB 5420E/ HORT 5420E/ BBMB 5420E/ NUTRS 5420E/ VMPM 5420E/ VDPAM 5420E).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: two-dimensional electrophoresis, laser scanning, mass spectrometry, and database searching. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

NREM 5420F: Introduction to Molecular Biology Techniques:**Metabolomics**

(Cross-listed with BMS 5420F/ EEOB 5420F/ FSHN 5420F/ GDCB 5420F/ HORT 5420F/ BBMB 5420F/ NUTRS 5420F/ VMPM 5420F/ VDPAM 5420F).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: metabolomics and the techniques involved in metabolite profiling. For non-chemistry majoring students who are seeking analytical aspects into their biological research projects. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

NREM 5420G: Introduction to Molecular Biology Techniques: Genomic

(Cross-listed with BMS 5420G/ EEOB 5420G/ FSHN 5420G/ GDCB 5420G/ HORT 5420G/ BBMB 5420G/ NUTRS 5420G/ VMPM 5420G/ VDPAM 5420G).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

NREM 5460: Integrating GPS and GIS for Natural Resource Management

(Dual-listed with NREM 4460/ ENSCI 4460). (Cross-listed with ENSCI 5460).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Emphasis on the use of GPS as a data collection tool for GIS. Basic theory of GPS. Use of Global Positioning System technology for spatial data collection and navigation. Post-processing and real-time correction of GPS data. GPS data transfer to GIS for mapping applications. Use of GIS to construct waypoints for use in GPS navigation. (Typically Offered: Fall)

NREM 5520: Ecosystem Management: Integrating Ecology, Society, and Policy

(Dual-listed with FOR 4520/ NREM 4520). (Cross-listed with FOR 5520).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Principles of planning, regulating, and decision-making associated with public and private lands, with consideration of forest, grassland, wetland, and freshwater aquatic ecosystems. Integrated natural resources management within ecological, social, economic and policy constraints. (Typically Offered: Spring)

NREM 5550: Stream Restoration

(Dual-listed with NREM 4550). (Cross-listed with GEOL 5550).

Credits: 3. Contact Hours: Laboratory 3, Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Interdisciplinary introduction to the science and practice of stream restoration, with emphasis on restoring physical and biological integrity and ecosystem services to streams and riparian corridors. Offered odd-numbered years. (Typically Offered: Fall)

NREM 5550L: Stream Restoration Lab

(Dual-listed with NREM 4550L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to measurement and analysis of stream form and function for restoration and rehabilitation. Includes field data collection, map and image analysis, and computation for assessment of channel stability, biotic integrity, and recovery potential. Offered odd-numbered years. (Typically Offered: Fall)

NREM 5660: Ecosystem Services

(Dual-listed with ENSCI 4660/ NREM 4660). (Cross-listed with ENSCI 5660).

Credits: 3. Contact Hours: Lecture 2, Discussion 1.

Prereq: Graduate Standing or Permission of Instructor

Ecosystem services are the societal benefits provided by natural and managed ecosystems. Benefits such as provision of food, purification of air and water, and regulation of climate are essential to human survival and prosperity, but rely upon maintenance of healthy ecosystems. This course will cover the science, policy, and practice of ecosystem services assessment and management, with a special focus on biodiversity, water quality, food production, and climate. Offered odd-numbered years. (Typically Offered: Spring)

NREM 5700: Advanced Decision-making in Natural Resource Allocation

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Analytical approach to economic aspects of forest resource management problems. Theory and application of economic decision-making criteria to traditional and modern forest resource management issues. Current problems in the allocation of forest resources. Offered even-numbered years. (Typically Offered: Spring)

NREM 5710: Agroforestry Systems

(Dual-listed with NREM 4710/ SUSAG 4710). (Cross-listed with SUSAG 5710).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Concepts of sustainable land use, agroecological dynamics, and component interactions of agroforestry systems. Agroforestry systems in temperate and tropical regions. Design and evaluation techniques for agroforestry systems. Ecological, socioeconomic and political aspects of agroforestry. Offered even-numbered years. Meets International Perspectives Requirement. (Typically Offered: Spring)

NREM 5830: Science + Design: Interpretation of Natural Resources in Montana

(Dual-listed with NREM 4830/ ARTGR 4830). (Cross-listed with ARTGR 5830).

Credits: 3. Contact Hours: Lecture 1, Studio 4.

Prereq: Graduate Standing or Permission of Instructor

Interdisciplinary service-learning. Design and production of natural resource related interpretive signs for Montana natural areas. Field-work experience followed by on-campus studio. (Typically Offered: Fall)

NREM 5850: Natural Resource Policy

(Dual-listed with NREM 3850).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Development, theory and practice of natural resource policy. Integrative approach with topical policy studies in North American wildlife, forestry, and water. Policy formation, the role of science, introduction to federal law compliance. (Typically Offered: Spring)

NREM 5890: Survey of Remote Sensing Technologies

(Dual-listed with MTEOR 4890/ EE 4890/ ENSCI 4890/ GEOL 4890/ NREM 4890). (Cross-listed with EE 5890/ ENSCI 5890/ GEOL 5890/ MTEOR 5890).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Electromagnetic-radiation principles, active and passive sensors, multispectral and hyperspectral sensors, imaging radar, SAR, thermal imaging, lidar. Examples of applications. Also offered online S. (Typically Offered: Fall)

NREM 5890L: Satellite Remote Sensing Laboratory

(Dual-listed with MTEOR 4890L/ EE 4890L/ GEOL 4890L/ NREM 4890L).

(Cross-listed with EE 5890L/ GEOL 5890L/ MTEOR 5890L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Processing and analysis of satellite sensor data (optical and radar).

Provides practical applications in an environmental context. (Typically Offered: Fall)

NREM 5900A: Special Topics: Animal Ecology

Credits: 1-4. Repeatable, maximum of 4 credits.

Prereq: Instructor Permission for Course

Offered on a satisfactory-fail basis only.

NREM 5900B: Special Topics: Forestry

Credits: 1-4. Repeatable, maximum of 4 credits.

Prereq: Instructor Permission for Course

Offered on a satisfactory-fail basis only.

NREM 5930: Workshop

Credits: 1-3. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

NREM 5960A: Travel Course: International

(Dual-listed with NREM 4960A).

Credits: 1-5. Repeatable, maximum of 3 times.

Prereq: Graduate Standing or Permission of Instructor

Limited enrollment. Extended field trips to study ecological and management topics in varied environments. Location and duration of trips will vary. Pre-trip sessions arranged. Trip expenses paid by students.

NREM 5960B: Travel Course: Domestic

(Dual-listed with NREM 4960B).

Credits: 1-5. Repeatable, maximum of 3 times.

Prereq: Graduate Standing or Permission of Instructor

Limited enrollment. Extended field trips to study ecological and management topics in varied environments. Location and duration of trips will vary. Pre-trip sessions arranged. Trip expenses paid by students.

NREM 5980: Natural Resource Ecology and Management Teaching Practicum

Credits: 1.

Prereq: Graduate classification and Permission of Instructor

Graduate student experience in teaching. Student must plan and present at least one unit of subject matter in a course or extension workshop.

Teaching practicum must be documented by the student and approved by the student's POS committee. Offered on a satisfactory-fail basis only.

(Typically Offered: Fall, Spring, Summer)

NREM 5990: Creative Component

Credits: 1-30. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Offered on a satisfactory-fail basis only.

Courses for graduate students:**NREM 6000: Seminar**

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Current topics in natural resources research and management. (Typically Offered: Fall, Spring)

NREM 6980: Natural Resource Ecology and Management Teaching Practicum

Credits: 1.

Prereq: Graduate classification and Permission of Instructor

Graduate student experience in teaching. Student must plan and present substantive subject matter for a minimum of three weeks in lecture and/or laboratory formats, or a series of extension seminars/workshops.

Teaching practicum must be documented by the student and approved by the student's POS committee. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

NREM 6990: Research

Credits: 1-12. Repeatable, maximum of 12 credits.

Offered on a satisfactory-fail basis only.

Naval Science (NS)

Courses primarily for undergraduates:**NS 1110: Introduction to Naval Science**

Credits: 3. Contact Hours: Lecture 3, Laboratory 3.

Introduction to the organization, regulations, and capabilities of the US Navy, with emphasis on mission and principal warfare components.

(Typically Offered: Fall)

NS 2120: Seapower and Maritime Affairs

Credits: 3. Contact Hours: Lecture 3, Laboratory 3.

An historical survey of sea power in terms of national domestic environments, foreign policy, and the evolution of maritime forces with trends in technology, doctrine, and tactics. The student will develop an understanding of the role the US Navy has played in the nation's history, both in peace and war. Naval events, forces and policies will be studied as elements in the shaping of the national consciousness and sense of purpose. Course content will include the development of the concept of sea power, the role of various warfare components of the Navy, the implementation of sea power as an instrument of national policy, the evolution of naval tactics, and the influence of maritime affairs around the world. (Typically Offered: Spring)

NS 2200: Leadership and Management

Credits: 3. Contact Hours: Lecture 3, Laboratory 3.

Introduction to the basic concepts of management and organization, their application to operations and personnel management. Experiential approach to learning principles of leadership and management by examining various management theories and their applications. Skills are developed in the areas of communication, counseling, control, direction, management, and leadership through active guided participation. (Typically Offered: Fall)

NS 2300: Navigation

Credits: 3. Contact Hours: Lecture 3, Laboratory 3.

Prereq: Sophomore classification

Study of the fundamentals of marine navigation used by ships at sea; includes practical exercises in piloting using visual and electronic means. In-depth discussion of laws that govern conduct of vessels in national and international waters. Course is supplemented with review and analysis of case studies involving actual navigation incidents. (Typically Offered: Spring)

NS 2400: Fundamentals of Maneuver Warfare

Credits: 3. Contact Hours: Lecture 3.

Prereq: NS 1110

Concepts, definition, and need for maneuver warfare and expeditionary operations. US Marine Corps case studies of specific battles, development, and implementation. Structure, operation and capabilities of the Marine expeditionary unit, Marine air-ground task force and expeditionary strike group. Discussion and incorporation of leadership traits and principles. Offered odd-numbered years. (Typically Offered: Spring)

NS 3200: Naval Ship Systems I (Engineering)

Credits: 3. Contact Hours: Lecture 3, Laboratory 3.

Prereq: PHYS 2310; PHYS 2310L; Sophomore classification

An introduction to naval engineering with emphasis on the equipment and machinery involved in the conversion of energy for propulsion and other purposes aboard the major ship types of the U.S. fleet. Basic concepts of the theory and design of steam, gas turbine, diesel, and nuclear propulsion. Introduction to ship design, stability, hydrodynamic forces, compartmentalization, electrical and auxiliary systems. (Typically Offered: Fall)

NS 3210: Evolution of Warfare

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Sophomore classification

Evolution of warfare from 3500 B.C. to contemporary times; analysis of the impact of historical precedents on modern military thought and action; emphasis on the historical development of military tactics, strategy, and technology. Offered even-numbered years. (Typically Offered: Spring)

NS 3300: Naval Ship Systems II (Weapons)

Credits: 3. Contact Hours: Lecture 3, Laboratory 3.

Prereq: PHYS 2310; Sophomore classification

Introduction to the theory and principles of operation of naval weapon systems. Included coverage of types of weapons and fire control systems, capabilities and limitations; theory of target acquisition, identification and tracking; basics of naval ordnance. (Typically Offered: Spring)

NS 4100: Naval Operations and Seamanship

Credits: 3. Contact Hours: Lecture 3, Laboratory 3.

Prereq: NS 2300; Senior classification

Study of tactical naval operations; employs practical use of maneuvering boards together with shiphandling principles to arrive at tactical shipboard maneuvering solutions. Study also of naval command and control, communications, and the Naval Warfare Doctrine. (Typically Offered: Fall)

NS 4120: Leadership and Ethics

Credits: 3. Contact Hours: Lecture 3, Laboratory 3.

Prereq: NS 1110; (HIST 3890 or NS 2120); NS 2200; NS 2300; NS 3200; NS 3300; NS 4100

Basic background concerning the duties and responsibilities of the junior naval officer and division officer in the areas of integrity and ethics, human resources management, personnel management, material management, and the administration of discipline. Preparation for responsibilities encountered immediately upon commissioning. (Typically Offered: Spring)

NS 4400: Senior Naval Science Seminar

Credits: 1. Contact Hours: Lecture 1.

Current leadership issues in the US Navy which will challenge the newly commissioned officer. Opportunities to analyze, provide solutions, and discuss actions related to a variety of real world situations. (Typically Offered: Fall, Spring)

NS 4900: Independent Study

Credits: 1-3. Repeatable, maximum of 9 credits.

Prereq: 6 credits in NS; Permission of Department Chair; Senior classification

Graduation Restriction: No more than 9 credits of NS 4900 may be counted toward graduation.

Neuroscience (NEURO)

Courses primarily for graduate students, open to qualified undergraduates:

NEURO 5560: Cellular, Molecular and Developmental Neuroscience

(Cross-listed with BMS 5560/ GDCB 5560).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Fundamental principles of neuroscience including cellular and molecular neuroscience, nervous system development, and regulatory systems. Offered odd-numbered years. (Typically Offered: Fall)

NEURO 5570: Rotations in Neuroscience

(Cross-listed with GDCB 5570).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Rotation experiences in various neuroscience research methods and techniques related to our current faculty specialties. (Typically Offered: Fall, Spring)

NEURO 5890: Systems Neuroscience: Brain, Behavior, and Nutrition-Related Integrative Physiology

(Cross-listed with FSHN 5890/ GERON 5890/ NUTRS 5890/ PSYCH 5890).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Qualified Undergraduate with Permission of Instructor

Structural, functional, and biochemical aspects of brain and non-motor behavior across the human lifespan. Types of neuroimaging used to assess the brain. Current research is leveraged to gauge how nutrition, diseases related to nutrition, and associated physiological processes influence the brain, particularly for common developmental, psychological, and neurological disorders. (Typically Offered: Spring)

Courses for graduate students:**NEURO 6610: Advanced Topics in Neuroscience**

(Cross-listed with BBMB 6610/ KIN 6610/ GDCB 6610).

Credits: 3. Contact Hours: Lecture 3.

Students will present three journal articles and two overview lectures on topics in neuroscience that are related but outside of their own research interest. Offered even-numbered years. (Typically Offered: Spring)

NEURO 6960: Neuroscience Seminar

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Seminar in neuroscience, current research interests, and/or professional development. (Typically Offered: Fall, Spring)

NEURO 6990: Research

Credits: 1-13. Repeatable.

Prereq: Instructor Permission for Course

Nursing (NRS)

Courses primarily for undergraduates:

NRS 2500: Introduction to BSN Nursing

Credits: 1. Contact Hours: Lecture 1.

Prereq: accepted into Nursing major

Designed to prepare the learner for the academic experience. Topics will include an introduction to student-centered learning, support services, communication, time management, and evaluation and assessment methods. The development of professional and scholarly writing skills for success will be emphasized. (Typically Offered: Fall)

NRS 3200: Essential Concepts for Professional Nursing Practice

Credits: 3. Contact Hours: Lecture 3.

Prereq: accepted into Nursing major

Philosophical, conceptual, and theoretical foundations of baccalaureate nursing practice will be centered around nursing professionalism and professional identity. Essential concepts that affect the nursing profession and healthcare from both historical and contemporary perspectives will be examined. Professional role development, interprofessional partnerships, healthcare technologies and informatics, and effective communication focusing on person-centered care will be addressed. (Typically Offered: Fall)

NRS 3400: Nursing Research and Evidence-Based Practice

Credits: 4. Contact Hours: Lecture 4.

Prereq: accepted into Nursing major

NRS 3400 has an \$80.00 course fee. Introduction to the critical thought processes and methods used in nursing research. Basic concepts and terminology of research methodology and analysis are presented. Ethical comportment in the conduct and dissemination of research and advocacy for human subjects will be addressed, as well as strategies for the implementation of evidence-based nursing practice to support quality and transformation in healthcare. Learners will interpret and evaluate nursing research, create a professional nursing research proposal poster, and present their research proposal in a public forum. (Typically Offered: Fall)

NRS 3600: Nursing Leadership and Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: Admission to the RN-to-BSN program

Examines the knowledge and skills necessary in nursing leadership and management roles in different healthcare settings. Explores the role of the nurse leader through various topics such as effective communication, organizational structure, information management, financial management, quality and outcomes measurement, and teamwork. Focus on transformational leadership and combine theoretical knowledge with practical case studies to gain a comprehensive understanding of the nurse leader role. (Typically Offered: Fall)

NRS 4200: Promoting a Culture of Health and Wellness

Credits: 3. Contact Hours: Lecture 3.

Prereq: accepted into Nursing major

Examines the culture of health, health promotion, and illness prevention across the lifespan in the context of theoretical foundations, historical and contemporary practice, and person-centered care. Complementary and alternative therapeutics to achieve personal goals that promote and maintain health, healing and wellness, build resilience, and incorporate self-care management strategies will be explored through a lens that considers personal perceptions of health and assesses lifestyle practices and patterns. (Typically Offered: Fall)

NRS 4400: Population Health Nursing

Credits: 3. Contact Hours: Lecture 3.

Prereq: NRS 3400 and NRS 4200

Addresses factors that affect the health outcomes and distribution of health among aggregates across the lifespan. Exploration of social determinants of health, epidemiology, genetics, health promotion and illness prevention, community assessment and intervention, and factors influencing health services access and delivery in the United States and globally. Individual and family case management, community wellness, health literacy, and health education will also be examined. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Spring)

NRS 4420: Population Health Nursing Practicum

Credits: 1-2.

Prereq: Credit or enrollment in NRS 4400

Practicum experience to accompany NRS 4400 for learners to see firsthand how social determinants of health impact health and health outcomes and learn from organizations that support and provide resources for vulnerable populations. Includes simulation and group immersion practicum experiences. (Typically Offered: Spring, Summer)

NRS 4700: Global Health Nursing

Credits: 3. Contact Hours: Lecture 3.

Concentrates on the delivery of health care globally and examines the influence of programs, systems, and policies on global health. Evaluation of natural and manmade disasters, and environmental, social, political, and economic factors that shape patterns and experiences of illness and health globally. Learners will reflect on their own worldviews, perceptions, and the influence of global issues on their own lives. (Typically Offered: Spring)

NRS 4800: Advanced Concepts of Professional Nursing

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or enrollment in NRS 4400 and NRS 4600

Exploration of professional issues in contemporary nursing through published research, professional standards, literature, and narrative evidence, with consideration of legal, political, and ethical influences. Equips learners with the necessary skills to become change agents and empower themselves to solve problems and advocate for change. (Typically Offered: Spring)

NRS 4900A: Independent Study: Transition into Professional Practice

Credits: 1-2. Repeatable, maximum of 4 credits.

Prereq: accepted into Nursing major

Independent work exploring diverse nursing roles as a professional nurse. A maximum of 4 credits of NRS 4900 may be used toward graduation. (Typically Offered: Fall, Spring, Summer)

NRS 4900B: Independent Study: Special Topics in Nursing

Credits: 1-2. Repeatable, maximum of 4 credits.

Prereq: accepted into Nursing major

Independent work in nursing. Graduation Restriction: A maximum of 4 credits of NRS 4900 may be used toward graduation. (Typically Offered: Fall, Spring, Summer)

NRS 4900C: Independent Study: International Experience

Credits: 1-2. Repeatable, maximum of 4 credits.

Prereq: Accepted into Nursing Major or Permission of Director of Nursing Education

Independent work in nursing. Graduation Restriction: A maximum of 4 credits of NRS 4900 may be used toward graduation. (Typically Offered: Fall, Spring, Summer)

Courses for graduate students:

NRS 6020X: Facilitating Learning and Learner Development in Nursing Education

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 2 times.

This course examines the multi dimensional roles of a nurse educator, focusing on the knowledge of teaching and learning theories, principles, and strategies. The course explores the roles and responsibilities of the nurse educator as a teacher, leader, change agent, and curriculum innovator. Emphasis is placed on innovative, transformational, and experiential teaching and learning strategies to support student development in multiple learning environments while addressing the needs of diverse learners. Take concurrently with NRS 6040 and NRS 6060. (Typically Offered: Fall)

NRS 6040X: Curriculum Design and Evaluation of Outcomes in Nursing Education

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 2 times.

This course will provide students with the knowledge and requisite skill set needed to effectively design, develop, implement, and evaluate outcomes in nursing education. Students will analyze concepts of nursing curricula based on national nursing accreditation standards and instructional design best practices to support learning in a diverse, real-world environment while reflecting contemporary trends in nursing education. Take concurrently with NRS 6020 and NRS 6060. (Typically Offered: Fall)

NRS 6060X: Teaching and Learning Strategies: Integrating Technology into Nursing Education

Credits: 3. Repeatable, maximum of 2 times.

This course focuses on the effective use of instructional technology to support learning-centered teaching, such as maximizing the use of current learning-management systems, presentations, and best practices for online teaching and learning. This course emphasizes pedagogically sound applications of instructional technologies from the perspective of theory, research, practice, and future needs. This course requires 45 clinical hours. Take concurrently with NRS 6020 and NRS 6040. (Typically Offered: Fall)

NRS 6100X: Nurse Educator Role: Seminar and Teaching Practicum

Credits: 3. Repeatable, maximum of 2 times.

This course provides students with a guided experience that meets the core competencies of nurse educators. Under the supervision of an experienced educator-preceptor, students will complete a teaching practicum in which they will assess learning styles and needs, teach diverse learners, develop critical thinking skills, socialize learners to the nursing role, and promote professional values within nursing. This course requires 90 clinical hours. (Typically Offered: Spring)

Nutritional Sciences (NUTRS)

Courses primarily for graduate students, open to qualified undergraduates:

NUTRS 5040: Nutrition and Epigenetic Regulation of Gene Expression

Credits: 1. Contact Hours: Lecture 1.

Prereq: Graduate Standing or Permission of Instructor

Discussion of epigenetic regulation of gene expression and the role that nutrition plays in this process. Examination of current research literature to understand how different nutrients and physiological states influence epigenetics, as well as, the research methodology used to address these relations. (Typically Offered: Fall, Spring, Summer)

NUTRS 5050: Short Course

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

NUTRS 5100: Advanced Nutrition and Metabolism in Health and Disease: Macronutrients

Credits: 2. Contact Hours: Lecture 2.

Metabolism of carbohydrates, lipids, and proteins; relation of these macronutrients to health and disease. (Typically Offered: Fall)

NUTRS 5110: Advanced Nutrition and Metabolism in Health and Disease: Micronutrients

Credits: 2. Contact Hours: Lecture 2.

Metabolism of vitamins (fat and water-soluble) and minerals; relation of these micronutrients to health and disease. (Typically Offered: Spring)

NUTRS 5180: Digestive Physiology and Metabolism of Non Ruminants
(Cross-listed with ANS 5180).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ANS 4190 or NUTRS 5010 or Graduate Classification

Digestion and metabolism of nutrients. Nutritional requirements and current research and feeding programs for poultry and swine. Offered odd-numbered years. (Typically Offered: Spring)

NUTRS 5200: Digestive Physiology and Metabolism of Ruminants
(Cross-listed with ANS 5200).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: ANS 4190 or NUTRS 5010 or Graduate Classification

Digestive physiology and nutrient metabolism in ruminant and preruminant animals. Offered even-numbered years. (Typically Offered: Spring)

NUTRS 5420A: Introduction to Molecular Biology Techniques: DNA Techniques

(Cross-listed with BMS 5420A/ EEOB 5420A/ FSHN 5420A/ GDCB 5420A/ HORT 5420A/ NREM 5420A/ BBMB 5420A/ VDPAM 5420A/ VMPM 5420A).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes genetic engineering procedures, sequencing, PCR, and genotyping. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

NUTRS 5420B: Introduction to Molecular Biology Techniques: Protein

(Cross-listed with BMS 5420B/ EEOB 5420B/ FSHN 5420B/ GDCB 5420B/ HORT 5420B/ NREM 5420B/ BBMB 5420B/ VDPAM 5420B).

Credits: 1. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. Offered on a satisfactory-fail basis only. (Typically Offered: Spring, Summer)

NUTRS 5420C: Introduction to Molecular Biology Techniques: Cell Techniques

(Cross-listed with BMS 5420C/ EEOB 5420C/ FSHN 5420C/ GDCB 5420C/ HORT 5420C/ NREM 5420C/ BBMB 5420C/ VMPM 5420C/ VDPAM 5420C).

Credits: 1. Contact Hours: Laboratory 2.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. ular biology techniques and related procedures. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

NUTRS 5420D: Introduction to Molecular Biology Techniques: Plant Transformation

(Cross-listed with BMS 5420D/ EEOB 5420D/ FSHN 5420D/ GDCB 5420D/ HORT 5420D/ NREM 5420D/ BBMB 5420D/ VMPM 5420D/ VDPAM 5420D).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: Agrobacterium and particle gun-mediated transformation of tobacco, Arabidopsis, and maize, and analysis of tranformants. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

NUTRS 5420E: Introduction to Molecular Biology Techniques: Proteomics

(Cross-listed with BMS 5420E/ EEOB 5420E/ FSHN 5420E/ GDCB 5420E/ HORT 5420E/ NREM 5420E/ BBMB 5420E/ VMPM 5420E/ VDPAM 5420E).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: two-dimensional electrophoresis, laser scanning, mass spectrometry, and database searching. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

NUTRS 5420F: Introduction to Molecular Biology Techniques:

Metabolomics

(Cross-listed with BMS 5420F/ EEOB 5420F/ FSHN 5420F/ GDCB 5420F/ HORT 5420F/ NREM 5420F/ BBMB 5420F/ VMPPM 5420F/ VDPAM 5420F).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: metabolomics and the techniques involved in metabolite profiling. For non-chemistry majoring students who are seeking analytical aspects into their biological research projects. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

NUTRS 5420G: Introduction to Molecular Biology Techniques: Genomic

(Cross-listed with BMS 5420G/ EEOB 5420G/ FSHN 5420G/ GDCB 5420G/ HORT 5420G/ NREM 5420G/ BBMB 5420G/ VMPPM 5420G/ VDPAM 5420G).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

NUTRS 5490: Advanced Vertebrate Physiology I

(Cross-listed with KIN 5490/ ANS 5490).

Credits: 4. Contact Hours: Lecture 4.

Prereq: Undergraduate course in Physiology and Biochemistry

Overview of mammalian physiology. Cell biology, endocrinology, cardiovascular, respiratory, immune, digestive, skeletal muscle and reproductive systems. (Typically Offered: Fall)

NUTRS 5610: Medical Nutrition and Disease I

(Dual-listed with FSHN 4610).

Credits: 4. Contact Hours: Lecture 4.

Prereq: BIOL 2560 or BIOL 3350; FSHN 3600; FSHN 3610; FSHN 3670

Pathophysiology of selected chronic disease states and their associated medical problems. Specific attention will be directed to medical nutrition needs of patients in the treatment of each disease state to optimize nutritional status and improve health. (Typically Offered: Fall, Spring, Summer)

NUTRS 5630: Community Nutrition and Health

(Dual-listed with FSHN 4630).

Credits: 3. Contact Hours: Lecture 3.

Prereq: FSHN 2650 or FSHN 3600; FSHN 3610

Dual listed with FSHN 4630. Survey of current public health nutrition problems among nutritionally vulnerable individuals and groups. Discussion of the multidimensional nature of those problems and of community programs addressing them. Grant writing as a means for funding community nutrition program development. Significant emphasis on written and oral communication at the lay and professional level. (Typically Offered: Fall, Spring, Summer)

NUTRS 5640: Medical Nutrition and Disease II

(Dual-listed with FSHN 4640).

Credits: 4. Contact Hours: Lecture 4.

Prereq: FSHN 3600; FSHN 4610 or NUTRS 5610

Dual listed with FSHN 4640. Pathophysiology of selected acute and chronic disease states and their associated medical problems. Specific attention will be directed to medical nutrition needs of patients in the treatment of each disease state to optimize nutritional status and promote health. (Typically Offered: Fall, Spring, Summer)

NUTRS 5890: Systems Neuroscience: Brain, Behavior, and Nutrition-Related Integrative Physiology

(Cross-listed with FSHN 5890/ GERON 5890/ NEURO 5890/ PSYCH 5890).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Qualified Undergraduate with Permission of Instructor

Structural, functional, and biochemical aspects of brain and non-motor behavior across the human lifespan. Types of neuroimaging used to assess the brain. Current research is leveraged to gauge how nutrition, diseases related to nutrition, and associated physiological processes influence the brain, particularly for common developmental, psychological, and neurological disorders. (Typically Offered: Spring)

Courses for graduate students:

NUTRS 6180: Vitamins and Minerals

(Cross-listed with ANS 6180).

Credits: 2. Contact Hours: Lecture 2.

Understanding molecular aspects of vitamin and mineral metabolism and homeostasis in humans and animals. An in-depth examination of the chemistry of vitamins and minerals, including genetic mutations, proteins involved in absorption and excretion, and their necessity in biological processes. Offered even-numbered years. (Typically Offered: Spring)

NUTRS 6190: Advanced Nutrition and Metabolism - Protein

(Cross-listed with ANS 6190).

Credits: 2. Contact Hours: Lecture 2.

Prereq: BBMB 4050

Digestion, absorption, and intermediary metabolism of amino acids and protein. Regulation of protein synthesis and degradation. Integration of cellular biochemistry and physiology of mammalian protein metabolism. Offered odd-numbered years. (Typically Offered: Fall)

NUTRS 6200: Advanced Nutrition and Metabolism - Energy

(Cross-listed with ANS 6200).

Credits: 2. Contact Hours: Lecture 2.

Prereq: BBMB 4050

Energy constituents of feedstuffs and energy needs of animals as related to cellular biochemistry and physiology. Interpretations of classical and current research. Offered odd-numbered years. (Typically Offered: Fall)

NUTRS 6800: Modern Views of Nutrition

Credits: Required. Contact Hours: Lecture 1.

Repeatable.

Current concepts in nutrition and related fields. (Typically Offered: Fall, Spring, Summer)

NUTRS 6900: Special Problems

Credits: 1-30. Repeatable.

(Typically Offered: Fall, Spring, Summer)

NUTRS 6950: Grant Proposal Writing

(Cross-listed with FSHN 6950).

Credits: 1. Contact Hours: Lecture 1.

Prereq: 3 credits of graduate course work in food science or nutritional sciences

Grant proposal preparation experiences including writing and critiquing of proposals and budget planning. Understanding the grant funding process from federal, foundation, and commodity agencies. Includes preparing a grant for possible submission and participation in the review of proposals. Discussion of the role of successful grant writing in career development. (Typically Offered: Fall, Spring)

NUTRS 6990: Research in Nutritional Sciences

Credits: 1-30. Repeatable.

Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

Organization for Tropical Studies (OTS)

Courses primarily for graduate students, open to qualified undergraduates:

OTS 5100: Tropical Biology: An Ecological Approach

Credits: 8. Contact Hours: Lecture 8.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

This course is designed for students in the early stages of graduate study in biology or a related field, with the goal of training graduate students in research methods by providing intensive field experience in diverse tropical ecosystems.

OTS 5150: Topics in Tropical Biology

Credits: 1-8. Contact Hours: Lecture 8.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

This course is designated for students enrolled in graduate course offerings through OTS (excluding OTS 5100). Examples of graduate courses offered by OTS include Tropical Plant Systematics, Tropical Ecology and Conservation, Molecular Methods in Tropical Ecology, and Tropical Agroecology.

Performing Arts (PERF)

Courses primarily for undergraduates:

PERF 1050: Performing Arts Seminar

Credits: 0.5. Contact Hours: Lecture 0.5.

Repeatable, maximum of 6 times.

Cross-disciplinary exploration of topics in the performing arts taken multiple semesters by Performing Arts majors and minors. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

PERF 3100: Performing Arts Internship

Credits: Required. Repeatable.

Required of performing arts majors. A job or internship with a professional or semi-professional performing arts organization. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

PERF 4010: Performing Arts Capstone Seminar

Credits: 2. Contact Hours: Lecture 2.

Prereq: Senior classification

Collaborative study and practice of topics in the performing arts specifically aimed at preparing students for post-undergraduate life. The course culminates in an individual or group capstone project. Required for performing arts majors. (Typically Offered: Spring)

Philosophy (PHIL)

Courses primarily for undergraduates:

PHIL 2010: Introduction to Philosophy

Credits: 3. Contact Hours: Lecture 3.

It has been rumored that the unexamined life is not worth living. Philosophy is an attempt to begin examining life by considering such questions as: What makes us human? What is the world ultimately like? How should we relate to other people? Is there a god? How can we know anything about these questions? Understanding questions of this kind and proposed answers to them is what this course is all about. (Typically Offered: Fall, Spring, Summer)

PHIL 2060: Introduction to Logic and Scientific Reasoning

Credits: 3. Contact Hours: Lecture 3.

Basic principles of critical reasoning and argument evaluation. A consideration of basic forms of argumentation in science and everyday life. Application to contemporary issues and controversies. (Typically Offered: Fall)

PHIL 2070: Introduction to Symbolic Logic

(Cross-listed with LING 2070).

Credits: 3. Contact Hours: Lecture 3.

Introduction to fundamental logical concepts and logical symbolism. Development of natural deduction through first order predicate logic with identity. Applications to arguments in ordinary English and to philosophical issues. Linguistics majors should take LING/PHIL 2070 as early as possible. (Typically Offered: Fall, Spring)

PHIL 2300: Moral Theory and Practice

Credits: 3. Contact Hours: Lecture 3.

Investigation of moral issues in the context of major ethical theories of value and obligation; e.g., punishment, abortion, economic justice, job discrimination, world hunger, and sexual morality. Emphasis on critical reasoning and argument analysis. (Typically Offered: Fall, Spring, Summer)

PHIL 2350: Ethical Issues in a Diverse Society

Credits: 3. Contact Hours: Lecture 3.

This course will examine a range of arguments on diversity issues. Topics will include: the social status of women, the moral status of sexuality and homosexuality, the nature and role of racism in contemporary society, the relationship between biology, gender roles and social status, and various proposals for change from a variety of political perspectives. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall, Spring)

PHIL 3100: Ancient Philosophy

(Cross-listed with CLST 3100).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 3 credits in PHIL or Permission of Instructor

Survey of ancient Greek philosophy, focusing on the pre-Socratics, Plato, and Aristotle. Questions concerning being, knowledge, language, and the good life are treated in depth. (Typically Offered: Fall)

PHIL 3140: 17th Century Philosophy

Credits: 3. Contact Hours: Lecture 3.

Readings from philosophers such as Hobbes, Descartes, Spinoza, Leibniz, and Locke. Changing conceptions of knowledge, self, and deities in response to Galileo's new science and post-reformation challenge to ecclesiastical authority. Offered even-numbered years. (Typically Offered: Spring)

PHIL 3150: 18th Century Philosophy

Credits: 3. Contact Hours: Lecture 3.

Readings from philosophers such as Berkeley, Hume, and Kant. Development of Enlightenment thought. Issues include idealism, causation, freedom, and knowledge regarding science, ethics, and deities. Offered odd-numbered years. (Typically Offered: Spring)

PHIL 3160: 19th Century Continental Philosophy

Credits: 3. Contact Hours: Lecture 3.

Prereq: 3 credits in PHIL or Permission of Instructor

The thought of Hegel, Marx, Nietzsche, and their contemporaries. Various perspectives on the philosophy of history, the nature of reason and subjectivity, the contrast between dialectical and nondialectical philosophy, and the relationship between philosophy and society. (Typically Offered: Fall)

PHIL 3170: Truth, Meaning, and Necessity

(Cross-listed with LING 3170).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 3 credits in PHIL

Major movements in recent and contemporary philosophy such as realism, logical positivism, ordinary language philosophy, and naturalism. Russell, Wittgenstein, Quine and other leading figures. Topics include knowledge of the material world, mind, language, values, and philosophical method. PHIL 2010 recommended. (Typically Offered: Spring)

PHIL 3200: Existentialism

Credits: 3. Contact Hours: Lecture 3.

Prereq: 3 credits in PHIL or Permission of Instructor

History, development and forms of existential thought. Consciousness, free will, authenticity and bad faith. Readings of major figures in existentialism, such as Kierkegaard, Nietzsche, Dostoevsky, Heidegger, Sartre, and de Beauvoir. (Typically Offered: Fall)

PHIL 3300: Ethical Theory

Credits: 3. Contact Hours: Lecture 3.

Prereq: 3 credits in PHIL or Permission of Instructor

Study of major theories of morality and the good life. Includes such topics as moral psychology, practical reasoning, and virtue theory. (Typically Offered: Fall)

PHIL 3310: Moral Problems in Medicine

Credits: 3. Contact Hours: Lecture 3.

In-depth study of some of the central moral problems arising in medicine, e.g., abortion, euthanasia, patients' rights, health care professionals' duties and responsibilities, allocation of medical resources. Major moral theories will be examined and applied. (Typically Offered: Spring)

PHIL 3320: Philosophy of Law

(Cross-listed with CJ 3320).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 3 credits in PHIL or Permission of Instructor

Extent of our obligation to obey the law; what constitutes just punishment; how much of the immoral should be made illegal? Relation of these questions to major theories of law and the state. Discussion of such concepts as coercion, equality, and responsibility. (Typically Offered: Fall, Spring)

PHIL 3340: Environmental Ethics

(Cross-listed with ENVS 3340).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 3 credits in PHIL or Permission of Instructor

Thorough study of some of the central moral issues arising in connection with human impact on the environment, e.g., human overpopulation, species extinction, forest and wilderness management, pollution. Several world views of the proper relationship between human beings and nature will be explored. (Typically Offered: Fall)

PHIL 3350: Social and Political Philosophy

Credits: 3. Contact Hours: Lecture 3.

Prereq: 3 credits in PHIL or Permission of Instructor

Foundational moral issues of social and political life. Topics include justice, political economy, liberty and equality, and democracy, rights, and authority. (Typically Offered: Fall)

PHIL 3360: Bioethics and Biotechnology

Credits: 3. Contact Hours: Lecture 3.

In-depth study of some central moral issues in the life sciences, e.g., genetic screening and testing, genetically engineered plants and animals, risk analysis, biotechnology patents, research ethics, biodiversity, the impact of biotechnology on society and the environment. Major moral theories will be discussed and applied.

PHIL 3380: Feminist Philosophy

(Cross-listed with WGS 3380).

Credits: 3. Contact Hours: Lecture 3.

A critical, theoretical examination of the philosophical and intellectual commitments that underlie feminist projects. Questions of identity, knowledge, and ethics will be considered from both historical and contemporary perspectives. Topics will include sex and gender, self and other, nature and nurture, masculinity and femininity, equity and justice, patriarchy, oppression, and intersectionality. 3 credits in PHIL or WGS recommended. (Typically Offered: Fall)

PHIL 3390: Liberty and Law in America

(Cross-listed with CJ 3390/ POLS 3390).

Credits: 3. Contact Hours: Lecture 3.

Competing conceptions of liberty in American political thought. Debates about how liberty should be protected by the law, in fields such as health care, drugs, property, speech, religion, and sex. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall, Spring)

PHIL 3400: Aesthetics: Art, Beauty, and Everyday Life

Credits: 3. Contact Hours: Lecture 3.

Aesthetic theory and applies it to everyday life. Theoretical topics include the nature of aesthetic experience, criticism, and expression. Aesthetic experience of such forms of art as poetry and painting, as well as interactions with nature, sports, architecture, and campus sculpture. (Typically Offered: Fall)

PHIL 3430: Philosophy of Technology

Credits: 3. Contact Hours: Lecture 3.

Moral and other philosophical problems related to developments in technology. Topics may include conditions under which technological innovations contribute to human emancipation, relationship of technology and democracy, utility and limits of technical rationality, and problems of ensuring that benefits of technological advance are communally shared. Topics discussed with reference to such issues as contemporary developments in microelectronics, technology transfer to the Third World, etc. (Typically Offered: Fall, Spring)

PHIL 3500: Philosophy of Religion

(Cross-listed with RELIG 3500).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 3 credits in PHIL or Permission of Instructor

The value and truth of religious life and belief. Mystical experience; religious faith and language; arguments for God's existence; the problem of evil; miracles; and religion and morality. Historical and contemporary readings. (Typically Offered: Fall)

PHIL 3630: Metaphysics in Science Fiction and Popular Culture

Credits: 3. Contact Hours: Lecture 3.

Prereq: 3 credits in PHIL or Permission of Instructor

Examination of metaphysical issues that commonly arise in science fiction and related areas of popular culture, such as the relationship between mind and reality, metaphysical personhood, time, and causation.

PHIL 3640: Metaphysics: God, Minds, and Matter

Credits: 3. Contact Hours: Lecture 3.

Prereq: 3 credits in PHIL or Permission of Instructor

A survey of classical and contemporary views on some basic metaphysical issues. Issues discussed include: Does God exist? Do you have a mind and, if so, how does it relate to your body? What is the nature of cause and effect? Do objects have any essential properties? How can we account for properties objects have in common?. (Typically Offered: Spring)

PHIL 3660: Knowledge, Rationality, and Evidence

Credits: 3. Contact Hours: Lecture 3.

Prereq: 3 credits in PHIL or Permission of Instructor

This course focuses on significant topics in theory of knowledge, including the value of true beliefs, the role of sense experience in supporting our theoretical views, and the place of reason in human nature. Historical and contemporary views will be considered. (Typically Offered: Fall)

PHIL 3800: Philosophy of Science

Credits: 3. Contact Hours: Lecture 3.

Prereq: PHIL 2010 or 6 credits in Philosophy or permission of instructor

Introduction to the philosophy of science. A variety of basic problems common to the natural and social sciences: the nature of explanation, the structure of theories, the unity of science, and the distinction between science and nonscience. (Typically Offered: Fall)

PHIL 3820: History and Philosophy of the Scientific Revolution

(Cross-listed with HIST 3820).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 3 credits in PHIL or Permission of Instructor

The emergence of empirical science as the authoritative methodology for production of knowledge about the natural world in the period between Copernicus and Kant. Scientific progress achieved during the period, including the work of Galileo, Descartes, and Newton. The re-shaping of epistemology in the Western intellectual tradition. Implications for philosophy and historiography. Offered odd-numbered years. (Typically Offered: Spring)

PHIL 3890: Philosophy of Psychology and Psychiatry

Credits: 3. Contact Hours: Lecture 3.

Prereq: 3 credits in PHIL or PSYCH, or Permission of Instructor

Philosophical foundations of 20th century psychology and psychiatry. Introduction to competing schools of thought in psychology and their philosophical assumptions. Examination of philosophical assumptions in the study of psychopathology/abnormal psychology. Offered odd-numbered years. (Typically Offered: Fall)

PHIL 4100: Soul, Mind, and World in Ancient Greek Philosophy

(Cross-listed with CLST 4100).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 6 credits in PHIL or CLST, or Permission of Instructor

Prominent theories of soul and mind developed by Greek philosophers in the classical period, roughly 500 BCE-200 CE, and how the philosophers located these theories within their general metaphysical views. Relationship between mind and body and the roles of reason, desire, and emotion. Philosophers to be studied include Plato, Aristotle, and selected others. (Typically Offered: Spring)

PHIL 4300: Value Theory

Credits: 3. Contact Hours: Lecture 3.

Prereq: 3 credits in PHIL or Permission of Instructor

Theoretical and normative topics in ethics or political philosophy. (Typically Offered: Spring)

PHIL 4350: Contemporary Political Philosophy

(Dual-listed with PHIL 5350/ POLS 5350). (Cross-listed with POLS 4350).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Prereq: 6 credits in PHIL or POLS, or Permission of Instructor

Examination of theories of justice proposed by contemporary political philosophers. Analysis of the philosophical foundations of perspectives such as liberalism, libertarianism, communitarianism, socialism, feminism. Normative assessments of socio-political institutions. (Typically Offered: Spring)

PHIL 4500: Agency and Free Will

Credits: 3. Contact Hours: Lecture 3.

Personal identity, agency, free will, moral responsibility, causation, future contingents, and time will be discussed. What makes a person the same person over time? Do humans have free will? Are we not morally responsible if our actions are inevitable consequences of the past and the laws of nature? What distinguishes causes from non-causes? Are there facts about the future? PHIL 2070 strongly encouraged. (Typically Offered: Fall)

PHIL 4650: Brains, Minds, and Computers

Credits: 3. Contact Hours: Lecture 3.

Examination of concepts such as computability, intelligence, programming, and free will; and of arguments about whether any human capacity is forever beyond realization in a machine. 3 credits in PHIL recommended. (Typically Offered: Fall)

PHIL 4660: Topics in Epistemology

Credits: 3. Contact Hours: Lecture 3.

Prereq: 3 credits in PHIL or Permission of Instructor

Topics in epistemology. Possible topics include skepticism about the external world, the extent of a priori knowledge, rival accounts of moral knowledge, feminist perspectives on the theory of knowledge, and the value of true belief. Topics vary each time offered. (Typically Offered: Spring)

PHIL 4850: Philosophy of Physics

Credits: 3. Contact Hours: Lecture 3.

Conceptual and philosophical issues relating to the interpretation of theories in classical and modern physics. May include one or more of the following topics: the relationship between mathematics and the physical world; Newtonian physics (determinism and predictability); thermodynamics and statistical physics (the nature of probability; entropy and the direction of time); relativistic physics (indeterminism; realism and nonlocality; consciousness and the role of the observer). Offered even-numbered years. (Typically Offered: Spring)

PHIL 4900: Independent Study

Credits: 1-4. Repeatable, maximum of 9 credits.

Prereq: 6 credits in PHIL; Permission of Instructor

Guided reading and research on special topics selected to meet needs of advanced students. Graduation Restriction: No more than 9 credits of PHIL 4900 may be counted toward graduation.

PHIL 4900H: Independent Study: Honors

Credits: 1-4. Repeatable, maximum of 9 credits.

Prereq: 6 credits in PHIL; Permission of Instructor; Membership in the University Honors Program

Guided reading and research on special topics selected to meet needs of advanced students. Graduation Restriction: No more than 9 credits of PHIL 4900 may be counted toward graduation.

PHIL 4920: Graduating Senior Survey

Credits: Required. Contact Hours: Lecture 1.

Prereq: Senior classification

Final presentation for graduation and the future. Outcomes assessment activities. (Typically Offered: Fall, Spring)

Courses primarily for graduate students, open to qualified undergraduates:

PHIL 5350: Contemporary Political Philosophy

(Dual-listed with PHIL 4350/ POLS 4350). (Cross-listed with POLS 5350).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Examination of theories of justice proposed by contemporary political philosophers. Analysis of the philosophical foundations of perspectives such as egalitarianism, libertarianism, and socialism. Normative assessment of social and political institutions. (Typically Offered: Spring)

PHIL 5900A: Special Topics in Philosophy: History of Philosophy

Credits: 2-4. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

PHIL 5900B: Special Topics in Philosophy: Epistemology and Metaphysics

Credits: 2-4. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

PHIL 5900C: Special Topics in Philosophy: Value Theory

Credits: 2-4. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

PHIL 5900D: Special Topics in Philosophy: Logic and Philosophy of Science

Credits: 2-4. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

PHIL 5930: Summer Bioethics Workshop for Teachers

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Topics include moral theory, pedagogical issues in teaching bioethics, and substantive current issues in bioethics. (Typically Offered: Summer)

Physics (PHYS)

Courses primarily for undergraduates:

PHYS 0500: Intro Physics Prep

Credits: 0. Contact Hours: Lecture 3.

An in#depth active learning experience designed to impart the fundamental concepts and principles of physics, with an emphasis on applied mathematical techniques and logical thinking. For students intending to enroll in classical physics (PHYS 2310/2320) who have not taken high school physics, who have not had a high school college preparatory physics course, or who need a review of physics problem solving and physics concepts. 1 year high school algebra recommended. (Typically Offered: Fall, Spring)

PHYS 1010: Physics for the Nonscientist

Credits: 3. Contact Hours: Lecture 3.

Survey of the principal areas of both classical and modern physics.

Emphasis on the nature of the physical universe and the application of physical principles to life in the modern world. (Typically Offered: Fall, Spring, Summer)

PHYS 1020L: Physical Sciences for Elementary Education

(Cross-listed with CHEM 1020L).

Credits: 3. Contact Hours: Lecture 1, Laboratory 4.

Prereq: Credit or concurrent enrollment in MATH 1950 OR Permission of Instructor

Physical science principles for future elementary teachers. Emphasis on experiments that address current elementary science education standards and that are appropriate for their future students to do, such as measurements of mass, length, time, light from atoms, charge and current, motion due to forces, energy and work, heat, waves, optics, building bridges and making musical instruments, studying states of matter and chemical reactions. (Typically Offered: Fall, Spring)

PHYS 1150: Physics for the Life Sciences

Credits: 4. Contact Hours: Lecture 3, Discussion 1.

Emphasis on basic physics principles applied to biological problems.

Topics include mechanics, fluids, thermodynamics, heat, light, sound, electricity and magnetism. A coordinated laboratory, PHYS 1150L laboratory is available. 1.5 yr. HS algebra, 1 yr. HS geometry, 1 semester HS trigonometry recommended. (Typically Offered: Fall, Spring)

PHYS 1150L: Laboratory in Physics for the Life Sciences

Credits: 1. Contact Hours: Laboratory 2.

Prereq: Credit or enrollment in PHYS 1150

Experiments related to the elementary topics of physics for the life sciences. Mechanics, fluids, thermodynamics, heat, light, sound, electricity and magnetism. (Typically Offered: Fall, Spring)

PHYS 1310: General Physics I

Credits: 4. Contact Hours: Lecture 3, Discussion 1.

General background in physical concepts, principles, and methods for those who do not plan advanced study in physics or engineering.

Mechanics, fluids, heat and thermodynamics, vibrations, waves, sound. 1.5 yr. HS algebra, 1 yr. HS geometry, 1 semester HS trigonometry recommended. (Typically Offered: Fall, Spring, Summer)

PHYS 1310L: General Physics I Laboratory

Credits: 1. Contact Hours: Laboratory 2.

Laboratory experiments in elementary kinematics, work and energy, conservation laws, rotational motion, waves and fluids. 1.5 yr. HS algebra, 1 yr. HS geometry, 1 semester HS trigonometry recommended. (Typically Offered: Fall, Spring, Summer)

PHYS 1320: General Physics II

Credits: 4. Contact Hours: Lecture 3, Discussion 1.

Prereq: PHYS 1310 or PHYS 2310

General background in physical concepts, principles, and methods for those who do not plan advanced study in physics or engineering.

Electricity and magnetism, ray and wave optics, topics in modern physics. (Typically Offered: Fall, Spring, Summer)

PHYS 1320L: General Physics II Laboratory

Credits: 1. Contact Hours: Laboratory 2.

Prereq: Credit or enrollment in PHYS 1320

Laboratory experiments in Electricity and Magnetism, Wave and Optics. (Typically Offered: Fall, Spring, Summer)

PHYS 1320Q: Ap - General Physics II Laboratory

Credits: 0-99. Contact Hours: Laboratory 2.

PHYS 1990: Introductory Seminar

Credits: 1.

Gain experience in key skills that physicists/astronomers use routinely, but are rarely explicitly taught in formal courses. Participate in faculty-led discussions on frontier areas and careers. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

PHYS 2310: Introduction to Classical Physics I

Credits: 4. Contact Hours: Discussion 1, Lecture 3.

Prereq: [MATH 1650 OR (MATH 1630X AND 1640X)] AND Credit or concurrent enrollment in MATH 1660

Tailored toward engineering majors (For a broader set of physics topics consider PHYS 2410). 3 hours of lecture each week plus 1 recitation each week. Review of basic vector manipulation, elementary mechanics including kinematics and dynamics of particles, work and energy, linear and angular momentum, conservation laws, rotational motion, oscillations, gravitation. . (Typically Offered: Fall, Spring, Summer)

PHYS 2310H: Introduction to Classical Physics I: Honors

Credits: 4. Contact Hours: Lecture 3, Discussion 1.

Prereq: [MATH 1650 OR (MATH 1630X AND 1640X)]; Credit or concurrent enrollment in MATH 1660; Membership in the University Honors Program

Tailored toward engineering majors (For a broader set of physics topics consider PHYS 2410). 3 hours of lecture each week plus 1 recitation each week. Review of basic vector manipulation, elementary mechanics including kinematics and dynamics of particles, work and energy, linear and angular momentum, conservation laws, rotational motion, oscillations, gravitation. (Typically Offered: Fall, Spring, Summer)

PHYS 2310L: Introduction to Classical Physics I Laboratory

Credits: 1. Contact Hours: Laboratory 2.

Prereq: MATH 1650 AND (credit or enrollment in MATH 1660) AND (credit or concurrent enrollment in PHYS 2310 or PHYS 2410)

Laboratory experiments in elementary kinematics, work and energy, conservation laws, and rotational motion. Proficiency in algebra, trigonometry, vector manipulation required. (Typically Offered: Fall, Spring, Summer)

PHYS 2310Q: Ap - Introduction to Classical Physics I Laboratory

Credits: 0-99. Contact Hours: Laboratory 2.

PHYS 2320: Introduction to Classical Physics II

Credits: 4. Contact Hours: Discussion 1, Lecture 3.

Prereq: MATH 1660; PHYS 2310 or PHYS 2410

3 hours of lecture each week plus 1 recitation each week. Electric forces and fields; Electrical currents; DC circuits; Magnetic forces and fields; LR, LC, LCR circuits; AC circuits. (Typically Offered: Fall, Spring, Summer)

PHYS 2320H: Introduction to Classical Physics II: Honors

Credits: 4. Contact Hours: Lecture 3, Discussion 1.

Prereq: MATH 1660; PHYS 2310 or PHYS 2410; Membership in the University Honors Program

3 hours of lecture each week plus 1 recitation each week. Electric forces and fields; Electrical currents; DC circuits; Magnetic forces and fields; LR, LC, LCR circuits; AC circuits. (Typically Offered: Fall, Spring)

PHYS 2320L: Introduction to Classical Physics II Laboratory

Credits: 1. Contact Hours: Laboratory 2.

Prereq: MATH 1660 AND (Credit or concurrent enrollment in PHYS 2320 or PHYS 2420)

Laboratory experiments in fluid dynamics, electric forces and fields, electrical currents, DC circuits, magnetic forces and fields, and wave optics. (Typically Offered: Fall, Spring, Summer)

PHYS 2410: Principles and Symmetries in Classical Physics I

Credits: 5. Contact Hours: Lecture 3, Discussion 1.5, Laboratory 1.

Prereq: MATH 1650; credit or concurrent enrollment in MATH 1660

Covers all of mechanics; kinematics and dynamics of particles, work and energy, linear and angular momentum, conservation laws, rotational motion, oscillations, gravitation, and extremum principles. Topics in kinetic theory, thermodynamics, waves and sound. Proficiency in algebra, trigonometry, vector manipulation required. (Typically Offered: Fall)

PHYS 2410H: Principles and Symmetries in Classical Physics I: Honors

Credits: 5. Contact Hours: Lecture 3, Discussion 1.5, Laboratory 1.

Prereq: [MATH 1650 OR (MATH 1630X AND 1640X)]; Credit or concurrent enrollment in MATH 1660; Membership in the University Honors Program

Covers all of mechanics; kinematics and dynamics of particles, work and energy, linear and angular momentum, conservation laws, rotational motion, oscillations, gravitation, and extremum principles. Topics in kinetic theory, thermodynamics, waves and sound. Proficiency in algebra, trigonometry, vector manipulation required. (Typically Offered: Fall)

PHYS 2420: Principles and Symmetries in Classical Physics II

Credits: 5. Contact Hours: Lecture 3, Discussion 1, Laboratory 2.

Prereq: PHYS 2310 or PHYS 2410; credit or concurrent enrollment in MATH 1660

Fluid dynamics, electrostatics, potentials and fields, currents, fields of moving charges, the magnetic field, electromagnetic induction, DC and AC circuits, Maxwell's equations and electromagnetic waves, electric and magnetic fields in matter. Topics in optics and special relativity. (Typically Offered: Spring)

PHYS 2420H: Principles and Symmetries in Classical Physics II: Honors

Credits: 5. Contact Hours: Lecture 3, Discussion 1, Laboratory 2.

Prereq: PHYS 2310 or PHYS 2410; credit or concurrent enrollment in MATH 1660; Membership in University Honors Program

Fluid dynamics, electrostatics, potentials and fields, currents, fields of moving charges, the magnetic field, electromagnetic induction, DC and AC circuits, Maxwell's equations and electromagnetic waves, electric and magnetic fields in matter. Topics in optics and special relativity. (Typically Offered: Spring)

PHYS 2900: Independent Study

Credits: 1-4. Repeatable.

Prereq: Instructor Permission for Course

Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

PHYS 2990: Intermediate Seminar

Credits: 1-2. Contact Hours: Lecture 2.

Conduct research or an independent study on topics in physics and astronomy. Learn science communication skills that physicists and astronomers use routinely. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

PHYS 3020: The Challenge of Contemporary Physics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

A largely nonmathematical but intellectually challenging exploration of physics, which assumes no previous work in the field. Selected material from classical and modern physics establishes the conceptual framework for the study of major areas of contemporary physics, culminating in the discussion of topics at the frontier of present knowledge. Topics vary yearly and may include quarks, lasers, superconductivity, fission and fusion, solid state devices, gravitational waves, string theory, facilities, left handed materials, and quantum computing. (Typically Offered: Spring)

PHYS 3040: Thermal Physics

Credits: 3. Contact Hours: Lecture 3.

Prereq: (MATH 2660 or MATH 2670); ([PHYS 2320; PHYS 2320L] or [PHYS 2420])

Concepts of temperature, entropy, and other characteristic thermodynamic functions, with application to macroscopic properties of matter. The laws of thermodynamics. Introduction to statistical mechanics, including quantum statistics. Application to black body radiation, crystalline vibrations, magnetic ions in solids, electronic heat capacity of metals. Phase transformations and chemical reactions. (Typically Offered: Spring)

PHYS 3100: Electronic Instrumentation for Experimental Physics

Credits: 4. Contact Hours: Lecture 2, Laboratory 4.

Prereq: MATH 1660; ([PHYS 2320; PHYS 2320L] or [PHYS 2420])

Common electrical instruments; power supplies; transducers; passive and active devices, analog integrated circuits, including filters and amplifiers; digital integrated circuits; signal transmission and enhancement. (Typically Offered: Fall)

PHYS 3110: Intermediate Laboratory

Credits: 1-2. Contact Hours: Laboratory 2.

Repeatable.

Prereq: PHYS 3220

Experiments in classical and modern physics performed independently by each student. (Typically Offered: Spring)

PHYS 3110T: Intermediate Laboratory for Secondary Physics Teachers

Credits: 3. Contact Hours: Laboratory 6.

Repeatable.

Prereq: (PHYS 1320; PHYS 1320L) or (PHYS 2320 or PHYS 2320H; PHYS 2320L) or PHYS 2420

Experiments in classical and modern physics performed independently by each student. For students preparing for a career in high school teaching. (Typically Offered: Spring)

PHYS 3210: Introduction to Modern Physics I

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or concurrent enrollment in (MATH 2660 or MATH 2670); ([PHYS 2320; PHYS 2320L] or [PHYS 2420 or PHYS 2420H])

Quantum nature of matter: photons, de Broglie's postulate: wave-like properties of matter; Bohr's model of hydrogen atom; Schrodinger equations in one dimension: energy quantization; detailed solutions for potential steps, barriers and wells; one-electron atoms, spin and magnetic interactions; ground states, optical and x-ray excitations of multi-electron atoms. (Typically Offered: Fall)

PHYS 3210L: Introductory Laboratory in Modern Physics I

Credits: 1. Contact Hours: Laboratory 2.

Prereq: Credit or enrollment in PHYS 3210

Experiments related to the foundations of modern physics. The dual wave and particle character of electrons and photons, statistics, interferometry and x-ray spectroscopy. (Typically Offered: Fall)

PHYS 3220: Introduction to Modern Physics II

Credits: 3. Contact Hours: Lecture 3.

Prereq: PHYS 3210

Quantum statistics; lasers; physics of molecules. Properties of solids, including electron band structure, superconductivity and magnetism. Nuclear physics, including nuclear sizes and masses, stability, decay modes, reactions, fission and fusion. Elementary particles, including strangeness, charm, and quarks. Fundamental forces of nature. (Typically Offered: Spring)

PHYS 3220L: Introductory Laboratory in Modern Physics II

Credits: 1. Contact Hours: Laboratory 2.

Prereq: Credit or enrollment in PHYS 3220

Experiments related to the foundations of modern physics. Radioactive decay, elementary particles, Hall effect, quantization, spectroscopy, statistics and instrumentation. (Typically Offered: Spring)

PHYS 3610: Classical Mechanics

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 2650; credit or concurrent enrollment in (MATH 2660 or MATH 2670); ([PHYS 2220 or PHYS 2220H] or [PHYS 2320 or PHYS 2320H; PHYS 2320L] or [PHYS 2420 or PHYS 2420H])

Newtonian mechanics including forced oscillations, central forces and orbital motion, collisions, moving frames of reference, Lagrange's equations. (Typically Offered: Spring)

PHYS 3620: Intermediate Mechanics

Credits: 3. Contact Hours: Lecture 3.

Prereq: PHYS 3610

Rigid body motion; small oscillations, normal modes. Special relativity including length contraction, time dilation, simultaneity, Lorentz transformation, 4-vector covariant formalism, relativistic mechanics. (Typically Offered: Fall)

PHYS 3640: Electricity and Magnetism I

Credits: 3. Contact Hours: Lecture 3.

Prereq: (MATH 2660 or MATH 2670); ([PHYS 2320; PHYS 2320L] or [PHYS 2420])

Static electric and magnetic fields, potential theory; electromagnetism, Maxwell's equations. (Typically Offered: Fall)

PHYS 3650: Electricity and Magnetism II

Credits: 3. Contact Hours: Lecture 3.

Prereq: PHYS 3640 and MATH 3850

Relativistic electromagnetic theory; radiation and propagation of electromagnetic waves; interaction with matter. (Typically Offered: Spring)

PHYS 3990: Seminar on Secondary School Physics

Credits: 1-2. Contact Hours: Lecture 2.

Repeatable, maximum of 2 credits.

Prereq: Instructor Permission for Course

Review of materials and curricula for secondary school physics presented and discussed by members of the class. Required for approval to teach physics in secondary schools. (Typically Offered: Spring)

PHYS 4210: Ultrafast Laser Science and Spectroscopy

(Dual-listed with PHYS 5210).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (PHYS 3210; PHYS 3650) or Permission of Instructor

Introduction to ultrafast lasers, nonlinear optics, and their applications. Topics selected from: basic optics, atom-photon interactions, electrodynamics of condensed matter, laser physics, ultrafast and nonlinear optics, ultrashort pulse generation, broadband pulse generation, time-resolved spectroscopy and instrumentation. (Typically Offered: Fall)

PHYS 4220: Foundations of Quantum Computing

(Dual-listed with PHYS 5220).

Credits: 3. Contact Hours: Lecture 3.

Overview of quantum computation and quantum information processing from a physics perspective. Introduction to classical computation; primer on quantum mechanics; quantum circuits and quantum algorithms; physical realizations; applications and near-term quantum algorithms. Previous coursework equivalent to MATH 2070 (Matrices and Linear Algebra) or MATH 3170 (Theory of Linear Algebra) is necessary for success in this course. (Typically Offered: Spring)

PHYS 4320: Molecular and Cell Biophysics

(Dual-listed with PHYS 5320).

Credits: 3. Contact Hours: Lecture 3.

Quantitative description of biological systems using basic physical laws, including a brief discussion of a variety of biophysical techniques. Topics include: thermodynamics, chemical equilibrium, gene expression, structure and physical properties of nucleic acids and proteins, folding of nucleic acids and proteins, chemical kinetics, catalysis, allosteric enzymes, cell membrane structure and physical properties, and machines in cell membranes. Previous coursework equivalent to PHYS 3040 (Thermal Physics) or CHEM 3250 (Chemical Thermodynamics) is necessary for success in this course. (Typically Offered: Spring)

PHYS 4500: Undergraduate Research

Credits: 1-6. Repeatable.

Prereq: Instructor Permission for Course

Theoretical research under supervision of physics faculty. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

PHYS 4500L: Undergraduate Research

Credits: 1-6. Repeatable.

Prereq: PHYS 3220L; Permission of Instructor

Laboratory project under supervision of physics faculty. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

PHYS 4700L: Applied Physics Laboratory

Credits: 2-5. Contact Hours: Laboratory 5.

Repeatable.

Prereq: PHYS 3220; Permission of Instructor

Studies in modern experimental techniques via experimentation and simulation in various areas of applied physics, e.g. superconductivity, optical spectroscopy, nuclear magnetic resonance, electron spin resonance, x-ray diffraction, and computation of electronic and structural properties of matter. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

PHYS 4800: Quantum Mechanics I

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 3850, PHYS 3210

First semester of a full-year course. A systematic development of the formalism and applications of quantum mechanics. Solutions to the time independent Schrodinger equation for various one-dimensional potentials including the harmonic oscillator; operator methods; Heisenberg picture; angular momentum; the hydrogen atom; spin; symmetry properties. (Typically Offered: Fall)

PHYS 4810: Quantum Mechanics II

Credits: 3. Contact Hours: Lecture 3.

Prereq: PHYS 4800

Continuation of 4800. Addition of angular momentum; charged particles in electromagnetic fields; time-independent perturbation theory; variational principles; WKB approximation; interaction picture; time-dependent perturbation theory; adiabatic approximation; scattering; selected topics in radiation theory; quantum paradoxes. (Typically Offered: Fall, Spring, Summer)

PHYS 4900: Independent Study

Credits: 1-4. Repeatable, maximum of 9 credits.

Prereq: 6 credits in PHYS; Permission of Instructor

Graduation Restriction: No more than 9 credits of PHYS 4900 may be counted toward graduation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

PHYS 4900H: Independent Study: Honors

Credits: 1-4. Repeatable, maximum of 9 credits.

Prereq: 6 credits in PHYS; Permission of Instructor; Membership in the University Honors Program

Graduation Restriction: No more than 9 credits of PHYS 4900 may be counted toward graduation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

PHYS 4960: Modern Optics

(Cross-listed with EE 4960).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or enrollment in PHYS 3220, PHYS 3650, and PHYS 4800

Review of wave and electromagnetic theory; topics selected from: reflection/refraction, interference, geometrical optics, Fourier analysis, dispersion, coherence, Fraunhofer and Fresnel diffraction, holography, quantum optics, nonlinear optics. (Typically Offered: Fall)

Courses primarily for graduate students, open to qualified undergraduates:

PHYS 5010: Oral Communication of Physics Seminar

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

A practical introduction to communication methods in physics and astronomy classrooms and professional settings. For graduate physics majors only. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

PHYS 5020: Introductory Research Seminar

Credits: Required. Contact Hours: Lecture 1.

Prereq: Graduate Standing or Permission of Instructor

Discussion by research staff of their research areas, expected thesis research work, and opportunities in the field. For graduate physics majors only. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

PHYS 5110: Condensed Matter Physics I

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

First semester of a full-year course. Free electron model; crystal symmetry; band theory of solids; transport properties; Fermi surface; phonons; semiconductors; crystal surfaces; magnetism; superconductivity. Previous coursework equivalent to PHYS 3040 (Thermal Physics) is necessary. Previous or current enrollment in PHYS 4810 (Quantum Mechanics II) is encouraged. (Typically Offered: Fall, Spring, Summer)

PHYS 5120: Condensed Matter Physics II

Credits: 3. Contact Hours: Lecture 3.

Prereq: PHYS 5110

Continuation of 5110. Free electron model; crystal symmetry; band theory of solids; transport properties; Fermi surface; phonons; semiconductors; crystal surfaces; magnetism; superconductivity. (Typically Offered: Fall, Spring, Summer)

PHYS 5220: Foundations of Quantum Computing

(Dual-listed with PHYS 4220).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Overview of quantum computation and quantum information processing from a physics perspective. Introduction to a classical computation; primer on quantum mechanics; quantum circuits and quantum algorithms; physical realizations; applications and near-term quantum algorithms. Previous coursework equivalent to MATH 2070 (Matrices and Linear Algebra) or MATH 3170 (Theory of Linear Algebra) is necessary for success in this course. (Typically Offered: Fall, Spring, Summer)

PHYS 5260: Particle and Nuclear Physics

Credits: 4. Contact Hours: Lecture 4.

Prereq: Graduate Standing or Permission of Instructor

Basic properties and structures of nuclei, hadrons, and elementary particles; weak and strong interactions; the Standard Model; accelerators and detectors; nuclear models; nuclear decay and stability; nuclear astrophysics; the Higgs mechanism; the CKM matrix; running coupling constants; relativistic heavy-ion collisions; selected topics beyond the standard model such as SUSY and grand unification. Previous or current coursework equivalent to PHYS 4810 (Quantum Mechanics II) is necessary for success in this course. (Typically Offered: Fall, Spring, Summer)

PHYS 5280: Mathematical Methods for the Physical Sciences

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Fast-paced coverage of mathematical techniques needed for advanced analysis in the physical sciences, particularly for quantum mechanics and electrodynamics. Linear vector spaces and operators. Linear differential equations for time-evolution and steady-state problems, Green's functions and propagators, Sturm-Liouville problems. Functions of a complex variable, calculus of residues, series expansions, integral transforms and applications. (Typically Offered: Fall)

PHYS 5310: Statistical Mechanics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Thermodynamic properties of systems of many particles obeying Boltzmann, Fermi-Dirac, and Bose-Einstein statistics; microcanonical, canonical, and grand canonical ensembles and their application to physical problems; density matrices; introduction to phase transitions; renormalization group theory; kinetic theory and fluctuations. Previous coursework equivalent to PHYS 3040 (Thermal Physics) is necessary. Previous or current enrollment in PHYS 4810 (Quantum Mechanics II), and MATH 3650 (Complex Variables with Applications) or PHYS 5280 (Mathematical Methods for the Physical Sciences) is encouraged. (Typically Offered: Spring)

PHYS 5320: Molecular and Cell Biophysics

(Dual-listed with PHYS 4320).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Quantitative description of biological systems using basic physical laws, including a brief discussion of a variety of biophysical techniques. Topics include: thermodynamics, chemical equilibrium, gene expression, structure and physical properties of nucleic acids and proteins, folding of nucleic acids and proteins, chemical kinetics, catalysis, allosteric enzymes, cell membrane structure and physical properties, and machines in cell membranes. Previous coursework equivalent to PHYS 3040 (Thermal Physics) or CHEM 3250 (Chemical Thermodynamics) is necessary for success in this course. (Typically Offered: Spring)

PHYS 5340: Symmetry and Group Theory in Physics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Theory of groups and group representations; introduction to both point and continuous groups, and their applications in physics. Previous or current enrollment in PHYS 4810 (Quantum Mechanics II) is necessary for success in this course. (Typically Offered: Fall)

PHYS 5350: Physics of Semiconductors

(Cross-listed with EE 5350).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Basic elements of quantum theory, Fermi statistics, motion of electrons in periodic structures, crystal structure, energy bands, equilibrium carrier concentration and doping, excess carriers and recombination, carrier transport at low and high fields, space charge limited current, photo-conductivity in solids, phonons, optical properties, amorphous semiconductors, heterostructures, and surface effects. Laboratory experiments on optical properties, carrier lifetimes, mobility, defect density, doping density, photo-conductivity, diffusion length of carriers.

PHYS 5360: Physics of Semiconductor Devices

(Cross-listed with EE 5360).

Credits: 3. Contact Hours: Lecture 3.

Prereq: EE 5350

P-n junctions, band-bending theory, tunneling phenomena, Schottky barriers, heterojunctions, bipolar transistors, field-effect transistors, negative-resistance devices and optoelectronic devices.

PHYS 5410: General Relativity

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Tensor analysis and differential geometry developed and used to formulate Einstein field equations. Schwarzschild and Kerr solutions. Other advanced topics may include gravitational radiation, particle production by gravitational fields, alternate gravitational theories, attempts at unified field theories, cosmology. Previous coursework equivalent to PHYS 3620 (Intermediate Mechanics), and MATH 2070 (Matrices and Linear Algebra) or MATH 3170 (Theory of Linear Algebra) is necessary for success in this course. (Typically Offered: Fall)

PHYS 5510: Computational Physics

Credits: 3. Contact Hours: Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Use of computational methods to solve complex problems in physics and carry out data analysis. Previous coursework equivalent to PHYS 3650 (Electricity and Magnetism II) is necessary. Previous or current enrollment in PHYS 4810 (Quantum Mechanics II) and some programming experience is encouraged. (Typically Offered: Spring)

PHYS 5640: Advanced Classical Mechanics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Variational principles, Lagrange's equations, Hamilton's canonical equations, canonical transformations, Hamilton-Jacobi theory, infinitesimal transformations, classical field theory, canonical perturbation theory, classical chaos. Previous coursework equivalent to PHYS 3620 (Intermediate Mechanics) is necessary for success in this course. (Typically Offered: Spring)

PHYS 5710: Electricity and Magnetism I

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Electrostatics, magnetostatics, boundary value problems, Maxwell's equations, wave phenomena in macroscopic media, wave guides. (Typically Offered: Fall)

PHYS 5720: Electricity and Magnetism II

Credits: 3. Contact Hours: Lecture 3.

Prereq: PHYS 5710

Special theory of relativity, least action and motion of charged particles in electromagnetic fields, radiation, collisions between charged particles, multipole fields, radiation damping. (Typically Offered: Spring)

PHYS 5900A: Nuclear Physics

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Topics of current interest. (Typically Offered: Fall, Spring, Summer)

PHYS 5900B: Condensed Matter Physics

Credits: 1-30. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Topics of current interest. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

PHYS 5900C: High Energy Physics

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Topics of current interest. (Typically Offered: Fall, Spring, Summer)

PHYS 5900D: Physics

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Topics of current interest. (Typically Offered: Fall, Spring, Summer)

PHYS 5900E: Applied Physics

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Topics of current interest. (Typically Offered: Fall, Spring, Summer)

PHYS 5900F: Biophysics

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Topics of current interest. (Typically Offered: Fall, Spring, Summer)

PHYS 5910: Quantum Physics I

Credits: 4. Contact Hours: Lecture 4.

Prereq: Graduate Standing or Permission of Instructor

First semester of a full-year course. Postulates of quantum mechanics; time-dependent and time-independent Schrodinger equations for one-,two-, and three-dimensional systems; theory of angular momentum; Rayleigh-Schrodinger time-independent perturbation theory. (Typically Offered: Fall)

PHYS 5920: Quantum Physics II

Credits: 4. Contact Hours: Lecture 4.

Prereq: PHYS 5910

Continuation of 5910. Variational theorem and WKB method; time-dependent perturbation theory and 2nd quantization of the EM field in Coulomb gauge; method of partial waves and Born approximation for scattering by central potentials; identical particles and symmetry; Dirac and Klein-Gordon equation for free particles; path integral formalism. (Typically Offered: Spring)

PHYS 5990: Creative Component

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Individually directed study of research-level problems for students electing the nonthesis M.S. degree option. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

Courses for graduate students:

PHYS 6110: Quantum Theory of Condensed Matter

Credits: 3. Contact Hours: Lecture 3.

Quantum theory of interacting many body systems: zero temperature field theory, Fermi systems, finite temperature field theory, superconductivity and superfluidity. Gauge theories and topological phases of matter: lattice gauge theory, quantum hall effect, and topological field theories. (Typically Offered: Spring)

PHYS 6240: Advanced Nuclear Physics

Credits: 3. Contact Hours: Lecture 3.

Prereq: PHYS 5260 and PHYS 5920

Microscopic few-body and many-body theory; theory of effective Hamiltonians; relativistic nuclear physics; nuclear effects in hadron-nucleus, lepton-nucleus, and nucleus-nucleus reactions. (Typically Offered: Fall, Spring, Summer)

PHYS 6250: Physics of Strong Interactions

Credits: 3. Contact Hours: Lecture 3.

Prereq: PHYS 6810

Quark model; Quantum Chromodynamics (QCD); perturbation methods for QCD; effective field theories for pions and nucleons; finite temperature field theories; quark-gluon plasma; phase transitions in QCD. (Typically Offered: Fall, Spring, Summer)

PHYS 6370: Elementary Particle Physics I

Credits: 3. Contact Hours: Lecture 3.

Prereq: PHYS 5260 and PHYS 5920

First semester of a full year course. Properties of leptons, bosons, and quarks and their interactions; quantum chromodynamics, Glashow-Weinberg-Salam model, grand unification theories, supersymmetry; modern theoretical techniques and tests of the Standard Model. (Typically Offered: Spring)

PHYS 6380: Elementary Particle Physics II

Credits: 3. Contact Hours: Lecture 3.

Prereq: PHYS 6370

Continuation of 6370. Properties of leptons, bosons, and quarks and their interactions; quantum chromodynamics, Glashow-Weinberg-Salam model, grand unification theories, supersymmetry, and superstring theory; modern theoretical techniques. (Typically Offered: Fall, Spring, Summer)

PHYS 6460: Mathematical Modeling of Complex Physical Systems

(Cross-listed with MATH 6460).

Credits: 3. Contact Hours: Lecture 3.

Modeling of the dynamics of complex systems on multiple scales: Classical and dissipative molecular dynamics, stochastic modeling and Monte-Carlo simulation; coarse grained nonlinear dynamics, interface propagation and spatial pattern formation. (Typically Offered: Spring)

PHYS 6500A: Nuclear Physics

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Topics of current interest. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

PHYS 6500B: Condensed Matter Physics

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Topics of current interest. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

PHYS 6500C: High Energy Physics

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Topics of current interest. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

PHYS 6500D: Physics

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Topics of current interest. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

PHYS 6500E: Applied Physics

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Topics of current interest. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

PHYS 6500F: Biophysics

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Topics of current interest. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

PHYS 6600B: Condensed Matter Physics

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Courses on advanced topics and recent developments. (Typically Offered: Fall, Spring, Summer)

PHYS 6600C: High Energy Physics

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Courses on advanced topics and recent developments. (Typically Offered: Fall, Spring, Summer)

PHYS 6600D: Physics

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Courses on advanced topics and recent developments. (Typically Offered: Fall, Spring, Summer)

PHYS 6600E: Applied Physics

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Courses on advanced topics and recent developments. (Typically Offered: Fall, Spring, Summer)

PHYS 6600F: Biophysics

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Courses on advanced topics and recent developments. (Typically Offered: Fall, Spring, Summer)

PHYS 6810: Quantum Field Theory I

Credits: 3. Contact Hours: Lecture 3.

Prereq: PHYS 5640, PHYS 5720, PHYS 5920

Quantization of fields (canonical and path integral); Feynman rules; introduction to gauge theories; Quantum Electrodynamics; radiative corrections; renormalization and renormalization group. (Typically Offered: Fall)

PHYS 6820: Quantum Field Theory II

Credits: 3. Contact Hours: Lecture 3.

Prereq: PHYS 6810

Continuation of 6810. Systematics of renormalization; renormalization group methods; symmetries; spontaneous symmetry breaking; non-abelian gauge theories; the Standard Model and beyond; special topics. (Typically Offered: Fall, Spring)

PHYS 6990: Research

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Graduate research. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

Plant Biology (PLBIO)

Courses primarily for graduate students, open to qualified undergraduates:

PLBIO 5130: Plant Metabolism

(Cross-listed with GDCB 5130).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Photosynthesis, respiration, and other aspects of plant metabolism. Offered even-numbered years. (Typically Offered: Fall)

PLBIO 5450: Plant Molecular, Cell and Developmental Biology

(Cross-listed with MCDB 5450/ GDCB 5450).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Plant nuclear and organelle genomes; regulation of gene expression; hormone signaling; organization, function, and development of plant cells and subcellular structures; regulation of plant growth and development. Offered odd-numbered years. (Typically Offered: Fall)

Courses for graduate students:

PLBIO 6960: Research Seminar

(Cross-listed with AGRON 6960/ BBMB 6960/ FOR 6960/ GDCB 6960/ HORT 6960).

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Research seminars by faculty and graduate students. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

PLBIO 6990: Research

Credits: 1-30. Repeatable.

Plant Pathology (PLP)

Courses primarily for undergraduates:

PLP 4080: Principles of Plant Path

(Dual-listed with PLP 5080).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Principles underlying the nature, diagnosis, and management of plant diseases. Laboratory complements lecture topics and provides experience in plant disease diagnosis. (Typically Offered: Fall, Spring)

PLP 4160: Forest Insects and Diseases

(Cross-listed with FOR 4160).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Nature of insects and pathogens of forest and shade trees; their role in the dynamics of natural and managed forest ecosystems; and the management of indigenous and exotic pests. Laboratory experience working with insect and fungal pests of trees. (Typically Offered: Fall)

PLP 4520: Integrated Management of Diseases and Insect Pests of Turfgrasses

(Dual-listed with PLP 5520/ ENT 5520/ HORT 5520). (Cross-listed with ENT 4520/ HORT 4520).

Credits: 3. Contact Hours: Lecture 3.

Prereq: HORT 3510

Identification and biology of important diseases and insect pests of turfgrasses. Development of integrated pest management programs in various turfgrass environments. Offered even-numbered years. (Typically Offered: Spring)

PLP 4770: Bacterial-Plant Interactions

(Dual-listed with MICRO 5770/ PLP 5770). (Cross-listed with MICRO 4770).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 3 credits in MICRO or PLP

Overview of plant-associated bacteria including their ecology, diversity, and the physiological and molecular mechanisms involved with their interactions with plants. The course covers bacterial plant pathogens and pathogenesis, nitrogen fixation and plant symbioses, biological control and plant growth promotion, bacterial disease diagnosis and management, and approaches to the study of microbial communities in the rhizosphere and on leaves. Offered even-numbered years. (Typically Offered: Spring)

PLP 4900A: Independent Study: Plant Pathology

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: 7 credits in BIOL; Junior or Senior classification; Permission of Instructor

Graduation Restriction: A maximum of 6 credits of PLP 4900 may be used toward the total of 128 credits required for graduation. (Typically Offered: Fall, Spring, Summer)

PLP 4900H: Independent Study: Honors

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: 7 credits in BIOL; Junior or Senior classification; Permission of Instructor; Membership in the University Honors Program

Graduation Restriction: A maximum of 6 credits of PLP 4900 may be used toward the total of 128 credits required for graduation. (Typically Offered: Fall, Spring, Summer)

PLP 4940: Seed Pathology

(Dual-listed with PLP 5940). (Cross-listed with STB 4940).

Credits: 2. Contact Hours: Lecture 2.

Prereq: PLP 4080

Significance of biotic and abiotic diseases that affect the production and utilization of seeds, during each phase of the seed life cycle: growing, harvesting, conditioning, storing, and planting seed. Mechanisms of seed infection and seed-to-seedling transmission are considered for fungi, bacteria, viruses/viroids, and nematodes. Aspects of epidemiology, management, and host-pathogen relationships are discussed. Emphases include the role of seed health testing in the global seed industry for quality control and phytosanitary certification, as well as the use of seed treatments to manage seedborne and soilborne pathogens and pests. Concurrent enrollment in PLP 4940L/5940L (Seed Pathology Laboratory) is strongly encouraged (on-campus students only). Graduation Restriction: Credit may not be obtained for both PLP/STB 5920 and PLP 5940. Offered odd-numbered years. (Typically Offered: Fall)

PLP 4940L: Seed Pathology Laboratory

(Dual-listed with PLP 5940L). (Cross-listed with STB 4940L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: PLP 4080

Laboratory in seed pathology. Seed health testing methods; effects of seed treatments and seed conditioning on seedborne pathogens. Offered odd-numbered years. (Typically Offered: Fall)

Courses primarily for graduate students, open to qualified undergraduates:

PLP 5060: Plant-Pathogen Interactions

Credits: 2. Contact Hours: Lecture 2.

Prereq: (BIOL 3130 and PLP 4080 or PLP 4160) or Graduate Classification

Introduction to mechanisms of plant-parasite interaction. Genetics and molecular genetics of plant disease resistance and pathogenicity. Offered odd-numbered years. (Typically Offered: Spring)

PLP 5080: Principles of Plant Path

(Dual-listed with PLP 4080).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Principles underlying the nature, diagnosis, and management of plant diseases. Laboratory complements lecture topics and provides experience in plant disease diagnosis. (Typically Offered: Fall, Spring)

PLP 5090: Plant Virology

(Cross-listed with MICRO 5090).

Credits: 2. Contact Hours: Lecture 1, Discussion 1.

Prereq: (BBMB 3010 or BIOL 3130) or Graduate Classification

Taxonomy, molecular mechanisms, host-interactions, vector transmission, epidemiology, detection, control and exploitation of plant viruses. Course will consist of a mixture of lectures, and student-led presentations using primary literature. Offered odd-numbered years. (Typically Offered: Spring)

PLP 5110: Integrated Management of Tropical Crops

(Cross-listed with ENT 5110/ HORT 5110).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (ENT 3700 or ENT 3760 or HORT 2210 or PLP 4080 or PLP 4160) or Graduate Classification

Applications of Integrated Crop management principles (including plant pathology, entomology, and horticulture) to tropical cropping systems. Familiarization with a variety of tropical agroecosystems and Costa Rican culture is followed by a 10-day tour of Costa Rican agriculture during spring break, then writeup of individual projects. Offered odd-numbered years. Meets International Perspectives Requirement. (Typically Offered: Spring)

PLP 5120: Lifestyles of plant pathogenic fungi and oomycetes.

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Exploration of the major groups of plant pathogenic fungi and oomycetes, focusing on the diseases they cause as well as pathogen ecology, diagnosis, crop resistance, and fungicide resistance. Offered odd-numbered years. (Typically Offered: Spring)

PLP 5300: Ecologically Based Pest Management Strategies

(Cross-listed with AGRON 5300/ ENT 5300/ SUSAG 5300).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Durable, least-toxic strategies for managing weeds, pathogens, and insect pests, with emphasis on underlying ecological processes. Offered odd-numbered years. (Typically Offered: Fall)

PLP 5430: Ecology and Epidemiology of Plant Diseases

Credits: 3. Contact Hours: Lecture 3.

Prereq: (PLP 4080 or PLP 4160) or graduate classification

Nutter. Theory and practice related to the ecology and epidemiology of plant disease epidemics. Interactions among host and pathogen populations as affected by the environment are quantified with respect to time and space. Aylis of ecological and host and pathogen genetic factors that alter the course of plant disease epidemics. Risk assessment theory, disease forecasting, and modeling the impact of biotic plant stresses on yield and quality are also emphasized. Offered odd-numbered years. (Typically Offered: Fall)

PLP 5520: Integrated Management of Diseases and Insect Pests of Turfgrasses

(Dual-listed with PLP 4520/ ENT 4520/ HORT 4520). (Cross-listed with ENT 5520/ HORT 5520).

Credits: 3. Contact Hours: Lecture 3.

Prereq: HORT 3510 or Graduate Classification

Identification and biology of important diseases and insect pests of turfgrasses. Development of integrated pest management programs in various turfgrass environments. Offered even-numbered years. (Typically Offered: Spring)

PLP 5740: Plant Nematology

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Morphology, anatomy, identification, management, and life cycles of common plant-parasitic nematodes; host parasite interactions; recent advances in plant nematology. Offered odd-numbered years. (Typically Offered: Fall)

PLP 5740L: Laboratory Techniques in Plant Nematology

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Practical skills of sample collection, processing, extraction, and identification of plant-parasitic nematodes from soil and roots; other techniques will be discussed. Offered odd-numbered years. (Typically Offered: Fall)

PLP 5770: Bacterial-Plant Interactions

(Dual-listed with MICRO 4770/ PLP 4770). (Cross-listed with MICRO 5770).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (3 credits in MICRO or PLP) or Graduate Classification

Overview of plant-associated bacteria including their ecology, diversity, and the physiological and molecular mechanisms involved with their interactions with plants. The course covers bacterial plant pathogens and pathogenesis, nitrogen fixation and plant symbioses, biological control and plant growth promotion, bacterial disease diagnosis and management, and approaches to the study of microbial communities in the rhizosphere and on leaves. Offered even-numbered years. (Typically Offered: Spring)

PLP 5810: Experience in Plant Science Extension and Outreach

(Cross-listed with AGRON 5810/ ENT 5810/ HORT 5810).

Credits: 1.

Prereq: Graduate Standing or Permission of Instructor

A supervised learning experience in several extension delivery methods used in the plant sciences. Participation in Iowa State University-based extension programs that may include field crops horticulture, or Master Gardener programming. Offered odd-numbered years. (Typically Offered: Summer)

PLP 5900: Special Topics

Credits: 1-3. Repeatable.

Prereq: 10 credits in biological sciences, Permission of Instructor

(Typically Offered: Fall, Spring, Summer)

PLP 5920: Seed Health Management

(Cross-listed with STB 5920).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Occurrence and management of diseases during seed production, harvest, conditioning, storage, and planting. Emphasis on epidemiology, disease management in the field, seed treatment, effects of conditioning on seed health, and seed health testing. Graduation Restriction: Credit may not be obtained for both PLP/STB 5920 and PLP 5940. Offered even-numbered years. (Typically Offered: Spring)

PLP 5940: Seed Pathology

(Dual-listed with PLP 4940). (Cross-listed with STB 5940).

Credits: 2. Contact Hours: Lecture 2.

Prereq: PLP 4080 or Graduate Classification

Significance of biotic and abiotic diseases that affect the production and utilization of seeds, during each phase of the seed life cycle: growing, harvesting, conditioning, storing, and planting seed. Mechanisms of seed infection and seed-to-seedling transmission are considered for fungi, bacteria, viruses/viroids, and nematodes. Aspects of epidemiology, management, and host-pathogen relationships are discussed. Emphases include the role of seed health testing in the global seed industry for quality control and phytosanitary certification, as well as the use of seed treatments to manage seedborne and soilborne pathogens and pests. Concurrent enrollment in PLP 4940L/5940L (Seed Pathology Laboratory) is strongly encouraged (on-campus students only). Graduation Restriction: Credit may not be obtained for both PLP/STB 5920 and PLP 5940. Offered odd-numbered years. (Typically Offered: Fall)

PLP 5940L: Seed Pathology Laboratory

(Dual-listed with PLP 4940L). (Cross-listed with STB 5940L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: PLP 4080 or Graduate Classification

Laboratory in seed pathology. Seed health testing methods; effects of seed treatments and seed conditioning on seedborne pathogens. Offered odd-numbered years. (Typically Offered: Fall)

PLP 5990: Creative Component

Credits: 1-30. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Independent study related to the student's area of specialization and approved by the student's major professor. (Typically Offered: Fall, Spring, Summer)

Courses for graduate students:**PLP 6080: Molecular Virology**

(Cross-listed with MICRO 6080/ VMPM 6080).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BBMB 4050 or GDCB 5110

Advanced study of virus host-cell interactions. Molecular mechanisms of viral replication and pathogenesis. Offered even-numbered years. (Typically Offered: Fall)

PLP 6280: Improving Professional Presentation Skills

Credits: 2. Contact Hours: Lecture 2.

Skill building to improve oral presentation fundamentals for graduate students in biological sciences. Principles and guidance in both personal speaking style and maximizing impact of presentation software. In-depth lectures and class discussions on all aspects of presentation skills. Video and anonymous peer review of individual speeches. (Typically Offered: Spring)

PLP 6910: Field Plant Pathology

Credits: 2. Contact Hours: Laboratory 6.

Repeatable.

Prereq: (PLP 4080 or PLP 4160) or graduate classification

Diagnosis of plant diseases, plant disease assessment methods, and the integration of disease management into commercial crop production practices. Objectives are to familiarize students with common diseases of Midwest crops and landscape plants, and to provide experience in disease diagnosis. Field trips include commercial operations, agricultural research facilities, and ornamental plantings. Offered even-numbered years. (Typically Offered: Summer)

PLP 6920: Molecular Biology of Plant-Pathogen Interactions

(Cross-listed with MICRO 6920).

Credits: 3. Contact Hours: Lecture 3.

Seminar and current research in molecular and physiological aspects of plant interactions with pathogens, including mechanisms of pathogenesis, host-pathogen recognition and host defense, with an emphasis on critical evaluation of primary literature. Students also complete a research proposal writing and peer review exercise. Offered odd-numbered years. (Typically Offered: Spring)

PLP 6940: Colloquium in Plant Pathology

Credits: 2. Contact Hours: Lecture 2.

Repeatable.

Advanced topics in plant pathology, including biological control, cultural control, resistance gene deployment, genetic engineering for disease resistance, chemical control, integrated pest management, emerging diseases, fungal genetics, insect vector biology, professional communications, etc. (Typically Offered: Spring)

PLP 6980: Seminar

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

PLP 6990: Thesis and Dissertation Research

Credits: 1-30. Repeatable.

Thesis and dissertation research. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

Political Science (POLS)

Courses primarily for undergraduates:

POLS 1010: Exploring Political Science

Credits: 1. Contact Hours: Lecture 1.

Introduction to a variety of approaches to political questions. Relevance to career paths. For political science majors and others interested in exploring political questions. Recommended first semester of freshman year, or as soon as possible after declaring the major. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

POLS 1110: Introduction to American Government

Credits: 3. Contact Hours: Lecture 3.

Fundamentals of American democracy; constitutionalism; federalism; rights and duties of citizens; executive, legislative, and judicial branches of government; elections, public opinion, interest groups, and political parties. (Typically Offered: Fall, Spring)

POLS 1210: Introduction to International Politics

Credits: 3. Contact Hours: Lecture 3.

Dynamics of interstate relations pertaining to nationalism, the nation state; peace and war; foreign policy making; the national interest; military capability and strategy; case studies of transnational issues, such as population, food, energy, and terrorism. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

POLS 1250: Democracy and Dictatorship: Introduction to Comparative Politics

Credits: 3. Contact Hours: Lecture 3.

Interactions between governments and citizens in countries outside the US. Causes of democracy, dictatorship, and economic and social development. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

POLS 2220X: Global Engagement

(Cross-listed with GLOBE 2220X).

Credits: 3. Contact Hours: Lecture 3.

Engagement with social and political issues on a global scale. Contributions of individual action, non-governmental organizations, and governments to changing societal and international outcomes. Techniques for identifying and addressing problems around the world. Meets International Perspectives Requirement. (Typically Offered: Fall)

POLS 2320X: Politics of Business

Credits: 3. Contact Hours: Lecture 3.

Characteristics of American political economy and its comparison to other countries. Wealth, power, and the market in politics; the relationship between capitalism and democracy. The regulation of corporations, and the relationship between governments and business. (Typically Offered: Fall, Spring, Summer)

POLS 2350: Introduction to Ethics and Politics

Credits: 3. Contact Hours: Lecture 3.

Moral controversies surrounding political issues such as violence, deception, corruption, civil disobedience, democracy, justice, equality, and freedom. Political applications of classic and contemporary texts. (Typically Offered: Fall)

POLS 2610: Thinking Like a Political Scientist: Qualitative Approaches

Credits: 3. Contact Hours: Lecture 3.

Theory and method in empirical political science, with an emphasis on qualitative social-science methodologies. Research design, causal logic, and use of evidence. Content analysis, case studies, focus groups, and interviews. (Typically Offered: Fall)

POLS 2620: Thinking Like a Political Scientist: Quantitative Approaches

Credits: 3. Contact Hours: Lecture 3.

Theory and method in empirical political science, with an emphasis on quantitative social-science methodologies. Research design, causal logic, and use of evidence. Regressions, experiments, and polls and surveys. (Typically Offered: Spring)

POLS 2710: Public Organizations and Leadership

Credits: 3. Contact Hours: Lecture 3.

Introductory survey of public governance at the administrative and managerial levels of international, national, state, and local government. Essential issues and competencies involved in efficient, effective, and ethical provision of public goods and services. Relationships inside and across governments, social equity, public-private partnerships, and privatization. (Typically Offered: Fall)

POLS 2830: Introduction to Environmental Politics and Policies

(Cross-listed with ENVS 2830).

Credits: 3. Contact Hours: Lecture 3.

Introduction to major ideologies' relations to conservation and ecology. Processes, participants, and institutions involved in state, national, and global environmental policymaking. Case studies of environmental controversies and proposals for policy reform. (Typically Offered: Spring)

POLS 2980: Cooperative Education

Credits: Required. Repeatable.

Prereq: Permission of the department cooperative education coordinator; sophomore classification

Required of all cooperative education students. Students must register for this course prior to commencing each work period. (Typically Offered: Fall, Spring, Summer)

POLS 3050: Comparative Political Behavior

Credits: 3. Contact Hours: Lecture 3.

Political attitudes and behaviors of citizens in democracies, both in the US and cross-nationally. Citizens' traits and their relationship to democracy. Offered even-numbered years. (Typically Offered: Fall)

POLS 3060: Public Opinion and Voting Behavior

Credits: 3. Contact Hours: Lecture 3.

The formation of political opinions and attitudes, political participation, and voting behavior of the general public, and their influences on American politics; polling as a means of assessing public opinions and behaviors. (Typically Offered: Spring)

POLS 3070X: Political Psychology

(Cross-listed with PSYCH 3070X).

Credits: 3. Contact Hours: Lecture 3.

Psychological influences on political behavior. Political preferences, personality, cognitive biases, political violence, and partisan identities. Psychological explanations of contemporary political events. (Typically Offered: Fall)

POLS 3080: Video Games and Politics

Credits: 3. Contact Hours: Lecture 3.

Interactions between video games and politics from the perspective of both state and society. History and regulation of video games; games' connection with war and with authoritarian regimes; representation, race, and gender in games and game communities; games' influence on social and political attitudes. (Typically Offered: Fall, Spring, Summer)

POLS 3100: State and Local Government

Credits: 3. Contact Hours: Lecture 3.

Role of state and local governments in the American federal system. Structures of participation: political parties, elections, interest groups. Major governmental institutions: legislative, executive, and judicial. Structure and functions of local governments. (Typically Offered: Fall, Spring)

POLS 3180: Campaigns and Elections

Credits: 3. Contact Hours: Lecture 3.

Methods and strategies of political campaigns in American elections. History of the electoral process and the transformation of American campaigns. (Typically Offered: Fall)

POLS 3190: Law and Politics

Credits: 3. Contact Hours: Lecture 3.

American judicial system and controversies spanning law and politics. Potential topics include statutory construction, judicial review, proper role of the judiciary, vagueness and ambiguity in law, competing constitutional philosophies, executive branch concerns, and relative power of different branches. POLS 1110 recommended. Graduation Restriction: Only one of POLS 2300, 3190 may count toward graduation. (Typically Offered: Fall)

POLS 3200: American Judicial Process

(Cross-listed with CJ 3200).

Credits: 3. Contact Hours: Lecture 3.

An overview of the American judicial process. Emphasis on specific topics such as application of constitutional rights to the states (particularly the Fourth, Fifth, Sixth, and Fourteenth Amendments), mechanics of judicial opinions, constitutional philosophies of Supreme Court Justices, decisions of first impression, and the value and scope of precedent. (Typically Offered: Spring)

POLS 3240: Health and Native American Communities

(Cross-listed with ANTHR 3240/ AMIN 3240).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500

Overview of historic and contemporary health and health care in Native Communities. Indian Health Service and specific regulations. Consideration of both cultural and scientific approaches to medicine. Specific health issues (e.g., diabetes, alcoholism, depression, etc.) in American Indian communities. Meets U.S. Cultures and Communities Requirement.

POLS 3250: Religion, Law, and Justice

(Cross-listed with CJ 3250/ RELIG 3250).

Credits: 3. Contact Hours: Lecture 3.

A study of the role of religion in law and justice with a focus on the United States. Examines the history of religious freedom, key contemporary legal cases, and how religious-oriented justice movements engage ethics and the law. (Typically Offered: Fall)

POLS 3330: Democracy in America

Credits: 3. Contact Hours: Lecture 3.

Competing American conceptions of democracy as expressed in founding documents and important texts in American political thought. Implications for contemporary debates about religion, race, gender, and wealth. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Spring)

POLS 3340: Politics and Society

(Cross-listed with SOC 3340).

Credits: 3. Contact Hours: Lecture 3.

The relationship between politics and society with emphasis on American society. Discussion of theories of inequality, power, social movements, elites, ruling classes, democracy, and capitalism. (Typically Offered: Fall)

POLS 3350: Science, Technology, and Public Policy

Credits: 3. Contact Hours: Lecture 3.

Examines the history and political dynamics of public science and technology policies. Examines differences in political and technological orientations. Assessment of the roles of politics, media, engineering, science, and private business in the formation of public policies that put heavy reliance on or seek to advance science and technology. (Typically Offered: Spring)

POLS 3360X: Climate Change Policy

(Cross-listed with ENVS 3360X).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 3 credits in POLS OR ECON 1010 OR Sophomore Classification

Policy-centered approach to climate-change solutions. Investigation, analysis, and evaluation of policy responses to the prospect and occurrence of climate change. Politics of climate-related technological, regulatory, and societal changes. Interaction of social movements, institutions, and economic interests in shaping national and global responses to climate change. (Typically Offered: Spring)

POLS 3370X: Health Politics and Policy

Credits: 3. Contact Hours: Lecture 3.

Analysis of the evolution of the American system of healthcare. Financing, regulation, delivery, and the policy process related to healthcare policymaking by political institutions including Congress, the presidency and executive branch, federal courts, and state and local governments. Exploration of factors leading to disparities in healthcare service delivery and outcomes. Offered odd-numbered years. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall)

POLS 3390: Liberty and Law in America

(Cross-listed with CJ 3390/ PHIL 3390).

Credits: 3. Contact Hours: Lecture 3.

Competing conceptions of liberty in American political thought. Debates about how liberty should be protected by the law, in fields such as health care, drugs, property, speech, religion, and sex. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall, Spring)

POLS 3400: Politics of Developing Areas

Credits: 3. Contact Hours: Lecture 3.

Economic and political development as they relate to the political process of developing states. Impact of social and technological change on political systems of developing areas. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

POLS 3420: Chinese Politics

Credits: 3. Contact Hours: Lecture 3.

Legacies of Imperial China, the origins of the Chinese Civil War, and the causes and consequences of the reform era. Issues of contemporary China, including economic transformation, the structure of the Party/state, the environment, the media and other topics. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

POLS 3430: Latin American Government and Politics

(Cross-listed with USLS 3430).

Credits: 3. Contact Hours: Lecture 3.

Political institutions, processes, and contemporary issues. Selected countries examined intensively to illustrate generalizations. Role of parties, military, church, human rights, women, environmental issues, interest groups, ideology, and globalization. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

POLS 3440: Public Policy

Credits: 3. Contact Hours: Lecture 3.

How agendas come to be set in public policy, theories describing the policy-making process, forces molding policy choices and the impact of such choices. (Typically Offered: Fall, Spring)

POLS 3460: European Politics

Credits: 3. Contact Hours: Lecture 3.

Comparative study of political institutions of Europe and the European Union; emphasis on parties, elections, and governmental structures. Substance and process of public policies in selected problem areas. Meets International Perspectives Requirement. (Typically Offered: Fall)

POLS 3480: British Government and Politics

Credits: 3. Contact Hours: Lecture 3.

Political institutions and processes in Great Britain and Northern Ireland; emphasis on Parliament, executive and monarchy, and public policies, including devolution. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

POLS 3490: Politics of Russia and Eastern Europe

Credits: 3. Contact Hours: Lecture 3.

Nation-states of Central and Eastern Europe. Comparison of European communist systems and the revolutionary conflict leading to the dissolution of communist Europe. Political analysis of post-communist Russian and Eastern European nation-states and their economic, cultural and social variations. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

POLS 3500: Politics of the Middle East

Credits: 3. Contact Hours: Lecture 3.

Introduction to the Middle East as a region and to issues of political importance to the Middle East and its place in the world. Topics covered include political Islam, regional conflicts and alliances, local leaders, political economy, democracy, and human rights. Meets International Perspectives Requirement. (Typically Offered: Spring)

POLS 3520: Migration and Refugees in the 21st Century

(Cross-listed with ANTHR 3520).

Credits: 0-99. Contact Hours: Lecture 3.

Repeatable.

The historical, economic, social, political, and environmental factors that explain human mobility in the 21st century. The definition of a 'migrant' with special emphasis on refugees (people who have been forcibly displaced across national borders). Ethnographic accounts of current refugee crises and of host state policy toward refugees.

POLS 3530: Immigration Policy

Credits: 3. Contact Hours: Lecture 3.

Political, economic, and social factors that affect immigration policy. Systematic analysis and implications of different types of immigration policies in countries sending and receiving immigrants. Policies regarding incorporation of migrants into, and effects of migrants on, American society. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall)

POLS 3540: War and the Politics of Humanitarianism

(Cross-listed with ANTHR 3540).

Credits: 3. Contact Hours: Lecture 3.

Humanitarianism as a system of thought and a system of intervention in conflict and post-conflict situations. Role of humanitarian organizations and actors in addressing human suffering caused by conflict or war. Military action as a form of humanitarian intervention. Meets International Perspectives Requirement.

POLS 3550: War and Politics

Credits: 3. Contact Hours: Lecture 3.

Theoretical relationship among politics, strategy, and war. Evolution of war, the relationship between technology and conflict, and the changing causes and nature of global violence. Meets International Perspectives Requirement. (Typically Offered: Fall)

POLS 3560: Theories of International Politics

Credits: 3. Contact Hours: Lecture 3.

Introduction to essential theoretical concepts and approaches, both classical and contemporary on world politics including realism, empiricism, liberalism, and postpositivism; for example, war and conflict, peace and cooperation, political economy, crisis decision-making, systemic theory, dependence and interdependence. (Typically Offered: Fall, Spring, Summer)

POLS 3570: International Security Policy

Credits: 3. Contact Hours: Lecture 3.

Contemporary approaches in the security area including strategic deterrence, cybersecurity, environmental security, peacekeeping and terrorism. Current cases to illustrate policies as well as historical and theoretical choices. (Typically Offered: Fall, Spring, Summer)

POLS 3580: United States Foreign Policy

Credits: 3. Contact Hours: Lecture 3.

U.S. foreign policy since World War II with emphasis on changing American values in foreign policy, the role of the President, Congress, and the bureaucracy in policy making, and a survey of current foreign policy issues and problems. (Typically Offered: Spring)

POLS 3590: Current Issues in American Foreign Policy

Credits: 3. Contact Hours: Lecture 3.

Examination of contemporary U.S. foreign policy issues (e.g., U.S. policy in the Middle East; defense budgeting in the post-Cold War era; conventional and nuclear arms control policy). The course will explore alternate methods to analyze policy, survey the evolution of each issue, and discuss different policy alternatives. (Typically Offered: Fall, Spring, Summer)

POLS 3600: American Institutions: Congress

Credits: 3. Contact Hours: Lecture 3.

Theory and practice of representation and deliberation in the legislative branch of the republic; operations of Congress in terms of its committees, leadership, legislative and oversight processes, partisan politics, electoral campaigns, service to local and special electoral campaigns, service to local and special interests, and interactions with the President. (Typically Offered: Fall, Spring, Summer)

POLS 3610: American Institutions: The Presidency

Credits: 3. Contact Hours: Lecture 3.

Creation and historical development of the office of chief executive; character and behavior of past chief executives; selection and control; powers, roles, functions; executive staff; relations with Congress, press, public opinion. (Typically Offered: Fall, Spring, Summer)

POLS 3630: American Institutions: Media

Credits: 3. Contact Hours: Lecture 3.

Influence of mass media organizations, forms, techniques, and technologies on the practices and expectations of American politics. Role of media in the political process, including promoting or discouraging political participation. Politics of traditional journalism, devices of propaganda, effects of campaign advertising, and media spectacles. (Typically Offered: Spring)

POLS 3640: Political Parties and Interest Groups

Credits: 3. Contact Hours: Lecture 3.

Nature of political parties and interest groups, their relation to each other, and their effects on American politics. Topics include party identification, party organization and mobilization, factionalism, lobbying, campaign contributions and financing, and the effects of special interests on public law. (Typically Offered: Fall)

POLS 3700: Religion and Politics

(Cross-listed with RELIG 3700).

Credits: 3. Contact Hours: Lecture 3.

The interaction of religion and politics in the U.S. from both an historical and contemporary perspective, as well as the role of religion in politics internationally. (Typically Offered: Fall)

POLS 3810: International Political Economy

Credits: 3. Contact Hours: Lecture 3.

Politics of international economic interaction. Trade wars and agreements, cross-border finance and multinational corporations, exchange rates and monetary policy, outsourcing, and development under conditions of globalization. (Typically Offered: Fall, Spring, Summer)

POLS 3850: Women in Politics

(Cross-listed with WGS 3850).

Credits: 3. Contact Hours: Lecture 3.

Entry and participation of women in politics in the United States and other countries. Contemporary issues and strategies for change through the political process. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Spring)

POLS 3870: First Ladies in U.S. History

(Cross-listed with HIST 3870/ WGS 3870).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Evolution of the role and office of the First Lady in U.S. history, including her political activism, social impact, and international influence. Analysis of the authority, intersectionality and agency of First Ladies in the aggregate and exploration of how individual First Ladies have interpreted and adapted this unique public position. Offered even-numbered years. (Typically Offered: Fall)

POLS 3900: Topics in Political Science

Credits: 1-4. Contact Hours: Lecture 4.

Repeatable.

Selected topics in political science. Graduation Restriction: A topic may not be taken more than once. (Typically Offered: Fall, Spring, Summer)

POLS 3970: International Study and Travel

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

Prereq: Instructor Permission for Course

Supervised study in an aspect of discipline while traveling or located in a foreign country. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

POLS 3980: Cooperative Education

Credits: Required. Repeatable.

Prereq: Permission of Department Cooperative Education Coordinator; Junior classification

Required of all cooperative education students. Students must register for this course prior to commencing work period. (Typically Offered: Fall, Spring, Summer)

POLS 4010: Political Analysis and Research

(Dual-listed with POLS 5010).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Scope and methods of political science. Introduction to theoretical approaches and analytical reasoning in political science. Relationship of theory and data. Research design. (Typically Offered: Fall)

POLS 4040: Proseminar in International Politics

(Dual-listed with POLS 5040).

Credits: 3. Contact Hours: Lecture 3.

Overview of major theoretical and empirical works in the study of international politics and foreign policy. Realism, liberalism, and constructivism; conflict, alliances, and international economic relations. (Typically Offered: Fall, Spring, Summer)

POLS 4050: Proseminar in Comparative Politics

(Dual-listed with POLS 5050).

Credits: 3. Contact Hours: Lecture 3.

Foundations of comparative politics, the study of different political regimes. Political behavior, development, causes and consequences of democracy and authoritarianism. Contrasting research methods and designs. (Typically Offered: Fall, Spring, Summer)

POLS 4070: Proseminar in Public Policy

(Dual-listed with POLS 5070).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

An overview of the major theoretical approaches and empirical methods relevant to the study of public policy. Emphasis is placed on agenda setting, policy formation, policy sustainability, and policy analysis. Seminal writings by leading scholars will be reviewed. Leading quantitative and qualitative methodological tools for analyzing policy are presented. Offered even-numbered years. (Typically Offered: Fall)

POLS 4080: Proseminar in Policy Implementation

(Dual-listed with POLS 5080).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

The implementation phase of the policy process, primarily within government. Examination of specific programs, rules, or pieces of legislation within a larger policy area, such as health, environment, transportation, education, welfare, or foreign policy. Offered even-numbered years. (Typically Offered: Fall)

POLS 4090: Political Game Theory

(Dual-listed with POLS 5090).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Application of economics to political science in the study of nonmarket decision-making. Behavior of bureaucrats, elected officials, and voters. Market failure, collective action, representative democracies, direct democracies, logrolling, voter paradoxes, and game theory. (Typically Offered: Fall, Spring, Summer)

POLS 4100: State Government and Politics

(Dual-listed with POLS 5100).

Credits: 3. Contact Hours: Lecture 3.

Comparative analysis of state political systems. Role of interest groups, political parties, legislatures, courts, and governors in state politics. Possible determinants of public policy outputs at the state level. (Typically Offered: Fall, Spring, Summer)

POLS 4170: Campaign Rhetoric

(Cross-listed with SPCM 4170).

Credits: 3. Contact Hours: Lecture 3.

Prereq: SPCM 2120

Backgrounds of candidates for state and national elections; selected speeches and issues; persuasive strategies and techniques of individual speakers. Offered even-numbered years. (Typically Offered: Fall)

POLS 4190: The Judiciary

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Judicial review, federal common law, judicial confirmation, strict construction of the Constitution, and qualifications to serving on Courts; judicial activism and the infusion of politics into courts.

POLS 4200: Constitutional Law

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior classification

Development of the United States Constitution through judicial action; influence of public law and judicial interpretations upon American government and society. (Typically Offered: Fall)

POLS 4210: Constitutional Freedoms

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior classification

Leading Supreme Court cases interpreting the Bill of Rights and the Fourteenth Amendment. Emphasis on religion, speech, privacy, due process, and equal protection. (Typically Offered: Spring)

POLS 4220: International Law

(Dual-listed with POLS 5220).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Legal aspects of international activities: state jurisdiction over territories and subjects, law of the sea, use of force, and judicial settlement of international disputes. (Typically Offered: Fall)

POLS 4250: Proseminar in American Political Behavior

(Dual-listed with POLS 5250).

Credits: 3. Contact Hours: Lecture 3.

Theoretical, empirical, and methodological works concerning mass political behavior in the United States. Political attitudes, public opinion, and ideologies; voting, electoral behavior and social movements; political psychology. Survey research and experimental approaches. Offered odd-numbered years. (Typically Offered: Fall, Spring, Summer)

POLS 4300: Foundations of Western Political Thought

(Dual-listed with POLS 5300/ CLST 5300). (Cross-listed with CLST 4300).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 6 credits in POLS, HIST, or PHIL

Study of original texts in political thought ranging from the classical period to the renaissance. Topics such as justice, freedom, virtue, the allocation of political power, the meaning of democracy, human nature, and natural law. (Typically Offered: Fall, Spring, Summer)

POLS 4310: Modern Political Thought

(Dual-listed with POLS 5310).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 6 credits in POLS, HIST, or PHIL

Study of original texts in political thought ranging from the Reformation to the French Revolution and its aftermath. Topics such as justice, freedom, rights, democracy, toleration, property, power, skepticism, and normative views of international politics. (Typically Offered: Spring)

POLS 4350: Contemporary Political Philosophy

(Dual-listed with PHIL 5350/ POLS 5350). (Cross-listed with PHIL 4350).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Prereq: 6 credits in PHIL or POLS, or Permission of Instructor

Examination of theories of justice proposed by contemporary political philosophers. Analysis of the philosophical foundations of perspectives such as liberalism, libertarianism, communitarianism, socialism, feminism. Normative assessments of socio-political institutions. (Typically Offered: Spring)

POLS 4430: Energy Policy

(Dual-listed with POLS 5430).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Energy policies and related social, environmental, and political issues. Energy problems and the impact of energy policies. (Typically Offered: Fall)

POLS 4520: Comparative Foreign Policy

(Dual-listed with POLS 5520).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Theoretical approaches to understanding foreign policy making and behavior through case studies of selected nations. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

POLS 4530: International Organization

(Dual-listed with POLS 5530).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Sources of international order in a variety of substantive areas such as international security, international trade and finance, the environment, and human rights: distribution of power, institutions, international law, and norms. (Typically Offered: Spring)

POLS 4600: Proseminar in American Political Institutions

(Dual-listed with POLS 5600).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Policymaking and governance in a federal, separation-of-powers system. Interaction between the chief executive, the legislature, judiciary, administrative agencies, and the public. Political and legal forces' effect on policymakers, public policies, and programs. Offered odd-numbered years. (Typically Offered: Fall)

POLS 4710: Organizational Theory in the Public Sector

(Dual-listed with POLS 5710).

Credits: 3. Contact Hours: Lecture 3.

Major theories of administrative organization, including motivations of administrators and organizations, comparisons of organizational arrangements, factors affecting organizational arrangements, and formal and informal decision-making structures. (Typically Offered: Fall, Spring, Summer)

POLS 4740: Policy and Program Evaluation

(Dual-listed with POLS 5740).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Integration, application, and utilization of public administration and public policy concepts in the interpretation of results and effectiveness of public programs and the prediction of consequences for policymakers and administrators. (Typically Offered: Spring)

POLS 4750: Management in the Public Sector

(Dual-listed with POLS 5750).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Literature and research on organizational behavior and management theory with emphasis on applied aspects of managing contemporary public-sector organizations. Distinctions between public and private organizations, leadership, productivity, employee motivation, organizational structure, and organizational change. (Typically Offered: Fall, Spring, Summer)

POLS 4770: Government, Business, and Society

(Dual-listed with POLS 5770).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Diverse perspectives on the changing roles and relationships of business, government, and society for more effective policy decisions on corporate affairs. The changing economy; transformation of workplace and community conditions; consumerism; social responsibilities of businesses; economic policies and regulations; politics in the business-government relationship. (Typically Offered: Fall)

POLS 4800: Ethics and Public Policy

(Dual-listed with POLS 5800).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Study of decision making approaches and application to case studies. Topics such as the different roles of public officials, proper scope and use of administrative discretion, and the admissibility of religious, political, and philosophical commitments in governmental decision making. (Typically Offered: Fall, Spring, Summer)

POLS 4870: Cyberpolitics

(Dual-listed with POLS 5870).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 12 credits in POLS; Permission of Instructor

Impact of information technology, the Internet, and artificial intelligence on politics and policy. Positive and negative effects on interest group behavior, media, civic participation, elections, and sense of community. Hacking, cybercrime, cyberterrorism, cyberwarfare, privacy, smart cities. (Typically Offered: Fall, Spring, Summer)

POLS 4900: Independent Study

Credits: 1-30. Repeatable, maximum of 9 credits.

Prereq: 6 credits in POLS; Permission of Instructor

Special studies in the political institutions, processes and policies of American, foreign, and international governments. Also, studies in traditional and behavioral political theory. Use of credit in POLS major and minor is limited. See Undergraduate Study for information. Graduation Restriction: No more than 9 credits of POLS 4900 may be counted toward graduation. (Typically Offered: Fall, Spring)

POLS 4900A: Independent Study: American Government and Politics

Credits: 1-30. Repeatable, maximum of 9 credits.

Prereq: 6 credits in POLS; Permission of Instructor

Special studies in the political institutions, processes and policies of American, foreign, and international governments. Also, studies in traditional and behavioral political theory. Use of credit in POLS major and minor is limited. See Undergraduate Study for information. (Typically Offered: Fall, Spring, Summer)

POLS 4900B: Independent Study: Theory and Method

Credits: 1-30. Repeatable, maximum of 9 credits.

Prereq: 6 credits in POLS; Permission of Instructor

Special studies in the political institutions, processes and policies of American, foreign, and international governments. Also, studies in traditional and behavioral political theory. Use of credit in POLS major and minor is limited. See Undergraduate Study for information. (Typically Offered: Fall, Spring, Summer)

POLS 4900C: Independent Study: Comparative Politics

Credits: 1-30. Repeatable, maximum of 9 credits.

Prereq: 6 credits in POLS; Permission of Instructor

Special studies in the political institutions, processes and policies of American, foreign, and international governments. Also, studies in traditional and behavioral political theory. Use of credit in POLS major and minor is limited. See Undergraduate Study for information. (Typically Offered: Fall, Spring, Summer)

POLS 4900D: Independent Study: International Relations

Credits: 1-30. Repeatable, maximum of 9 credits.

Prereq: 6 credits in POLS; Permission of Instructor

Special studies in the political institutions, processes and policies of American, foreign, and international governments. Also, studies in traditional and behavioral political theory. Use of credit in POLS major and minor is limited. See Undergraduate Study for information. (Typically Offered: Fall, Spring, Summer)

POLS 4900E: Independent Study: Extended credit

Credits: 1-2. Repeatable, maximum of 9 credits.

Prereq: 6 credits in POLS; Permission of Instructor

Extra study for any 3000-Special studies in the political institutions, processes and policies of American, foreign, and international governments. Also, studies in traditional and behavioral political theory. Use of credit in POLS major and minor is limited. See Undergraduate Study for information. (Typically Offered: Fall, Spring, Summer)

POLS 4900H: Independent Study

Credits: 1-30. Repeatable, maximum of 9 credits.

Prereq: 6 credits in POLS; Permission of Instructor; Membership in the University Honors Program

Special studies in the political institutions, processes and policies of American, foreign, and international governments. Also, studies in traditional and behavioral political theory. Use of credit in POLS major and minor is limited. See Undergraduate Study for information. Graduation Restriction: No more than 9 credits of POLS 4900 may be counted toward graduation. (Typically Offered: Fall, Spring)

POLS 4910: Senior Thesis

Credits: 3.

Prereq: 21 credits of POLS; Permission of Instructor

Written under the supervision of a Political Science faculty advisor.

(Typically Offered: Fall, Spring, Summer)

POLS 4920: Graduating Senior Survey

Credits: Required.

Offered on a satisfactory-fail basis only. Outcomes-assessment activities including job-placement surveys and evaluations of instructors, advisors, and courses. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

POLS 4960: Teaching Internship in Political Science

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: 12 credits in POLS; Permission of Instructor

Undergraduate teaching experience through assisting an instructor with an introductory course in political science. Use of credit in POLS major and minor is limited. See Undergraduate Study for information. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

POLS 4970: Research Internship in Political Science

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: 12 credits in POLS; Permission of Instructor

Undergraduate research experience through assisting on a scholarly project with an instructor in political science. Use of credit in POLS major and minor is limited. See Undergraduate Study for information. (Typically Offered: Fall, Spring)

POLS 4980: Cooperative Education

Credits: Required. Repeatable.

Prereq: Permission of Department Cooperative Education Coordinator; Senior classification

Required of all cooperative education students. Students must register for this course prior to commencing each work period. (Typically Offered: Fall, Spring, Summer)

POLS 4990: Internship in Political Science

Credits: 1-30. Repeatable, maximum of 12 credits.

Prereq: 6 credits in POLS; Junior or Senior classification; Internship Coordinator Permission

Work experience with a specific nongovernmental or governmental agency at the local, state, national, or international level, combined with academic work under faculty supervision. Use of credit in POLS major and minor is limited. See Undergraduate Study for information. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

POLS 5010: Political Analysis and Research

(Dual-listed with POLS 4010).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Scope and methods of political science. Introduction to theoretical approaches and analytical reasoning in political science. Relationship of theory and data. Research design. (Typically Offered: Fall)

POLS 5040: Proseminar in International Politics

(Dual-listed with POLS 4040).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Overview of major theoretical and empirical works in the study of international politics and foreign policy. Realism, liberalism, and constructivism; conflict, alliances, and international economic relations. Offered even-numbered years. (Typically Offered: Fall)

POLS 5050: Proseminar in Comparative Politics

(Dual-listed with POLS 4050).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Foundations of comparative politics, the study of different political regimes. Political behavior, development, causes and consequences of democracy and authoritarianism. Contrasting research methods and designs. Offered odd-numbered years. (Typically Offered: Fall)

POLS 5070: Proseminar in Public Policy

(Dual-listed with POLS 4070).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

An overview of the major theoretical approaches and empirical methods relevant to the study of public policy. Emphasis is placed on agenda setting, policy formation, policy sustainability, and policy analysis. Seminal writings by leading scholars will be reviewed. Leading quantitative and qualitative methodological tools for analyzing policy are presented.

POLS 5080: Proseminar in Policy Implementation

(Dual-listed with POLS 4080).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

The implementation phase of the policy process, primarily within government. Examination of specific programs, rules, or pieces of legislation within a larger policy area, such as health, environment, transportation, education, welfare, or foreign policy. Offered even-numbered years. (Typically Offered: Fall)

POLS 5090: Political Game Theory

(Dual-listed with POLS 4090).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Application of economics to political science in the study of nonmarket decision-making. Behavior of bureaucrats, elected officials, and voters. Market failure, collective action, representative democracies, direct democracies, logrolling, voter paradoxes, and game theory.

POLS 5100: State Government and Politics

(Dual-listed with POLS 4100).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Comparative analysis of state political systems. Role of interest groups, political parties, legislatures, courts, and governors in state politics. Possible determinants of public policy outputs at the state level.

POLS 5220: International Law

(Dual-listed with POLS 4220).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Legal aspects of international activities: state jurisdiction over territories and subjects, law of the sea, use of force, and judicial settlement of international disputes.

POLS 5250: Proseminar in American Political Behavior

(Dual-listed with POLS 4250).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Theoretical, empirical, and methodological works concerning mass political behavior in the United States. Political attitudes, public opinion, and ideologies; voting, electoral behavior and social movements; political psychology. Survey research and experimental approaches. Offered odd-numbered years. (Typically Offered: Fall)

POLS 5300: Foundations of Western Political Thought

(Dual-listed with POLS 4300/ CLST 4300). (Cross-listed with CLST 5300).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Study of original texts in political thought ranging from the classical period to the renaissance. Topics such as justice, freedom, virtue, the allocation of political power, the meaning of democracy, human nature, and natural law. (Typically Offered: Fall, Spring, Summer)

POLS 5310: Modern Political Thought

(Dual-listed with POLS 4310).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Study of original texts in political thought ranging from the Reformation to the French Revolution and its aftermath. Topics such as justice, freedom, rights, democracy, toleration, property, power, skepticism, and normative views of international politics.

POLS 5340: Legal and Ethical Issues in Cyber Security

(Cross-listed with CPRE 5340/ CYBSC 5340).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Legal and ethical issues in computer security. State and local codes and regulations. Privacy issues. (Typically Offered: Spring)

POLS 5350: Contemporary Political Philosophy

(Dual-listed with PHIL 4350/ POLS 4350). (Cross-listed with PHIL 5350).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Examination of theories of justice proposed by contemporary political philosophers. Analysis of the philosophical foundations of perspectives such as egalitarianism, libertarianism, and socialism. Normative assessment of social and political institutions. (Typically Offered: Spring)

POLS 5430: Energy Policy

(Dual-listed with POLS 4430).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Energy policies and related social, environmental, and political issues. Energy problems and the impact of energy policies.

POLS 5520: Comparative Foreign Policy

(Dual-listed with POLS 4520).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Theoretical approaches to understanding foreign policy making and behavior through case studies of selected nations. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

POLS 5530: International Organization

(Dual-listed with POLS 4530).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Sources of international order in a variety of substantive areas such as international security, international trade and finance, the environment, and human rights: distribution of power, institutions, international law, and norms.

POLS 5600: Proseminar in American Political Institutions

(Dual-listed with POLS 4600).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Polymaking and governance in a federal, separation-of-powers system. Interaction between the chief executive, the legislature, judiciary, administrative agencies, and the public. Political and legal forces' effect on policymakers, public policies, and programs. Offered odd-numbered years. (Typically Offered: Fall)

POLS 5710: Organizational Theory in the Public Sector

(Dual-listed with POLS 4710).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Major theories of administrative organization, including motivations of administrators and organizations, comparisons of organizational arrangements, factors affecting organizational arrangements, and formal and informal decision-making structures.

POLS 5740: Policy and Program Evaluation

(Dual-listed with POLS 4740).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Integration, application, and utilization of public administration and public policy concepts in the interpretation of results and effectiveness of public programs and the prediction of consequences for policymakers and administrators.

POLS 5750: Management in the Public Sector

(Dual-listed with POLS 4750).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Literature and research on organizational behavior and management theory with emphasis on applied aspects of managing contemporary public-sector organizations. Distinctions between public and private organizations, leadership, productivity, employee motivation, organizational structure, and organizational change.

POLS 5770: Government, Business, and Society

(Dual-listed with POLS 4770).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Diverse perspectives on the changing roles and relationships of business, government, and society for more effective policy decisions on corporate affairs. The changing economy; transformation of workplace and community conditions; consumerism; social responsibilities of businesses; economic policies and regulations; politics in the business-government relationship.

POLS 5800: Ethics and Public Policy

(Dual-listed with POLS 4800).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Study of decision making approaches and application to case studies. Topics such as the different roles of public officials, proper scope and use of administrative discretion, and the admissibility of religious, political, and philosophical commitments in governmental decision making.

POLS 5870: Cyberpolitics

(Dual-listed with POLS 4870).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Impact of information technology, the Internet, and artificial intelligence on politics and policy. Positive and negative effects on interest group behavior, media, civic participation, elections, and sense of community. Hacking, cybercrime, cyberterrorism, cyberwarfare, privacy, smart cities. (Typically Offered: Fall, Spring, Summer)

POLS 5900A: Special Topics: American Politics

Credits: 2-5. Repeatable.

Prereq: 15 credits in POLS and instructor permission

(Typically Offered: Fall, Spring)

POLS 5900D: Special Topics: Global Politics

Credits: 2-5. Repeatable.

Prereq: 15 credits in POLS and instructor permission

(Typically Offered: Fall, Spring)

POLS 5900G: Special Topics: Public Policy

Credits: 2-5. Repeatable.

Prereq: 15 credits in POLS and instructor permission

(Typically Offered: Fall, Spring)

POLS 5900J: Special Topics: Theory, Law, and Methods

Credits: 2-5. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

(Typically Offered: Fall, Spring)

POLS 5980: Graduate Student Internship

Credits: 3-6. Repeatable, maximum of 6 credits.

Prereq: Graduate Standing or Permission of Instructor

Supervised internship with administrative agencies, legislative organizations, judicial branch offices, and nonprofit groups. (Typically Offered: Fall, Spring)

POLS 5990: Creative Component

Credits: 1-30. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

(Typically Offered: Fall, Spring, Summer)

Courses for graduate students:**POLS 6100A: Graduate Seminars: American Politics**

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

(Typically Offered: Fall, Spring, Summer)

POLS 6100D: Graduate Seminars: Global Politics

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

(Typically Offered: Fall, Spring, Summer)

POLS 6100G: Graduate Seminars: Public Policy

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

(Typically Offered: Fall, Spring, Summer)

POLS 6990: Research

Credits: 1-30. Repeatable.

(Typically Offered: Fall, Spring, Summer)

Portuguese (PORT)

Courses primarily for undergraduates:**PORT 1010: Elementary Portuguese I**

Credits: 4. Contact Hours: Lecture 4.

An introduction to the Portuguese language through the communicative approach within the context of Luso-Brazilian culture.

PORT 1020: Elementary Portuguese II

Credits: 4. Contact Hours: Lecture 4.

Prereq: PORT 1010

An introduction to the Portuguese language through the communicative approach within the context of Luso-Brazilian culture. Meets International Perspectives Requirement.

PORT 1110: Intensive Beginning Portuguese

Credits: 3. Contact Hours: Lecture 3.

A communicative approach to grammar and vocabulary within the context of Luso-Brazilian culture for students whose native language is not Portuguese. Taught in Portuguese.

PORT 1120: Elementary Portuguese, Accelerated II

Credits: 3. Contact Hours: Lecture 3.

Prereq: PORT 1110

An introduction to the Portuguese language through the communicative approach within the context of Luso-Brazilian culture. Meets International Perspectives Requirement.

PORT 3750: Brazil Today

Credits: 3. Contact Hours: Lecture 3.

A survey of social, political, economic, and cultural topics relevant to contemporary Brazil. Includes an introduction to Portuguese language. Meets International Perspectives Requirement. (Typically Offered: Fall)

Psychology (PSYCH)

Courses primarily for undergraduates:**PSYCH 1010: Introduction to Psychology**

Credits: 3. Contact Hours: Lecture 2, Discussion 1.

Fundamental psychological concepts derived from the application of the scientific method to the study of behavior and mental processes. Applications of psychology. (Typically Offered: Fall, Spring, Summer)

PSYCH 1020: Laboratory in Introductory Psychology

Credits: 1. Contact Hours: Laboratory 2.

Prereq: Credit or concurrent enrollment in PSYCH 1010

Laboratory to accompany 1010. (Typically Offered: Fall, Spring)

PSYCH 1110: Orientation to Psychology

Credits: 1. Contact Hours: Lecture 1.

Program requirements and degree/career options. Required of psychology majors. (Typically Offered: Fall, Spring)

PSYCH 1120: Psychology Learning Community Seminar

Credits: 1. Contact Hours: Lecture 1.

Repeatable, maximum of 2 credits.

Topics include orientation to academic program requirements, career awareness, strategies for successful transition to college, connections with other disciplines, and applying psychology via service learning opportunities. (Typically Offered: Fall, Spring)

PSYCH 1310: Academic Learning Skills

Credits: 1. Contact Hours: Lecture 1.

Evidence-based approach to learning and applying academic skills such as time management, note-taking, reading, test preparation, goal setting and motivation, and well-being. Hybrid course structured in a team-based learning format. (Typically Offered: Fall, Spring)

PSYCH 2110: Career Opportunities in Psychology

Credits: 1. Contact Hours: Lecture 1.

Prereq: PSYCH 1110 or PSYCH 1120 or Sophomore classification

Introduction to career options for psychology majors. Development of foundational career preparation topics like resume writing, interviewing, and other career-related topics. Thorough introduction to the sub-fields of psychology. Guidance on applying to graduate school or seeking a job with a bachelor's degree. (Typically Offered: Fall, Spring)

PSYCH 2210X: Clinical Psychology

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: PSYCH 1010

Overview of the field of clinical psychology. Readings, small group work, class discussion, lectures, and videos to describe the field of clinical psychology.

PSYCH 2300: Developmental Psychology

Credits: 3. Contact Hours: Lecture 3.

Life-span development of physical traits, cognition, intelligence, language, social and emotional behavior, personality, and adjustment. (Typically Offered: Fall, Spring, Summer)

PSYCH 2500: Psychology of the Workplace

Credits: 3. Contact Hours: Lecture 3.

Survey of theories and research methods of psychology applied to the workplace. Consideration of employee selection, training, performance evaluation, leadership, work groups, employee motivation, job attitudes and behaviors, organizational culture, organizational development, human factors, and job design from the scientist-practitioner approach.

PSYCH 2600: Psychology of Immigration

Credits: 3. Contact Hours: Lecture 3.

Understanding U.S. immigrants' psychological experiences and challenges, with a focus on psychological theories and research in social, cultural, developmental, and counseling psychology. Topics include (1) individual development, including identity changes and language development, (2) causes, forms, and experiences of prejudice and discrimination, (3) contextual social influences and life span consideration, (4) experiences in education, workplace, and clinical context, and (5) strategies for promoting acceptance of diversity. International and other migration contexts may be discussed for comparison. (Typically Offered: Spring)

PSYCH 2600X: Psychology of Immigration

Credits: 3. Contact Hours: Lecture 3.

Understanding U.S. immigrants' psychological experiences and challenges, with a focus on psychological theories and research in social, cultural, developmental, and counseling psychology. Topics include (1) individual development, including identity changes and language development, (2) causes, forms, and experiences of prejudice and discrimination, (3) contextual social influences and life span consideration, (4) experiences in education, workplace, and clinical context, and (5) strategies for promoting acceptance of diversity. (Typically Offered: Fall, Spring, Summer)

PSYCH 2800: Social Psychology

Credits: 3. Contact Hours: Lecture 3.

Individual human behavior in social contexts. Emphasis on social judgments and decisions, attitudes, perceptions of others, social influence, aggression, stereotypes, and helping. (Typically Offered: Fall, Spring, Summer)

PSYCH 2910: Introductory Research Experience

Credits: 1-4. Repeatable, maximum of 4 credits.

Prereq: PSYCH 1010; Sophomore classification; Permission of Instructor

Beginning level supervised research experience in a faculty laboratory. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

PSYCH 3010: Research Design and Methodology

Credits: 3. Contact Hours: Lecture 3.

Prereq: (STAT 1010 or STAT 1040 or STAT 2260); 1 PSYCH course

Overview of the principal research techniques used in psychology with an emphasis on the statistical analysis of psychological data. (Typically Offered: Fall, Spring, Summer)

PSYCH 3020: Research Methods in Psychology

Credits: 3.

Prereq: PSYCH 3010 and ENGL 2500

Discussion of and experience in designing research studies, collecting and analyzing data, and preparing research reports in psychology. (Typically Offered: Fall, Spring)

PSYCH 3070X: Political Psychology

(Cross-listed with POLS 3070X).

Credits: 3. Contact Hours: Lecture 3.

Psychological influences on political behavior. Political preferences, personality, cognitive biases, political violence, and partisan identities. Psychological explanations of contemporary political events. (Typically Offered: Fall)

PSYCH 3100: Brain and Behavior

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 1010

Survey of basic concepts in the neurosciences with emphasis on brain mechanisms mediating sensory processes, arousal, motivation, learning, and abnormal behavior. (Typically Offered: Fall, Spring)

PSYCH 3120: Sensation and Perception

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 1010

Survey of the physiology and psychology of human sensory systems including vision, audition, smell, taste, the skin senses, and the vestibular senses. (Typically Offered: Fall, Spring)

PSYCH 3130: Learning and Memory

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 1010

Survey of fundamental concepts and theories related to learning and memory derived from human and animal research. (Typically Offered: Fall, Spring)

PSYCH 3140: Motivation

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 1010

Theory and research on motivation at biological, environmental, and psychological levels. Topics include emotion, eating, sex, music, addictions, incentives, goal performance, personality, coping, self-determination and purpose. (Typically Offered: Fall, Spring)

PSYCH 3150: Drugs and Behavior

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 1010

Biologically based examination of the effects of drugs on behavior and social interactions, including recreational drugs and drugs used in the treatment of psychiatric and neurological disorders. (Typically Offered: Fall, Spring)

PSYCH 3160: Cognitive Psychology

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 1010

Overview of human cognition, including sensation and perception, attention, memory, language, and judgment and decision making. (Typically Offered: Fall, Spring)

PSYCH 3180: Judgment and Decision Making

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 1010; (STAT 1010 or STAT 1040 or STAT 2260 or Permission of Instructor)

Understanding human reasoning and decision making, including evaluating evidence, judging probabilities, emotional influences, and social dilemmas, with emphasis on the mechanisms that underlie decision making. (Typically Offered: Fall, Spring)

PSYCH 3200: Sleep and Dreams

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 1010

Scientific study of sleep and dreams including basic biological and psychological aspects of sleep-wake cycles, the nature and function of dreams, and the role of sleep in human behavior, performance, and well-being. Sleep problems and their social consequences. (Typically Offered: Spring)

PSYCH 3270: Persuasion and Social Influence

(Cross-listed with COMST 3270).

Credits: 3. Contact Hours: Lecture 3.

Examination of theories and research in persuasive communication, including attitudes and social influence. Emphasis on persuasive communication strategies in everyday social settings that influence changes in attitudes and actions. (Typically Offered: Fall, Spring, Summer)

PSYCH 3300: Forensic Psychology

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 1010

The science and practice of forensic psychology: the application of psychology to inform legal decisions when some question related to psychology is involved. Focuses especially on the ways in which psychologists do clinical work (assessment and treatment) to help courts make informed decisions about cases. (Typically Offered: Fall, Spring, Summer)

PSYCH 3330: Educational Psychology

(Cross-listed with EDUC 3330).

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 2300 or HDFS 1020

Psychological theories relevant to student development, learning, and motivation. Review of assessment principles and practices. Implications of theory for teaching children and for assessing learning in K-12 educational settings, with an emphasis on grades 5 - 12. (Typically Offered: Fall, Spring)

PSYCH 3350: Child and Adolescent Psychopathology

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 1010; HDFS 1020 or PSYCH 2300

Psychopathology of children and adolescents, including childhood depression and anxiety disorders. Consideration of multiple probable causes and corresponding therapies. (Typically Offered: Fall, Spring)

PSYCH 3460: Psychology of Women

(Cross-listed with WGS 3460).

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 1010; 1 additional PSYCH course

Survey of theory and research related to major biological, interpersonal, and cultural issues affecting girls' and women's psychological development and behavior. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Spring)

PSYCH 3470: U.S. Latino/a Psychology

(Cross-listed with USLS 3470).

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 1010; 1 additional PSYCH course

Historical, political, and social contexts of psychological and mental health constructs in terms of their validity and utility for use with Latino/a people in the U.S. Unique aspects of psychological functioning particular to Latino/a people in the U.S. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Spring)

PSYCH 3480: Psychology of Religion

(Cross-listed with RELIG 3480).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 9 credits in PSYCH

Survey of psychological theory and research investigating religious and spiritual attitudes, beliefs and practices.

PSYCH 3490X: Psychology of Sexual Orientation

(Cross-listed with WGS 3490X).

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: PSYCH 1010; 3 additional credits in PSYCH

Development of major human sexual orientation identities (e.g., bisexual, gay, heterosexual, and lesbian) from a research perspective. How persons navigate life contexts (e.g., family, work, relationships) in connection with their sexual identity. Factors that enhance positive sexual orientation identity development. (Typically Offered: Spring)

PSYCH 3500: Human Factors in Technology

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 1010; junior classification

Understanding human behavior and cognition in the context of modern technologies. Focus on emergent interactive technologies, human computer interaction, user centered design, usability analysis, and usability testing. (Typically Offered: Fall)

PSYCH 3600: Personality Psychology

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 1010

Historical and contemporary theory and research on development and expression of personality with a focus on normal functioning. (Typically Offered: Fall, Spring, Summer)

PSYCH 3800: Social Cognition

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 1010 or PSYCH 2800

How people understand themselves and others, including attitude formation and change, attribution, impression formation, social categories and schemas, the self, stereotypes, and prejudice. (Typically Offered: Spring)

PSYCH 3830: Psychology and Law

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 1010 or PSYCH 2800

Survey of topics in the interface between psychology and the legal system including but not limited to Miranda warning, confessions, police interrogation, lie detection, juries, eyewitness identification, false memories, and the death penalty. (Typically Offered: Fall, Spring)

PSYCH 3860: Media Psychology

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 1010 or PSYCH 2300 or PSYCH 2800

Theories and research on the psychological mechanisms (e.g., attitudes, perceptions, emotions, arousal) by which media influence children and adults. Topics include media violence, educational media, advertising, music, video games, media literacy, and ratings. (Typically Offered: Fall, Spring, Summer)

PSYCH 4050: History of Psychology

(Dual-listed with PSYCH 5050).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 4 courses in PSYCH

Origins of psychology in philosophy, physiology, medicine and religion. Development as a scientific discipline during the nineteenth and twentieth centuries. Historical overview of clinical practice and theory. (Typically Offered: Spring)

PSYCH 4110: Evolutionary Psychology

Credits: 3. Contact Hours: Lecture 3.

Examination of the application of the principles of evolutionary biology to the understanding of human behavior. Evolutionary perspectives on brain development, cognition, language, mating behavior, sex differences, altruism, artistic behavior, and criminal behavior are explored. Arguments by those critical of the evolutionary approach to psychology are also examined. (Typically Offered: Spring)

PSYCH 4130: Psychology of Language

(Cross-listed with LING 4130).

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 1010

Introduction to psycholinguistics. Topics may include origin of language, speech perception, language comprehension, reading, bilingualism, brain bases of language, and computational modeling of language processes. (Typically Offered: Spring)

PSYCH 4220: Counseling Theories and Techniques

Credits: 3. Contact Hours: Lecture 3.

Prereq: 3 courses in PSYCH

Overview of the major counseling theories and techniques, with emphasis on the key concepts of each theory, the role of the counselor, therapeutic goals, and the main techniques derived from each theory.

(Typically Offered: Fall)

PSYCH 4220L: Laboratory in Counseling Theory and Techniques

Credits: 1. Contact Hours: Laboratory 2.

Prereq: 3 courses in PSYCH AND (credit or concurrent enrollment in PSYCH 4220)

Learn basic counseling skills such as active listening, reflecting feelings, empathy, confrontation, immediacy and self-disclosure. Supervised practice using basic counseling skills. (Typically Offered: Fall)

PSYCH 4400: Psychological Measurement I

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: PSYCH 3010; 9 additional PSYCH credits; (STAT 1010 or STAT 1040 or STAT 2260)

Principles of psychological measurement, including concepts of reliability and validity; interpretation of scores; factors influencing performance; construction and use of measures of ability, achievement, and personality. (Typically Offered: Fall, Spring, Summer)

PSYCH 4500: Industrial Psychology

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 1010; 1 additional PSYCH course; (STAT 1010 or STAT 1040 or STAT 2260)

Theory, content and methods of industrial psychology related to the effective operation of organizations. Application of psychology principles to topics including different approaches used to select employees, how to conduct performance appraisals, and how to train and keep employees safe. Work attitudes and behaviors of employees as well as relevant legal issues. Statistics including regression and correlation are used. (Typically Offered: Fall, Spring)

PSYCH 4600: General Psychopathology

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 1010; 2 additional PSYCH courses

Description of major forms of psychopathology including anxiety, mood disorders, personality disorders, substance abuse, and schizophrenia. Coverage of research examining causes, development, and clinical issues concerning psychopathology. (Typically Offered: Fall, Spring, Summer)

PSYCH 4840: Psychology of Close Relationships

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 2800; 6 additional credits in PSYCH

Theories and research concerning the functions, development, and deterioration of close relationships. Influence of psychological processes on friendship, romantic, marital, and family relationships. Topics include mate selection, interdependence, trust and commitment, power and dominance in relationships, sexuality, divorce, gender roles, and family interaction. (Typically Offered: Fall, Spring)

PSYCH 4850: Health Psychology

Credits: 3. Contact Hours: Lecture 3.

Prereq: 6 credits in PSYCH; Junior classification

Application of psychological theory and research methods to issues in physical health. Psychological factors in illness prevention, health maintenance, treatment of illness, recovery from injury and illness, and adjustment to chronic illness. (Typically Offered: Fall)

PSYCH 4870: Human Aggression

Credits: 3. Contact Hours: Lecture 3.

Prereq: (PSYCH 2300 or PSYCH 2800); PSYCH 3010; (PSYCH 3130, PSYCH 3160, PSYCH 3170 or PSYCH 3800)

Theory and research on development and occurrence of human aggression; implications for prevention and treatment. (Typically Offered: Spring)

PSYCH 4880: Cultural Psychology

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 2800; Junior classification

Examination of the ways that cultural beliefs, values, and affordances shape cognitive, developmental, social and other psychological phenomena, as well as the forces that shape and change culture. Meets International Perspectives Requirement.

PSYCH 4900: Independent Study

Credits: 1-3. Repeatable, maximum of 9 credits.

Prereq: 6 credits in PSYCH; Junior classification; Permission of Instructor

Supervised reading in an area of psychology. Writing requirement. Graduation Restriction: No more than 9 credits of PSYCH 4900 may be counted toward a degree in psychology. (Typically Offered: Fall, Spring, Summer)

PSYCH 4910: Research Practicum

Credits: 1-30. Repeatable, maximum of 9 credits.

Prereq: Credit or concurrent enrollment in PSYCH 3010; Junior classification; Permission of Instructor

Supervised research in an area of psychology. Primarily for students intending to pursue graduate education. Graduation Restriction: No more than 9 credits of PSYCH 4910 may be counted toward a degree in psychology. (Typically Offered: Fall, Spring, Summer)

PSYCH 4920A: Fieldwork Practicum: Human Services

Credits: 1-30. Repeatable, maximum of 9 credits.

Prereq: 12 credits in PSYCH; Junior classification; Permission of Instructor

Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

PSYCH 4920B: Fieldwork Practicum: I/O Psychology

Credits: 1-30. Repeatable, maximum of 9 credits.

Prereq: (PSYCH 2500 or PSYCH 4500); 9 additional PSYCH credits; Junior classification; Permission of Instructor

Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

PSYCH 5010: Foundations of Behavioral Research

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate classification

Ethical issues, research design, sampling design, measurement issues, power and precision analysis, interpretation of statistical results in non-experimental, quasi-experimental, and experimental research, use of statistical packages. (Typically Offered: Fall, Spring)

PSYCH 5050: History of Psychology

(Dual-listed with PSYCH 4050).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Classification or Permission of Instructor

Origins of psychology in philosophy, physiology, medicine and religion. Development as a scientific discipline during the nineteenth and twentieth centuries. Historical overview of clinical practice and theory. (Typically Offered: Spring)

PSYCH 5160: Advanced Cognition

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate classification

Theoretical models and empirical research in human cognition including perception, attention, memory, concepts/categorization, imagery, and judgment and decision making. (Typically Offered: Fall, Spring)

PSYCH 5190: Cognitive Neuropsychology

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate classification

Psychological models and related neurological substrates underlying cognition in normal and brain-damaged individuals.

PSYCH 5210: Cognitive Psychology of Human Computer Interaction

(Cross-listed with HCI 5210).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate classification

Biological, behavioral, perceptual, cognitive and social issues relevant to human computer interactions.

PSYCH 5220: Scientific Methods in Human Computer Interaction

(Cross-listed with HCI 5220).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate classification

Basics of hypothesis testing, experimental design, analysis and interpretation of data, and the ethical principles of human research as they apply to research in human computer interaction. Offered odd-numbered years. (Typically Offered: Spring)

PSYCH 5330: Theories of Learning

(Cross-listed with EDUC 5330).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Major theories of learning and cognition in educational settings. Emphasis on behavioral, cognitive, constructivist, and sociocultural theories and their implications for educational policy and practice. (Typically Offered: Fall)

PSYCH 5380: Developmental Disabilities

(Cross-listed with HDFS 5380).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Theories, research, and current issues regarding the intersection of development and disabilities. Investigation of interventions with individuals and families (Online course offering via Distance Education). Offered odd-numbered years. (Typically Offered: Fall)

PSYCH 5420: Applied Psychological Measurement

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate classification

Principles of psychological measurement, including concepts of reliability and validity; interpretation of scores; factors influencing performance; test construction and use of measures of intelligence, ability, achievement, vocational interest, and personality. Ethical and multicultural issues in measurement. (Typically Offered: Fall)

PSYCH 5440: Cognitive Assessment

Credits: 3.

Prereq: PSYCH 5420; graduate student in Psychology

Principles, concepts, and methods of clinical interviewing, behavioral observation, and administration, scoring, and interpreting individual tests of cognitive function. (Typically Offered: Fall, Spring)

PSYCH 5440A: Behavioral Assessment

Credits: 2. Contact Hours: Lecture 2, Laboratory 1.

Prereq: Graduate Standing or Permission of Instructor

Supervised practice in designing and implementing observational systems and in administering, scoring, interpreting, and reporting individual tests.

PSYCH 5440B: Individual Tests: Children

Credits: 2. Contact Hours: Lecture 2, Laboratory 1.

Prereq: Graduate Standing or Permission of Instructor

Supervised practice in designing and implementing observational systems and in administering, scoring, interpreting, and reporting individual tests.

PSYCH 5440C: Testing: Adult Ages

Credits: 2.

Prereq: Graduate Standing or Permission of Instructor

Supervised practice in designing and implementing observational systems and in administering, scoring, interpreting, and reporting individual tests.

PSYCH 5600: Advanced Personality Psychology

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate classification

Advanced analysis of contemporary theory and research on personality measurement, development, heritability, and social expression.

PSYCH 5620: Personality Assessment

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 5420; graduate student in Psychology

Principles, concepts, and methods of personality assessment. Though not a practicum course, exposure is given to a variety of objective, projective, and situational tests.

PSYCH 5800: Advanced Social Psychology: Psychological Perspectives

Credits: 3. Contact Hours: Lecture 3.

Prereq: Enrollment in Graduate Psychology Program

Current theories, methods, and research in social psychology with an emphasis on cognitive and interpersonal processes such as attribution, social cognition, attitude change, attraction, aggression, and social comparison.

PSYCH 5890: Systems Neuroscience: Brain, Behavior, and Nutrition-Related Integrative Physiology

(Cross-listed with FSHN 5890/ GERON 5890/ NEURO 5890/ NUTRS 5890).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Qualified Undergraduate with Permission of Instructor

Structural, functional, and biochemical aspects of brain and non-motor behavior across the human lifespan. Types of neuroimaging used to assess the brain. Current research is leveraged to gauge how nutrition, diseases related to nutrition, and associated physiological processes influence the brain, particularly for common developmental, psychological, and neurological disorders. (Typically Offered: Spring)

PSYCH 5900A: Special Topics: Counseling

Credits: 1-30. Repeatable.

Prereq: Graduate classification and Permission of Instructor

PSYCH 5900Q: Special Topics: Cognitive

Credits: 1-30. Repeatable.

Prereq: Graduate classification and Permission of Instructor

PSYCH 5900R: Special Topics: Social

Credits: 1-30. Repeatable.

Prereq: Graduate classification and Permission of Instructor

PSYCH 5900Z: Special Topics: General

Credits: 1-30. Repeatable.

Prereq: Graduate classification and Permission of Instructor

PSYCH 5920C: Seminar in Psychology: Developmental

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate classification and Permission of Instructor

(Typically Offered: Fall, Spring)

PSYCH 5920P: Seminar in Psychology: Research Methods and Psychometrics

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate classification and Permission of Instructor

PSYCH 5920Z: Seminar in Psychology: General

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate classification and Permission of Instructor

PSYCH 5940A: Quantitative Behavioral Methods: Classical Psychometric Theory

Credits: 1. Contact Hours: Lecture 1.

Prereq: PSYCH 5010

(Typically Offered: Fall, Spring)

PSYCH 5940B: Quantitative Behavioral Methods: Modern Psychometric Methods

Credits: 1. Contact Hours: Lecture 1.

Prereq: PSYCH 5010

(Typically Offered: Fall, Spring)

PSYCH 5940C: Quantitative Behavioral Methods: Construct Validation

Credits: 1. Contact Hours: Lecture 1.

Prereq: PSYCH 5010

(Typically Offered: Fall, Spring)

PSYCH 5940D: Quantitative Behavioral Methods: Multi-Dimensional Scaling

Credits: 1. Contact Hours: Lecture 1.

Prereq: PSYCH 5010

(Typically Offered: Fall, Spring)

PSYCH 5940E: Quantitative Behavioral Methods: Cluster Analysis

Credits: 1. Contact Hours: Lecture 1.

Prereq: Graduate Standing or Permission of Instructor

(Typically Offered: Fall, Spring)

PSYCH 5940F: Quantitative Behavioral Methods: Meta-analysis

Credits: 1. Contact Hours: Lecture 1.

Prereq: Graduate Standing or Permission of Instructor

(Typically Offered: Fall, Spring)

PSYCH 5940G: Quantitative Behavioral Methods: Longitudinal Analysis

Credits: 1. Contact Hours: Lecture 1.

Prereq: PSYCH 5010

(Typically Offered: Fall, Spring)

PSYCH 5940I: Quantitative Behavioral Methods: Focus Groups

Credits: 1. Contact Hours: Lecture 1.

Prereq: Graduate Standing or Permission of Instructor

(Typically Offered: Fall, Spring)

PSYCH 5940K: Quantitative Behavioral Methods: Mediation and Moderation

Credits: 1. Contact Hours: Lecture 1.

Prereq: Graduate Standing or Permission of Instructor

Specialized quantitative methods for social and behavioral research problems. (Typically Offered: Fall, Spring)

PSYCH 5940L: Quantitative Behavioral Methods: Missing Data

Credits: 1. Contact Hours: Lecture 1.

Prereq: Graduate Standing or Permission of Instructor

Specialized quantitative methods for social and behavioral research problems. (Typically Offered: Fall, Spring)

PSYCH 5940M: Quantitative Behavioral Methods: Power Analysis

Credits: 1. Contact Hours: Lecture 1.

Prereq: Graduate Standing or Permission of Instructor

Specialized quantitative methods for social and behavioral research problems. (Typically Offered: Fall, Spring)

PSYCH 5940N: Quantitative Behavior Methods: Generalized Linear Models

Credits: 1. Contact Hours: Lecture 1.

Prereq: Graduate Standing or Permission of Instructor

Specialized quantitative methods for social and behavioral research problems. (Typically Offered: Spring)

PSYCH 5940P: Quantitative Behavioral Methods: Systematic Review

Credits: 1. Contact Hours: Lecture 1.

Prereq: Graduate Standing or Permission of Instructor

Specialized quantitative methods for social and behavioral research problems.

PSYCH 5940R: Quantitative Behavioral Methods: Practical Data Analysis

Credits: 1. Contact Hours: Lecture 1.

Prereq: Graduate Standing or Permission of Instructor

Specialized quantitative methods for social and behavioral research problems. (Typically Offered: Spring)

PSYCH 5950A: Seminar in Social Psychology: Social Cognition

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: PSYCH 5800; Graduate classification

(Typically Offered: Fall, Spring)

PSYCH 5950B: Seminar in Social Psychology: Aggression

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: PSYCH 5800; Graduate classification

(Typically Offered: Fall, Spring)

PSYCH 5950C: Seminar in Social Psychology: Culture

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: PSYCH 5800; Graduate classification

(Typically Offered: Fall, Spring)

PSYCH 5950D: Seminar in Social Psychology: Attitudes and Attitude Change

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: PSYCH 5800; Graduate classification

(Typically Offered: Fall, Spring)

PSYCH 5950E: Seminar in Social Psychology: Psychology and Law

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: PSYCH 5800; Graduate classification

(Typically Offered: Fall, Spring)

PSYCH 5950F: Seminar in Social Psychology: Health Psychology

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: PSYCH 5800; Graduate classification

(Typically Offered: Spring)

PSYCH 5950G: Seminar in Social Psychology: Close Relationships

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: PSYCH 5800; Graduate classification

(Typically Offered: Fall, Spring)

PSYCH 5950I: Seminar in Social Psychology: General

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: PSYCH 5800; Graduate classification

(Typically Offered: Fall, Spring)

PSYCH 5950J: Seminar in Social Psychology: Industrial Organizational Psychology

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: PSYCH 5800; Graduate classification

(Typically Offered: Fall)

PSYCH 5950K: Seminar in Social Psychology: Media Psychology

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: PSYCH 5800; Graduate classification

(Typically Offered: Spring)

PSYCH 5950L: Seminar in Social Psychology: Self and Identity

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

PSYCH 5960A: Seminar in Counseling Psychology: Supervision

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

Prereq: Psychology Graduate Student

(Typically Offered: Fall, Spring)

PSYCH 5960B: Seminar in Counseling Psychology: Research

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

Prereq: Psychology Graduate Student

(Typically Offered: Fall, Spring)

PSYCH 5960C: Seminar in Counseling Psychology: Multicultural

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

Prereq: Psychology Graduate Student

(Typically Offered: Fall, Spring)

PSYCH 5960D: Seminar in Counseling Psychology: Professional Issues and Ethics

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

Prereq: Psychology Graduate Student

(Typically Offered: Fall, Spring)

PSYCH 5960E: Seminar in Counseling Psychology: General

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

Prereq: Psychology Graduate Student

(Typically Offered: Fall, Spring)

PSYCH 5980A: Seminar in Cognitive Psychology: Attention and Perception

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

Prereq: PSYCH 5160; graduate classification

(Typically Offered: Fall, Spring)

PSYCH 5980B: Seminar in Cognitive Psychology: Memory

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

Prereq: PSYCH 5160; graduate classification

(Typically Offered: Fall, Spring)

PSYCH 5980C: Seminar in Cognitive Psychology: Cognitive Neuroscience

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

Prereq: PSYCH 5160; graduate classification

(Typically Offered: Fall, Spring)

PSYCH 5980D: Seminar in Cognitive Psychology: Judgment and Decision Making

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

Prereq: PSYCH 5160; graduate classification

(Typically Offered: Fall, Spring)

PSYCH 5980E: Seminar in Cognitive Psychology: Evolution

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

Prereq: PSYCH 5160; graduate classification

(Typically Offered: Fall, Spring)

PSYCH 5980F: Seminar in Cognitive Psychology: Language

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

Prereq: PSYCH 5160; graduate classification

(Typically Offered: Fall, Spring)

PSYCH 5980G: Seminar in Cognitive Psychology: Applied

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

Prereq: PSYCH 5160; graduate classification

(Typically Offered: Fall, Spring)

PSYCH 5980I: Seminar in Cognitive Psychology: General

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

Prereq: PSYCH 5160; graduate classification

(Typically Offered: Fall, Spring)

PSYCH 5990: Creative Component

Credits: 1-30. Repeatable.

Prereq: Graduate classification and Permission of Instructor

Offered on a satisfactory-fail basis only.

Courses for graduate students:

PSYCH 6050: Multi-level Modeling

(Cross-listed with HDFS 6050).

Credits: 3. Contact Hours: Lecture 3.

Rationale for and interpretation of random coefficient models. Strategies for the analysis of multi-level and panel data including models for random intercepts, random slopes, and growth curves. Offered odd-numbered years. (Typically Offered: Spring)

PSYCH 6210: Psychological Counseling -Theory and Process

Credits: 3. Contact Hours: Lecture 3.

Prereq: Psychology graduate student; instructor permission

Overview of major counseling theories with emphases upon: key concepts of theories, the role of the counselor, and applications of theory in fostering client change. (Typically Offered: Fall)

PSYCH 6210L: Psychological Counseling -Theory and Process: Techniques in Counseling

Credits: 3. Contact Hours: Laboratory 6.

Prereq: Psychology graduate student; instructor permission

Development of basic counseling skills and techniques through observation, role-playing, case studies, and supervised counseling sessions. (Typically Offered: Fall)

PSYCH 6230: Vocational Behavior

Credits: 3. Contact Hours: Lecture 3.

Prereq: Psychology Graduate Student

Theoretical views, research, and issues in career development through the life span. Methods of career counseling, including appraisal interviewing, assessment, test interpretation, and use of information sources.

PSYCH 6260: Group Counseling

Credits: 3. Contact Hours: Lecture 4.

Prereq: Psychology Graduate Student

Theory, research, ethical issues, and therapeutic considerations relevant to group counseling. Participation in lab exercises for development of group counseling skills and observation of ongoing groups.

PSYCH 6330: Teaching of Psychology

Credits: 3. Contact Hours: Lecture 3.

Prereq: Psychology Graduate Student

Orientation to teaching of psychology at college level: academic issues and problems, instructional and evaluative techniques. (Typically Offered: Spring)

PSYCH 6610: Adult Psychopathology

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate classification

Examination of DSM and research based perspectives pertinent to the major forms of adult psychopathology including: anxiety, mood, psychotic, personality and other disorders. Coverage of research examining causes, development, and clinical issues concerning adult psychopathology.

PSYCH 6910A: Practicum in Psychology: Counseling (Beginning)

Credits: 1-30. Repeatable, maximum of 6 credits.

Prereq: PSYCH 6210L; Psychology graduate student

(Typically Offered: Fall, Spring)

PSYCH 6910B: Practicum in Psychology: Counseling (Intermediate)

Credits: 1-30. Repeatable, maximum of 6 credits.

Prereq: PSYCH 6910A; Psychology graduate student

(Typically Offered: Fall, Spring)

PSYCH 6910C: Practicum in Psychology: Counseling (Advanced)

Credits: 1-30. Repeatable, maximum of 6 credits.

Prereq: PSYCH 6910B; Psychology graduate student

(Typically Offered: Fall, Spring)

PSYCH 6910D: Practicum in Psychology: Counseling (Advanced External Practicum)

Credits: 1-30. Repeatable.

Prereq: PSYCH 6910C; Psychology graduate student

(Typically Offered: Fall, Spring)

PSYCH 6910G: Practicum in Psychology: Group Counseling

Credits: 1-30. Repeatable.

Prereq: PSYCH 6260; Psychology graduate student

(Typically Offered: Fall, Spring)

PSYCH 6910S: Practicum in Psychology: Supervision

Credits: 1-30. Repeatable.

(Typically Offered: Fall, Spring)

PSYCH 6910T: Practicum in Psychology: Teaching

Credits: 1-30. Repeatable, maximum of 6 credits.

Prereq: Psychology graduate student; instructor permission

Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

PSYCH 6910Z: Practicum in Psychology: General

Credits: 1-30. Repeatable, maximum of 6 credits.

Prereq: Psychology graduate student; instructor permission

(Typically Offered: Fall, Spring)

PSYCH 6920A: Research Seminar: Counseling

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Psychology Graduate Student

PSYCH 6920Q: Research Seminar: Cognitive

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Psychology Graduate Student

PSYCH 6920R: Research Seminar: Social

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Psychology Graduate Student

PSYCH 6920Z: Research Seminar: General

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Psychology Graduate Student

PSYCH 6970: Internship in Counseling Psychology

Credits: Required.

Prereq: Psychology graduate student; instructor permission

Full time supervised predoctoral internship experience in a setting relevant to counseling psychology. (Typically Offered: Fall, Spring, Summer)

PSYCH 6990: Research

Credits: 1-30. Repeatable.

Prereq: Graduate classification and Permission of Instructor

Offered on a satisfactory-fail basis only.

Public Relations (PR)

Courses primarily for undergraduates:

PR 2200: Principles of Public Relations

Credits: 3. Contact Hours: Lecture 3.

Introduction to public relations in business, government and non-profit organizations; functions, processes, and management; ethics, public opinion and theory.

PR 3010: Research and Strategic Planning for Advertising and Public Relations

(Cross-listed with ADVRT 3010).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ADVRT 2300 or PR 2200

Use of primary and secondary research methods utilizing conventional and online tools for development of successful strategic communications and campaign development for advertising and public relations.

PR 3050: Publicity Methods

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500; Sophomore classification

Communication and publicity fundamentals and the use of media for publicity purposes. Not available to Greenlee School majors.

PR 3210: Public Relations Writing

Credits: 3.

Prereq: JLMC 1100; Minimum of C+ in JLMC 2010; Credit or concurrent enrollment in ADVRT 3010/PR 3010

Developing and writing public relations materials with an emphasis on media relations and news. Techniques addressed include media kits, brochures, newsletters, digital media and speeches.

PR 3240: Brand Storytelling

Credits: 3. Contact Hours: Lecture 3.

Prereq: JLMC 2010

Combining critical journalism skills with persuasive tactics of public relations and advertising to tell inspiring brand stories. Introduction to transmedia storytelling that tells compelling stories shared with and by diverse audiences. (Typically Offered: Fall, Spring)

PR 3900: Professional Skills Development

(Cross-listed with ADVRT 3900/ JLMC 3900/ SMC 3900).

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: (Minimum of C+ in JLMC 2010; JLMC major or ADVRT major or PR major or SMC major)

Check with Greenlee School for course availability. No More Than 3 Credits In JLMC/ADVRT/PR 3900 May Be Applied Toward Major Requirements For Graduation. (Typically Offered: Fall, Spring)

PR 3910: Short Course Intensive

(Cross-listed with ADVRT 3910/ JLMC 3910/ SMC 3910).

Credits: 1. Contact Hours: Lecture 1.

Repeatable, maximum of 6 credits.

Focused short courses on timely concepts. Check with Greenlee School for course availability. Offered on a satisfactory-fail basis only.

PR 4200: Crisis Communication

Credits: 3. Contact Hours: Lecture 3.

Prereq: PR 2200

Public relations strategies and tactics for crisis situations to protect and recover an organization's reputation: public behavior in crisis, crisis assessment, crisis communication plan, media training for leaders and spokespersons, apology strategy, corporate social responsibility, rumor in social media and reputation management.

PR 4240: Public Relations Campaigns

Credits: 3. Contact Hours: Lecture 3.

Prereq: ADVRT 3010 or PR 3010; minimum of C+ in PR 3210

Developing public relations and public information campaigns for business and social institutions.

PR 4730: Social Media Strategy

(Cross-listed with JLMC 4730/ ADVRT 4730).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

The strategic use of social media, from both an advertising and public relationship standpoint, to the advantage of a client or organization. Examination and analysis of the social media space from a business perspective. Best practices in the areas of strategic planning, tactical execution, and measurement of social media platforms via online digital tools. (Typically Offered: Fall, Spring)

PR 4900: Independent Study in Media and Communication

(Cross-listed with ADVRT 4900/ JLMC 4900/ SMC 4900).

Credits: 1-30. Repeatable.

Prereq: Junior or Senior classification; Instructor Permission

Projects during which students may study problems associated with a medium, a professional specialization, a philosophical or practical concern, a reportorial method or writing technique, or a special topic in their field. Credit is not given for working on student or professional media without an accompanying research component. Graduation Restriction: No more than 3 credits of ADVRT/JLMC/PR/SMC 4900 may be used toward a degree in the Greenlee School.

PR 4970: Special Topics in Communication

(Cross-listed with JLMC 4970/ ADVRT 4970/ SMC 4970).

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: Junior classification

Seminars or one-time classes on topics of relevance to students in communication. See Schedule of Classes for topics.

PR 4990A: Professional Media Internship: Required

(Cross-listed with ADVRT 4990A/ JLMC 4990A/ SMC 4990A).

Credits: 3.

Prereq: ([JLMC major; JLMC 1100; minimum of C+ in JLMC 3020 or JLMC 3030] or [ADVRT major; JLMC 1100; ADVRT 3010 or PR 3010; minimum of C+ in JLMC 2010] or [PR major; JLMC 1100; ADVRT 3010 or PR 3010; minimum of C+ in PR 3210] or [SMC major; minimum of C+ in JLMC 2010; SMC 3040 or SMC 3510]); Advisor Approval

Initial, required internship. A 400-hour (for 3 credits) internship in the student's specialization. Assessment based on employer evaluations, student reports and faculty reviews. Available only to Greenlee School majors. Offered on a satisfactory-fail basis only.

PR 4990B: Professional Media Internship: Optional

(Cross-listed with ADVRT 4990B/ JLMC 4990B/ SMC 4990B).

Credits: 1-3. Repeatable.

Prereq: ([JLMC major; JLMC 1100; minimum of C+ in JLMC 3020 or JLMC 3030] or [ADVRT major; JLMC 1100; ADVRT 3010 or PR 3010; minimum of C+ in JLMC 2010] or [PR major; JLMC 1100; ADVRT 3010 or PR 3010; minimum of C+ in PR 3210] or [SMC major; minimum of C+ in JLMC 2010; SMC 3040 or SMC 3510]); Advisor Approval

Optional internship in the student's specialization. Assessment based on employer evaluations, student reports and faculty reviews. Available only to Greenlee School majors. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

Religious Studies (RELIG)

Courses primarily for undergraduates:

RELIG 2050: World Religions

(Cross-listed with WLC 2050).

Credits: 3. Contact Hours: Lecture 3.

An introduction to religious studies - the academic study of religion.

Religions from around the world will be discussed, including their myths, rituals, beliefs, values, and social forms. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

RELIG 2100: Religion in America

Credits: 3. Contact Hours: Lecture 3.

Introductory study of the major beliefs, practices, and institutions of American Judaism, Catholicism, Protestantism, and Islam with emphasis on the diversity of religion in America, and attention to issues of gender, race, and class. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall, Spring, Summer)

RELIG 2150: Religion and Popular Culture

Credits: 3. Contact Hours: Lecture 3.

Popular culture is awash with gods, sacred figures, cults, myths, and rituals. Introduction to cultural representations of diverse religions and how popular culture can function like a religion. Focus on video games, board games, and film. Meets International Perspectives Requirement. (Typically Offered: Spring)

RELIG 2420: History of Christianity: Early to Medieval

Credits: 3. Contact Hours: Lecture 3.

A survey of the major historical developments in Christian thought and practice that shaped Christianity from the time of Jesus through the late medieval period. Attention given to significant persons and major events, including those involving relations with Judaism and Islam. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

RELIG 2430: History of Christianity: Modern

Credits: 3. Contact Hours: Lecture 3.

A survey of the major figures, events, and issues that shaped the historical development of Christianity from the Reformation era to the present. Explores the diverse social, political, and cultural movements within Christianity as a global religion. (Typically Offered: Fall, Spring, Summer)

RELIG 2730: Game Design and Cultures

(Cross-listed with GAME 2730).

Credits: 3. Contact Hours: Lecture 3.

Examination of how games draw on diverse cultures and religions in developing game mechanics, building worlds, and telling stories. Students will play digital and analog games, discover how games work, and develop skills to create their own games.

RELIG 2770: Religion and Society

(Cross-listed with SOC 2770).

Credits: 3. Contact Hours: Lecture 3.

Religion as a human construction, institution, activity, and identity.

Connections between religion and other social institutions and processes. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Spring)

RELIG 3210: The Hebrew Bible

Credits: 3. Contact Hours: Lecture 3.

An in-depth study of the literature and religion of ancient Israel in light of recent archaeological discoveries, research about the ancient Near East, and a variety of interpretations. (Typically Offered: Fall)

RELIG 3220: The New Testament

Credits: 3. Contact Hours: Lecture 3.

A detailed survey of the sacred scriptures of Christianity in light of recent archaeological discoveries and historical research about their Greco-Roman and Jewish background. (Typically Offered: Spring)

RELIG 3250: Religion, Law, and Justice

(Cross-listed with CJ 3250/ POLS 3250).

Credits: 3. Contact Hours: Lecture 3.

A study of the role of religion in law and justice with a focus on the United States. Examines the history of religious freedom, key contemporary legal cases, and how religious-oriented justice movements engage ethics and the law. (Typically Offered: Fall)

RELIG 3280: Native American Religions

Credits: 3. Contact Hours: Lecture 3.

An introduction to the beliefs and practices of Native American religious traditions, with attention to cultural, historical, and political contexts.

RELIG 3320: Catholicism

Credits: 3. Contact Hours: Lecture 3.

Examination of the history and theology of Catholicism from an academic perspective. Attention to Catholic doctrine, diverse experiences of lay Catholics, and Catholicism's influence on politics, culture, and art. (Typically Offered: Fall)

RELIG 3340: Africana Religions

(Cross-listed with AFAM 3340).

Credits: 3. Contact Hours: Lecture 3.

A focused study of the religious histories and cultures of West Africans and their descendants in the Americas. Topics include West African traditions, Christianity, Islam, and indigenous Afro-Caribbean religions, with attention to their gendered, theological, and cultural dimensions. Prior course work in Religious Studies or African American Studies recommended. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall)

RELIG 3360: Religion, Sex and Gender

(Cross-listed with WGS 3360).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (3 credits in RELIG or WGS) or Permission of Instructor

Gender and sexuality in the historical and contemporary contexts of various religious traditions. Meets International Perspectives Requirement. (Typically Offered: Fall)

RELIG 3390: Goddess Religions

(Cross-listed with WGS 3390).

Credits: 3. Contact Hours: Lecture 3.

Focal study of selected global Goddess traditions in context, including American Goddess spirituality. Historical and cross-cultural images, identities, and discourses of female divinity.

RELIG 3400: Magic, Witchcraft, and Religion

(Dual-listed with ANTHR 5400/ RELIG 5400). (Cross-listed with ANTHR 3400).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ANTHR 2010 or ANTHR 3060

Survey of global religious belief and practice from an anthropological perspective. Emphasis on myth and ritual, shamanism, magic, witchcraft, beliefs in spirits, conceptions of the soul, mind and body relationships, and healing and therapeutic practices. Discussion of religious response to dramatic political and social change; effects of globalization on religious practice. Meets International Perspectives Requirement. (Typically Offered: Spring)

RELIG 3480: Psychology of Religion

(Cross-listed with PSYCH 3480).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 9 credits in PSYCH

Survey of psychological theory and research investigating religious and spiritual attitudes, beliefs and practices.

RELIG 3490: Cognitive Science of Religion

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500 or Permission of Instructor

Using case studies from the world's religions, this course examines cross-culturally occurring forms of religious expression in light of humanistic and scientific researches in the cognitive science of religion (CSR). Topics may include beliefs in god and other supernatural beings, afterlife beliefs, morality, rituals, and religious experiences, among others. Prior coursework in Religious Studies or Psychology recommended. Meets International Perspectives Requirement. (Typically Offered: Spring)

RELIG 3500: Philosophy of Religion

(Cross-listed with PHIL 3500).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 3 credits in PHIL or Permission of Instructor

The value and truth of religious life and belief. Mystical experience; religious faith and language; arguments for God's existence; the problem of evil; miracles; and religion and morality. Historical and contemporary readings. (Typically Offered: Fall)

RELIG 3520: Religions of India

(Cross-listed with WLC 3520).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500 or Permission of Instructor

Study of texts, practices, beliefs, historical development, and mutual influence of a variety of the religious traditions of India. Emphasis on Vedic religion and the diversity of traditions of Classical Hinduism; survey of Buddhist, Jain, Sikh, and South Asian Islamic traditions. Meets International Perspectives Requirement.

RELIG 3580: Islam

(Cross-listed with WLC 3580).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500 or Permission of Instructor

An introduction to Islamic religion, culture, and society from its origins to the present. Topics include the Quran, the Prophet Muhammad, Islamic theology and philosophy, Islamic history, and Islam in America. Meets International Perspectives Requirement.

RELIG 3590: The Quran

(Cross-listed with WLC 3590).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500 or Permission of Instructor

A study of the Quran, the sacred text of Islam, with attention to its history, its major themes, and the diverse ways it is interpreted and applied. Meets International Perspectives Requirement.

RELIG 3600: Religion and Ethics

Credits: 3. Contact Hours: Lecture 3.

Investigation of comparative religious ethical theories and approaches to contemporary moral issues. Exploration of the connections between religious belief, identity, and moral practice.

RELIG 3610X: Religion, Health, and Medicine

Credits: 3. Contact Hours: Lecture 3.

A broad overview of the relationship between religion, health, and medicine for students interested in religion and those interested in entering healthcare fields. Exploration of physical and mental health and healing throughout history and among practitioners of Western, Eastern, and Indigenous religious traditions. Examination of religion and public health crises and the role of religion in culturally competent healthcare today. (Typically Offered: Fall, Spring)

RELIG 3670: Christianity in the Roman Empire

(Cross-listed with CLST 3670).

Credits: 3. Contact Hours: Lecture 3.

An historical introduction to the rise of Christianity in the Roman empire, with special attention to the impact of Greco-Roman culture on the thought and practice of Christians and the interaction of early Christians with their contemporaries.

RELIG 3680: Religions of Ancient Greece and Rome

(Cross-listed with CLST 3680).

Credits: 3. Contact Hours: Lecture 3.

Nature, origins and development of religious beliefs and practices in ancient Greece and Rome from earliest times up to the rise of Christianity. Roles of divinities and rituals in lives of individuals and families and the governing of city-states and empires. Emphasis on historical contexts of the Graeco-Roman world and influences of neighboring cultures in Africa and Asia. Meets International Perspectives Requirement.

RELIG 3700: Religion and Politics

(Cross-listed with POLS 3700).

Credits: 3. Contact Hours: Lecture 3.

The interaction of religion and politics in the U.S. from both an historical and contemporary perspective, as well as the role of religion in politics internationally. (Typically Offered: Fall)

RELIG 3800: Catholic Social Thought

Credits: 3. Contact Hours: Lecture 3.

Examines biblical roots of and major developments in Catholic social thought. Contemporary issues such as human rights, economic justice, the environment, and war and peace will be treated using principles of Catholic ethics, social analysis, official church documents, and contributions of notable theologians and activists. (Typically Offered: Spring)

RELIG 3890: Exhibiting Religion

(Cross-listed with ANTHR 3890).

Credits: 3. Contact Hours: Lecture 3.

Display of religion in museums, fairs, and exhibitions. History and ethics of museum collecting, storage, display, public engagement, and repatriation. Visit local museums and explore digital galleries.

RELIG 4750: Seminar: Issues in the Study of Religion

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 times.

Prereq: 6 credits in RELIG and Permission of Instructor

Topic changes each time offered. Closed to freshmen. Sophomores must have approval of instructor.

RELIG 4900: Independent Study

Credits: 1-3. Repeatable, maximum of 9 credits.

Prereq: 6 credits in RELIG and Permission of Instructor

Guided reading and research on special topics selected to meet the needs of advanced students. Graduation Restriction: No more than 9 credits of RELIG 4900 may be counted toward graduation. (Typically Offered: Fall, Spring, Summer)

RELIG 4900H: Independent Study: Honors

Credits: 1-3. Repeatable, maximum of 9 credits.

Prereq: 6 credits in RELIG; Permission of Instructor; Membership in the University Honors Program

Guided reading and research on special topics selected to meet the needs of advanced students. Graduation Restriction: No more than 9 credits of RELIG 4900 may be counted toward graduation. (Typically Offered: Fall, Spring, Summer)

RELIG 4910: Senior Thesis

Credits: 3.

Prereq: Instructor Permission for Course

Written under the supervision of a Religious Studies faculty advisor.

RELIG 4940: Special Studies in Religious Research Languages

Credits: 2-3. Repeatable.

Prereq: 6 credits in RELIG and Permission of Instructor

Courses primarily for graduate students, open to qualified undergraduates:

RELIG 5400: Magic, Witchcraft, and Religion

(Dual-listed with ANTHR 3400/ RELIG 3400). (Cross-listed with ANTHR 5400).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Survey of global religious belief and practice from an anthropological perspective. Emphasis on myth and ritual, shamanism, magic, witchcraft, beliefs in spirits, conceptions of the soul, mind and body relationships, and healing and therapeutic practices. Discussion of religious response to dramatic political and social change; effects of globalization on religious practice. Meets International Perspectives Requirement.

(Typically Offered: Spring)

RELIG 5900: Special Topics in Religious Studies

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

Research and Evaluation (RESEV)

Courses primarily for graduate students, open to qualified undergraduates:

RESEV 5500: Introduction to Educational Research

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Understanding the nature of quantitative and qualitative research; reviewing the literature; developing research problems and questions; research designs; data collection and analysis issues; evaluating research studies. (Typically Offered: Fall, Spring, Summer)

RESEV 5520: Basic Educational Statistics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Statistical concepts and procedures for analyzing educational data; descriptive statistics, correlation, t tests, and chi square with computer applications. (Typically Offered: Fall)

RESEV 5530: Intermediate Educational Statistics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

A continuation of statistical concepts and procedures for analyzing educational data, using multiple regression and logistic regression.

RESEV 5540: Intermediate Research Methods

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Intermediate quantitative research methodology in preparation for carrying out thesis and dissertation research, with an emphasis on the estimation of causal effects using observational data. (Typically Offered: Fall, Summer)

RESEV 5700: Surveys in Educational Research

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Examination of survey design and administration in educational research. Designing surveys; developing, evaluating, and asking survey questions; survey sampling; measuring survey reliability and validity; administering mail and web surveys; decreasing survey nonresponse; conducting post-collection survey data processing; conducting survey research with integrity. (Typically Offered: Spring)

RESEV 5800: Introduction to Qualitative Research Methodology

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Qualitative research in the human sciences, emphasizing education; principles of qualitative inquiry, including theoretical foundations, research design, and fieldwork. (Typically Offered: Fall, Spring, Summer)

RESEV 5900: Special Topics

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Guided reading and in research and evaluation study on special topic. (Typically Offered: Fall, Spring, Summer)

RESEV 5910: Supervised Field Experience

Credits: 2-4. Repeatable.

Prereq: RESEV 5330 or RESEV 6800; and Permission of Instructor

Supervised on the job field experience.

RESEV 5930: Workshop

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Intensive, concentrated exposure to a special educational research or evaluation problem. (Typically Offered: Fall, Spring, Summer)

RESEV 5970: Program Assessment and Evaluation

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Evaluation models and professional standards. Techniques of evaluating educational programs. Emphasis on both theory and practical applications. (Typically Offered: Spring)

Courses for graduate students:

RESEV 6010: Foundations of Educational Inquiry

Credits: 3. Contact Hours: Lecture 3.

Required course for all School of Education PhD students that introduces students into the community of educational scholars with a focus on: 1) the history of education as an academic field of study; (2) the philosophical underpinnings of social scientific and educational inquiry; and (3) the contemporary methodological landscape of the field of education. (Typically Offered: Fall)

RESEV 6030: Foundations of Qualitative Inquiry in Education

Credits: 3. Contact Hours: Lecture 3.

Focus on the nature of qualitative research, including the ways in which knowledge is produced through qualitative methodologies, the theoretical and epistemological underpinnings of qualitative research, the importance of theoretical and/or conceptual frameworks in qualitative research, and the various methodological approaches to qualitative research. (Typically Offered: Spring)

RESEV 6040: Advanced Qualitative Inquiry in Education

Credits: 3. Contact Hours: Lecture 3.

Conceptions of data and analysis in qualitative methodologies; focus on applied topics in qualitative data analysis. Combination format of reading and discussion seminars and classroom workshops focusing on individual research projects (not for thesis or dissertation). (Typically Offered: Fall)

RESEV 6050X: Introduction to Mixed and Multiple Methods

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 3 credits.

Prereq: RESEV 6040. This course introduces the theoretical and practical considerations of designing a mixed methods or multiple methods research study in educational contexts and the broader social sciences.

RESEV 6150: Current Topics in Research and Evaluation

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

RESEV 6200: College Access in Policy, Practice, and Research

Credits: 1-3. Contact Hours: Lecture 3.

Exploration of the plurality of frameworks used to conceptualize college access as a social problem (for research, policy, and practice). Development of application of understandings of college access frameworks to policy, practice, and research. (Typically Offered: Fall, Spring, Summer)

RESEV 6800: Critical Qualitative Research

Credits: 3. Contact Hours: Lecture 3.

Feminist, indigenous, critical, queer, and other perspectives are used to raise important questions about qualitative research and help us rethink dilemmas of voice, appropriation, collaboration, and difference, and consider ethical and political issues that arise when engaging in research. Readings and assignments will concentrate on reciprocity, reflexivity, decolonization of research methods, and the necessity of engaging in culturally responsive and ethically informed research, particularly when working with colonized or marginalized communities, and when we aim to produce knowledge in the service of social justice and social change. (Typically Offered: Spring)

RESEV 6810: Analytical Approaches in Qualitative Inquiry

Credits: 3. Contact Hours: Lecture 3.

Conceptions of data and analysis in qualitative methodologies; focus on applied topics in qualitative data analysis, such as narrative analysis, ethnographic analysis, life history analysis, postmodern analyses, discourse analysis, arts-based analytical strategies, constructing data; combination format of reading and discussion seminars and classroom workshops focusing on individual research projects (not for thesis or dissertation). (Typically Offered: Fall)

RESEV 6900: Advanced Special Topics

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Instructor Permission for Course

Guided reading and/or study on special topics of an advanced nature.

RESEV 6990: Research

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

Russian (RUS)

Courses primarily for undergraduates:

RUS 1010: Introduction to Russian Language and Culture I

Credits: 4. Contact Hours: Lecture 4.

Introduction to the Russian language (focusing on the development of speaking, listening, reading and writing skills) and Russian culture. (Typically Offered: Fall)

RUS 1020: Introduction to Russian Language and Culture II

Credits: 4. Contact Hours: Lecture 4.

Prereq: RUS 1010

Continuation of RUS 1010. Introduction to the Russian language (focusing on the development of speaking, listening, reading and writing skills) and Russian culture. Meets International Perspectives Requirement. (Typically Offered: Spring)

RUS 2010: Intermediate Russian I

Credits: 4. Contact Hours: Lecture 4.

Prereq: RUS 1020

Thorough review of grammar and growth of vocabulary. Selected readings. Continued use of the four basic skills. Meets International Perspectives Requirement. (Typically Offered: Fall)

RUS 2020: Intermediate Russian II

Credits: 4. Contact Hours: Lecture 4.

Prereq: RUS 2010

Thorough review of grammar and growth of vocabulary. Selected readings. Continued use of the four basic skills. Meets International Perspectives Requirement. (Typically Offered: Spring)

RUS 3010: Composition and Conversation

Credits: 3. Contact Hours: Lecture 3.

Prereq: RUS 2020

Thorough study of the Russian language, with emphasis on strengthening proficiency in writing, speaking, reading, and listening. Increased focus on syntax and word formation. Meets International Perspectives Requirement. (Typically Offered: Fall)

RUS 3040: Russian for Global Professionals

Credits: 3. Contact Hours: Lecture 3.

Prereq: RUS 1020

Communication in business and professional contexts in Russian-speaking countries. Development of effective communication strategies and project management in the workplace. Cultural contexts of business and professional practice. Meets International Perspectives Requirement. (Typically Offered: Fall)

RUS 3140: Reading Russian Literary and Cultural Texts

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: RUS 1020

Selected readings in Russian literature and culture. Emphasis on techniques of reading and analysis of literary and cultural texts. Meets International Perspectives Requirement.

RUS 3700: Russian Studies in English Translation

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Topics vary according to faculty interest. Author, genre or period study, women writers, cinema, or contemporary theory. Readings, discussions, and papers in English.

RUS 3700A: Russian Studies in English Translation: Topics in Russian Literature

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Focus on Russian literature. Topics vary according to faculty interest. Author, genre or period study, women writers, cinema, or contemporary theory. Readings, discussions, and papers in English. Meets International Perspectives Requirement.

RUS 3700B: Russian Studies in English Translation: Russian Fairy Tales

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Focus on Russian fairy tales. Topics vary according to faculty interest. Author, genre or period study, women writers, cinema, or contemporary theory. Readings, discussions, and papers in English. Meets International Perspectives Requirement.

RUS 3700R: Studies in English Translation: Russian Topics on Women or Feminism

(Cross-listed with WGS 3700R).

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Topics vary according to faculty interest. Author, genre or period study, women writers, cinema, or contemporary theory. Readings, discussions, and papers in English. Meets International Perspectives Requirement.

RUS 3750: Russia Today

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

A survey of social, political, economic, and cultural topics relevant to contemporary Russia. Readings, discussions and papers in English. Meets International Perspectives Requirement.

RUS 3780: Russian Film Studies in English

Credits: 3. Contact Hours: Lecture 3.

Analysis and interpretation of cinema in Russia and the Soviet Union.

Topics vary according to faculty interest. Film directors, genres, movements, historical survey, aesthetics, and cinematography. Readings, discussions and papers in English. Meets International Perspectives Requirement.

RUS 3950: Study Abroad

Credits: 1-6. Repeatable.

Supervised instruction in language and culture of Russia; formal class instruction at level appropriate to student's training, augmented by practical living experience. Meets International Perspectives Requirement.

RUS 4900: Independent Study

Credits: 1-6. Repeatable.

Prereq: 6 credits in Russian and permission of department chair

Designed to meet the needs of students who seek work in areas other than those in which courses are offered, or who desire to integrate a study of literature or language with special problems in major fields. Graduation Restriction: No more than 9 credits of RUS 4900 may be counted toward graduation.

RUS 4990: Internship in Russian

Credits: 1-3. Repeatable.

Work experience using Russian language skills in the public or private sector combined with academic work under faculty supervision. Available only to minors. Graduation Restriction: No more than 3 credits may be applied to the minor. (Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

RUS 5900A: Special Topics in Russian: Literature or Literary Criticism

Credits: 2-4. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

RUS 5900B: Special Topics in Russian: Linguistics

Credits: 2-4. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

RUS 5900C: Special Topics in Russian: Language Pedagogy

Credits: 2-4. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

RUS 5900D: Special Topics in Russian: Civilization

Credits: 2-4. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Scientific Illustration and Visualization (SCIVZ)

Courses primarily for undergraduates:

SCIVZ 3230: Scientific Illustration Principles and Techniques

(Cross-listed with ART 3230).

Credits: 3. Contact Hours: Studio 6.

Repeatable.

Prereq: (ART 2300; BIOL 2110 or BIOL 2120) or Permission of Instructor

Studio basics and professional techniques in black & white, continuous tone, and color. Introduction to professional practice and principles of communicating science through art. Emphasis on tools, materials, and rendering.

SCIVZ 3260: Digital Rendering

(Cross-listed with ART 3260).

Credits: 3. Contact Hours: Studio 6.

Repeatable.

Prereq: ART 3230/SCIVZ 3230, or permission of the instructor

An introduction to digital illustration software. Application of painting, drawing, and image-making techniques using vector and raster-based programs.

SCIVZ 3270: Illustration as Communication

(Cross-listed with ART 3270).

Credits: 3. Contact Hours: Studio 6.

Prereq: ART 3230/SCIVZ 3230, or permission of the instructor

Investigation of illustration as a form of communication. Emphasis on problem solving, effective composition, and advancement of rendering skills.

SCIVZ 3370: Application of Scientific Illustration Techniques

(Cross-listed with ART 3370).

Credits: 3. Contact Hours: Studio 6.

Repeatable, maximum of 6 credits.

Prereq: ART 3270

Rendering techniques applied to different types of biological and scientific subjects emphasizing communication. The use of traditional and digital media. Term project required. (Typically Offered: Spring)

SCIVZ 3400X: Artificial Intelligence (AI) in Art and Design

(Cross-listed with ART 3400X).

Credits: 3. Contact Hours: Studio 6.

Repeatable.

Artificial intelligence tools for art and design: strategies, principles, and tools for AI in visual art, applied art, and creative industry practices. The aesthetics of AI systems in creative practices. An overview of working with AI as artistic and visual communication media including using AI and machine learning applications, histories of AI in the arts, generative deep learning systems, supervised and unsupervised machine learning tasks, and integrating AI systems through art and design practices. Producing AI multimedia outputs that include a range of forms from imagery to sound. (Typically Offered: Fall, Spring, Summer)

SCIVZ 3950: Field Illustration

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: ART 2300 or permission of instructor

A combination seminar and field trip course emphasizing nature interpretation, field sketching techniques and preparation of a final illustration based on field experience. (Typically Offered: Spring, Summer)

SCIVZ 3980: Cooperative Education

Credits: Required.

Prereq: Junior standing or permission of instructor.

Required of all cooperative education students. Students must register for these courses prior to commencing each work period. (Typically

Offered: Fall, Spring, Summer)

SCIVZ 4060: Introduction to 3D Organic Modeling in ZBrush

(Cross-listed with ART 4060).

Credits: 3. Contact Hours: Studio 6.

Repeatable, maximum of 2 times.

Introduction to organic 3D model creation in ZBrush. Digital clay sculpting informed by traditional techniques. 3D printing pipeline. Emphasis on science research and visual design thinking for science communication. Some experience with other 3D modeling software beneficial, but not required. (Typically Offered: Spring)

SCIVZ 4700: Data, Code, and Form

(Dual-listed with ART 5700X). (Cross-listed with ART 4700).

Credits: 3. Contact Hours: Studio 6.

Repeatable.

Data visualization strategies, principles, and tools for encoding data in visual art, applied art, and creative industry practices. The aesthetics of encoded data in creative practices. An overview of working with data as artistic and visual communication media including data acquisition, organization, representation, and interaction with data through art and design. Producing data display outputs that include a range of displays from screen to installation. (Typically Offered: Fall)

SCIVZ 4900: Independent Study

Credits: 1-3. Repeatable, maximum of 3 credits.

Prereq: Instructor Permission for Course

SCIVZ 4910: Portfolio Design and Professional Development

Credits: 2. Repeatable.

Prereq: SCIVZ 3370, junior or senior classification

Portfolio and professional preparation including identity package development, writing and speaking. Career-readiness, professional practice, leadership, networking, exploring research subfields within scientific visualization. Creating print and digital visual materials, learning approaches for entering the field, and developing business practice skills. Final portfolio materials presented at the end of the term. (Typically Offered: Spring)

SCIVZ 4940: Special Topics in Illustration

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Intensive exploration of illustration techniques in a studio or field setting.

SCIVZ 4970: Illustration Internship

Credits: 1-6. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

Offered on a satisfactory-fail basis only.

Seed Technology and Business (STB)

Courses primarily for undergraduates:

STB 4940: Seed Pathology

(Dual-listed with PLP 5940). (Cross-listed with PLP 4940).

Credits: 2. Contact Hours: Lecture 2.

Prereq: PLP 4080

Significance of biotic and abiotic diseases that affect the production and utilization of seeds, during each phase of the seed life cycle: growing, harvesting, conditioning, storing, and planting seed. Mechanisms of seed infection and seed-to-seedling transmission are considered for fungi, bacteria, viruses/viroids, and nematodes. Aspects of epidemiology, management, and host-pathogen relationships are discussed. Emphases include the role of seed health testing in the global seed industry for quality control and phytosanitary certification, as well as the use of seed treatments to manage seedborne and soilborne pathogens and pests. Concurrent enrollment in PLP 4940L/5940L (Seed Pathology Laboratory) is strongly encouraged (on-campus students only). Graduation Restriction: Credit may not be obtained for both PLP/STB 5920 and PLP 5940. Offered odd-numbered years. (Typically Offered: Fall)

STB 4940L: Seed Pathology Laboratory

(Dual-listed with PLP 5940L). (Cross-listed with PLP 4940L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: PLP 4080

Laboratory in seed pathology. Seed health testing methods; effects of seed treatments and seed conditioning on seedborne pathogens. Offered odd-numbered years. (Typically Offered: Fall)

Courses primarily for graduate students, open to qualified undergraduates:

STB 5010: Strategic Management

(Cross-listed with BUSAD 5010).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Admission to the Graduate Program in Seed Technology and Business or Permission of Instructor

Critical analysis of current practice and case studies in strategic management with an emphasis on integrative decision making. Strategy formulation and implementation will be investigated in the context of complex business environments.

STB 5030: Information Systems

(Cross-listed with BUSAD 5030).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Admission to the Graduate Program in Seed Technology and Business or Permission of Instructor

Introduction to a broad variety of information systems (IS) topics, including current and emerging developments in information technology (IT), IT strategy in the context of corporate strategy, and IS planning and development of enterprise architectures. Cases, reading, and discussions highlight the techniques and tactics used by managers to cope with strategic issues within an increasingly technical and data-driven competitive environment.

STB 5040: Marketing and Logistics

(Cross-listed with BUSAD 5040).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Admission to the Graduate Program in Seed Technology and Business or Permission of Instructor

Integration of the business functions concerned with the marketing and movement of goods along the supply chain with the primary goal of creating value for the ultimate customer. Coordination of marketing, production, and logistics activities within the firm and with outside suppliers and customers in the supply chain.

STB 5070: Organizational Behavior

(Cross-listed with BUSAD 5070).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Admission to the Graduate Program in Seed Technology and Business or Permission of Instructor

Understanding human behavior in organizations, and the nature of organizations from a managerial perspective. Special emphasis on how individual differences, such as perceptions, personality, and motivation, influence individual and group behavior in organizations and on how behavior can be influenced by job design, leadership, groups, and the structure of organizations.

STB 5080: Accounting and Finance

(Cross-listed with BUSAD 5080).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Admission to the Graduate Program in Seed Technology and Business or Permission of Instructor

Survey of fundamental topics in accounting and finance. Financial statement reporting and analysis for agriculture firms, corporate governance issues related to financial reporting, (e.g., Sarbanes-Oxley). Basic tools and techniques used in financial management, including stock and bond valuation. How to assess and use capital budgeting methods to evaluate proposed firm investments.

STB 5090: International Seed Business Practices, Policies, & Regulation

(Cross-listed with BUSAD 5090).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Admission to the Graduate Program in Seed Technology and Business or Permission of Instructor

Cultural, financial, economic, political, legal/regulatory environments shaping an organization's international business strategy. Topics include entry (and repatriation) of people, firms, goods, services, and capital. Special attention to the institutions of seed regulation and policy. Ethical issues facing managers operating in an international context.

STB 5100: Crop Improvement

(Cross-listed with AGRON 5100).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

A study of agriculture from its origins with the domestication of crop plants through basic genetics, demonstrating the challenges and elements of breeding strategies intended to manage gene x environmental interactions. Elements of biotechnology including use of molecular markers, development of genetically modified cultivars, gene mapping, cloning, and gene editing will be covered. Methods to measure the effectiveness of plant breeding (genetic gain) and the impact of improved agronomic practices contributing to increased agricultural productivity will be covered. Use of intellectual property protection, and the conservation and utilization of exotic genetic resources.

STB 5110: Crop Improvement

(Cross-listed with AGRON 5110).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Basic principles in the genetic improvement of crop plants. Methods of cultivar development in self-pollinated and cross-pollinated crop species. (Typically Offered: Fall, Spring)

STB 5130: Data Science for Agricultural Professionals

(Cross-listed with AGRON 5130).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (AGRON 1810 or equivalent, MATH 1400, STAT 1040) OR Graduate Classification

Quantitative methods for analyzing and interpreting agronomic information. Principles of experimental design, hypothesis testing, analysis of variance, regression, correlation, and graphical representation of data. Use of SAS and Excel for organization, analyzing, and presenting data. (Typically Offered: Fall, Spring)

STB 5340: Seed and Variety, Testing and Technology

(Cross-listed with AGRON 5340).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Admission to the Graduate Program in Seed Technology and Business or Permission of Instructor

The components of seed quality and how they are assessed in the laboratory, including traits derived from modern biotechnology. The impact of new technologies on seed quality testing. Variety maintenance procedures and breeder seed. Variety identification: phenotype and grow-out trials, isozyme testing, and DNA marker testing. Procedures for evaluating varieties. The variance tests appropriate for fixed effects analysis of variance. Statistical inference and stratification for yield trials. Use of strip plot testing. (Typically Offered: Summer)

STB 5350: Introduction to the Seed Industry

Credits: 1. Contact Hours: Lecture 1.

Prereq: Admission to the Graduate Program in Seed Technology and Business or Permission of Instructor

This introductory course is a quick overview of the academic program and the seed industry. It describes how the STB program components relate to the seed industry scope; the role of the seed industry in global agriculture and society; public and private institutions involved in seed research, development, and regulation; quality management for seed products. Current issues including industry consolidation, ethical and economic issues related to biotechnology, and incorporation of digital technology in the seed business will be discussed by course instructors and guest lecturers from the seed industry.

STB 5360: Quantitative Methods for Seed

(Cross-listed with AGRON 5360).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Quantitative Methods for analyzing and interpreting agronomic and business information for the seed industry. Principles of experimental design and hypothesis testing, regression, correlation, analysis of variance, and graphical representation of data. Use of spreadsheets and statistical software for manipulating, analyzing and presenting data. (Typically Offered: Fall)

STB 5390: Seed Conditioning and Storage

(Cross-listed with AGRON 5390).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Admission to the Graduate Program in Seed Technology and Business or Permission of Instructor

The technical operations which may be carried out on a seed lot from harvest until it is ready for marketing and use. The opportunities for quality improvement and the risks of deterioration which are present during that time. Analysis of the costs of and benefits of operations. Evaluation of equipment based on benefits to the customer and producer. Interpretation of the role of the conditioning plant and store as a focal points within the overall operations of a seed company. (Typically Offered: Spring)

STB 5430: Seed Physiology

(Cross-listed with HORT 5430).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Admission to the Graduate Program in Seed Technology and Business or Permission of Instructor

Brief introduction to plant physiology. Physiological aspects of seed development, maturation, longevity, dormancy and germination. Links between physiology and seed quality. (Typically Offered: Fall)

STB 5470: Seed Production

(Cross-listed with AGRON 5470).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Admission to the Graduate Program in Seed Technology and Business or Permission of Instructor

Survey of crop production; including management of soil fertility, planting dates, populations, weed control, and insect control. Analysis of the principles of seed multiplication and the key practices which are used to ensure high quality in the products. Field inspection procedures and production aspects that differ from other crop production. Foundation seed production. Analysis of the typical organization of field production tasks. Survey of the differences in seed production strategies between crops and the impact of these differences on seed production.

STB 5900: Special Topics

Credits: 1-3. Repeatable.

Prereq: Admission to the Graduate Program in Seed Technology and Business or Permission of Instructor

Guided instruction and self-study on special topics relevant to seed technology and business. (Typically Offered: Fall, Spring, Summer)

STB 5920: Seed Health Management

(Cross-listed with PLP 5920).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Occurrence and management of diseases during seed production, harvest, conditioning, storage, and planting. Emphasis on epidemiology, disease management in the field, seed treatment, effects of conditioning on seed health, and seed health testing. Graduation Restriction: Credit may not be obtained for both PLP/STB 5920 and PLP 5940. Offered even-numbered years. (Typically Offered: Spring)

STB 5940: Seed Pathology

(Dual-listed with PLP 4940). (Cross-listed with PLP 5940).

Credits: 2. Contact Hours: Lecture 2.

Prereq: PLP 4080 or Graduate Classification

Significance of biotic and abiotic diseases that affect the production and utilization of seeds, during each phase of the seed life cycle: growing, harvesting, conditioning, storing, and planting seed. Mechanisms of seed infection and seed-to-seedling transmission are considered for fungi, bacteria, viruses/viroids, and nematodes. Aspects of epidemiology, management, and host-pathogen relationships are discussed. Emphases include the role of seed health testing in the global seed industry for quality control and phytosanitary certification, as well as the use of seed treatments to manage seedborne and soilborne pathogens and pests. Concurrent enrollment in PLP 4940L/5940L (Seed Pathology Laboratory) is strongly encouraged (on-campus students only). Graduation Restriction: Credit may not be obtained for both PLP/STB 5920 and PLP 5940. Offered odd-numbered years. (Typically Offered: Fall)

STB 5940L: Seed Pathology Laboratory

(Dual-listed with PLP 4940L). (Cross-listed with PLP 5940L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: PLP 4080 or Graduate Classification

Laboratory in seed pathology. Seed health testing methods; effects of seed treatments and seed conditioning on seedborne pathogens. Offered odd-numbered years. (Typically Offered: Fall)

STB 5950: Seed Quality, Production, and Research Management

(Cross-listed with AGRON 5950).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Admission to the Graduate Program in Seed Technology and Business or Permission of Instructor

Advanced survey of the organization, staff capabilities and management characteristics typical in seed production and crop improvement in seed enterprises. Analysis of the use of quality information in the management of seed operations and sales. Process management applications for seed. Production planning for existing capacity. Analysis of the manager's tasks in the annual cycle and how the tasks of these managers relate to the general categories of business management roles. Difference in management strategies used with different situations and groups of employees.

STB 5990: Creative Component

Credits: 1-3. Repeatable.

Prereq: Admission to the Graduate Program in Seed Technology and Business or Permission of Instructor

A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

Sociology (SOC)

Courses primarily for undergraduates:

SOC 1100: Orientation to Agricultural and Rural Policy Studies

Credits: 1. Contact Hours: Lecture 1.

Orientation to Agricultural and Rural Policy Studies major. Familiarization with degree requirements. Exploration of career tracks and career planning. Recommended during first semester of freshman year or as soon as possible after transfer into the department. (Typically Offered: Fall)

SOC 1150: Orientation to Sociology

Credits: 1. Contact Hours: Lecture 1.

Orientation to sociology. A familiarization with University and LAS College requirements and procedures. Occupational tracks and career options open to sociology; introduction to career planning. Recommended during first semester of freshman year, or as soon as possible after transfer into the department. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

SOC 1340: Introduction to Sociology

Credits: 3. Contact Hours: Lecture 3.

Overview of sociological thought and research on the sociological imagination, socialization, social control, stratification, institutions, and the forces of social change. Individual lives are placed in social and historical context to better understand our place in the world and our time in history. (Typically Offered: Fall, Spring, Summer)

SOC 1340H: Introduction to Sociology: Honors

Credits: 3. Contact Hours: Lecture 3.

Prereq: Membership in the University Honors Program

Social interaction and group behavior with emphasis on the scientific study of contemporary U.S. society, including issues relating to socialization, inequality, and changing rural and urban communities. Analysis of relationships among the institutions of family, religion, political participation, work, and leisure. (Typically Offered: Fall, Spring, Summer)

SOC 2100: Social & Civic Innovation

Credits: 3. Contact Hours: Lecture 3.

Learn how to infuse innovation and entrepreneurship into social and civic problems. Students will be introduced to solution-oriented ways of thinking, grounded in sociology, data-driven methodologies, and the design thinking paradigm. Explore real-world case studies and methods in the US and international social contexts. Special attention is given to novel policies, programs, and interventions that address the challenges and opportunities of rural places. (Typically Offered: Spring)

SOC 2190: Families and Intimate Relationships

Credits: 3. Contact Hours: Lecture 3.

Exploration of families and intimate relationships using a sociological perspective, with the goal to help students make informed and intentional choices in their relationships across the life course. Topics covered include family definitions and theories, sexuality, singlehood, dating, cohabitation, marriage, parenting, divorce, stepfamilies, and aging. Relationship quality, communication, conflict, and work-life balance will also be examined, as well as differences in family dynamics by gender, race and ethnicity, and class. (Typically Offered: Fall, Spring)

SOC 2200: Globalization and Sustainability

(Cross-listed with ANTHR 2200/ ENVS 2200/ GLOBE 2200/ ME 2200/ MATE 2200).

Credits: 3. Contact Hours: Lecture 3.

An introduction to understanding the key global issues in sustainability. Focuses on interconnected roles of energy, materials, human resources, economics, and technology in building and maintaining sustainable systems. Applications discussed will include challenges in both the developed and developing world and will examine the role of technology in a resource-constrained world. Graduation Restriction: Cannot be used for technical elective credit in any engineering department. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

SOC 2300: Rural Society in Transition

Credits: 3. Contact Hours: Lecture 3.

Introduction to the causes and consequences of social and economic change affecting rural people and places. Uses a sociological perspective to examine social structures, social change, and social relationships within rural society. Topics include community, population change, inequality, rural economy, structure of agriculture, social and environmental impacts of resource extraction. . (Typically Offered: Fall)

SOC 2340X: Conservation Values & Ethics

Credits: 3.

Experiential course learning about conservation values, beliefs, ethics, practices, and policies through classical and contemporary readings in the field of conservation ethics. Exploration of wilderness areas, national parks, forest, and monuments, and the rural communities near these conservation areas, meeting with stakeholders in the conservation ecosystem, and engaging in service learning to gain a first-hand knowledge of the conservation landscape. Travel component to the ISU Montana campus prior to the start of the semester. 8-week course. (Typically Offered: Fall)

SOC 2350: Social Problems and American Values

Credits: 3. Contact Hours: Lecture 3.

Explores relationship between contemporary social problems and American values. Explores how contradictory values impede political consensus while complicating our ability to define and solve social problems. Discussion may focus upon: working conditions, income and wealth, poverty and welfare, impacts of technology on society, criminal justice and victimization, reproductive rights and gender, child rearing and education, immigration and race, guns and violence, and environment and climate change. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall, Spring)

SOC 2410: Youth and Crime

(Cross-listed with CJ 2410).

Credits: 3. Contact Hours: Lecture 3.

An examination of delinquency that focuses on the relationship between youth as victims and as offenders, social and etiological features of delinquency, the role of the criminal justice system, delinquents' rights, and traditional and alternative ways of dealing with juvenile crime.

(Typically Offered: Fall)

SOC 2620: Data Discovery, Analytics, and Visualization in the Social Sciences

Credits: 3.

Experiential learning course on how to find, analyze, and present data to address issues in agricultural and rural policy. Data skills include accessing and analysis of public data, creating effective charts and maps, and formatting and writing policy reports. Students will use Excel, Word, ArcGIS, Canva. (Typically Offered: Spring)

SOC 2640: Facilitation of Public Issues in Agriculture

Credits: 3.

Experiential learning course on how to use public facilitation skills to address issues in agricultural and rural policy. Skills include ensuring participation among diverse audiences, generation and prioritization of ideas, facilitating discussions and managing conflict, and building consensus to make decisions. Students will practice these skills with relevant stakeholder groups. . (Typically Offered: Fall)

SOC 2770: Religion and Society

(Cross-listed with RELIG 2770).

Credits: 3. Contact Hours: Lecture 3.

Religion as a human construction, institution, activity, and identity. Connections between religion and other social institutions and processes. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Spring)

SOC 3020: Research Methods for the Social Sciences

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or enrollment in STAT 1010 or STAT 1040

Introduction to the principal research methods used in sociology, including survey research, interviewing, content analysis, experiments, ethnographies, focus groups, historical analysis, and analysis of secondary data. Instruction on sampling and the principles of validity and reliability underlying quantitative and qualitative methods. Training in data analysis using statistical software packages. (Typically Offered: Spring)

SOC 3050: Social Psychology: A Sociological Perspective

Credits: 3. Contact Hours: Lecture 3.

Examination of human behavior in a social environment with emphasis on development of the self, interpersonal relations, attitudes, and small groups. (Typically Offered: Fall, Spring, Summer)

SOC 3100: Community

Credits: 3. Contact Hours: Lecture 3.

Analysis of evolving theory and research of community as an ideal type, an ecological system, a political economy, and an interactional field; examination of the impact of economic, cultural, social and political infrastructures on community power structures and change processes in a global era. (Typically Offered: Fall, Spring)

SOC 3250: Agriculture in Transition

Credits: 3. Contact Hours: Lecture 3.

The impacts of socioeconomic and agricultural changes on farm families, rural communities, and consumers. Past, present, and future trends in farm structures, the U.S. agrifood system, and their social implications including ethics and policy options. (Typically Offered: Spring)

SOC 3270: Gender and Sexualities in Society

(Cross-listed with WGS 3270).

Credits: 3. Contact Hours: Lecture 3.

Develop a foundational understanding of the role of gender and sexuality in society. Students will explore the biological, social, and cultural meanings of gender and sexuality and their intersections with class, race/ethnicity, ability, socioeconomic status and other identities. Contemporary social science research, theories, and feminist perspectives as they relate to gender and sexuality, and explores gender and sexuality within families, education, the media, politics, and the economy. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall, Spring, Summer)

SOC 3280: Sociology of Masculinities and Manhood

(Cross-listed with WGS 3280).

Credits: 3. Contact Hours: Lecture 3.

Examination of socially constructed and idealized images of manhood, the nature of social hierarchies and relations constructed on the basis of imagery, ideologies, and norms of masculinity. Theories on gender (sociological, psychological, and biological). Particular attention given to theory and research on gender variations among men by race, class, ethnicity, sexual orientation, physical ability and age. (Typically Offered: Spring)

SOC 3300: Ethnic and Race Relations

(Cross-listed with AFAM 3300).

Credits: 3. Contact Hours: Lecture 3.

Analysis of ethnic and race relations, particularly in America; emphasis on the sociology and psychology of race and ethnic relations. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall, Spring, Summer)

SOC 3310: Social Class and Inequality

Credits: 3. Contact Hours: Lecture 3.

Social stratification and processes resulting in social and economic inequalities; implications of status, class, and poverty for people of different races, ethnicities, and gender. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall, Spring, Summer)

SOC 3320: The Latino/Latina Experience in U.S. Society

Credits: 3. Contact Hours: Lecture 3.

Examination of the social, historical, economic and political experience of varied Latino ethnic groups in the U.S. - primarily focusing on Mexican, Puerto Ricans, and Cubans. (Typically Offered: Fall)

SOC 3340: Politics and Society

(Cross-listed with POLS 3340).

Credits: 3. Contact Hours: Lecture 3.

The relationship between politics and society with emphasis on American society. Discussion of theories of inequality, power, social movements, elites, ruling classes, democracy, and capitalism. (Typically Offered: Fall)

SOC 3400: Deviant and Criminal Behavior

(Cross-listed with CJ 3400).

Credits: 3. Contact Hours: Lecture 3.

Theory and research on the etiology of types of social deviance; issues relating to crime, antisocial behavior and social policies designed to control deviant behavior. (Typically Offered: Spring, Summer)

SOC 3450: Population and Society

(Cross-listed with ENVS 3450).

Credits: 3. Contact Hours: Lecture 3.

History of present and future of human populations. How human population growth and structure impacts our world, influencing food and the environment, causes of death, fertility rates, and international migration. Compare the U.S. with other societies worldwide. Understand population policies and their impacts on climate, social and economic inequalities, and human well-being. Gain hands-on experience practicing demographic techniques and applying demographic data to real-world population problems. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

SOC 3480: Global Poverty, Resources and Sustainable Development

Credits: 3. Contact Hours: Lecture 3.

Trends in hunger, poverty, resource use and development. Assessment of theories, policies, and programs to promote sustainable livelihoods, resource management, and development at local and national levels. Examine solutions through institutional efforts and grassroots social movements. Meets International Perspectives Requirement.

SOC 3500: Human Diversity in Agriculture and the Food System

Credits: 3. Contact Hours: Lecture 3.

Role of under-represented groups in agriculture and the food system from a sociological perspective, with a focus on the United States. Analysis of the status, contributions, and barriers of farmers and farm workers who identify as women, under-represented racial and ethnic groups, LGBTQ, and lower income. Discussion of historical and current issues. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall)

SOC 3620: Applied Ethics in Agricultural and Rural Development

Credits: 3. Contact Hours: Lecture 3.

Explore ethics of policy development and program implementation in agricultural and rural development. Focus in U.S. and international contexts. Identify major ethical issues and dilemmas in policy and programs. Discuss and debate proper ethical behaviors when working with policy-makers, NGOs, farmers, and rural communities. . (Typically Offered: Fall)

SOC 3800: Sociology of Work

Credits: 3. Contact Hours: Lecture 3.

Prereq: SOC 1340

Inequalities (gender, race, class) related to jobs, occupations, firms, and industries. Satisfactions, rewards, alienation, discrimination, and other topics of importance to workers are examined. (Typically Offered: Fall, Spring)

SOC 3820: Environmental Sociology

(Cross-listed with ENVS 3820).

Credits: 3. Contact Hours: Lecture 3.

Environment-society relations; social construction of nature and the environment; social and environmental impacts of resource extraction, production, and consumption; environmental inequality; environmental mobilization and movements; U.S. and international examples. Meets International Perspectives Requirement. Meets International Perspectives Requirement. (Typically Offered: Spring)

SOC 4010: Contemporary Sociological Theories

Credits: 3. Contact Hours: Lecture 3.

Sociological theories (Marx, Durkheim, Weber) explain the traumatic transition from stable, traditional societies into dynamic, modern capitalism, the personal and social implications of late capitalism, globalization, technology, rationalization and other concepts regarding future trends and their practical impact upon social reality. (Typically Offered: Fall, Spring)

SOC 4100: Human Trafficking

(Dual-listed with SOC 5100/ WGS 5100). (Cross-listed with WGS 4100).

Credits: 3. Contact Hours: Lecture 3.

Prereq: WGS 2010 or 3 credits in WGS at 3000 level or above

Issues related to human trafficking and modern-day slavery in the US and world. History of and concepts defining forms of violence experienced by trafficking victims and methods used to recruit and control victims. Students will learn how to educate others about this crime against humanity. Examines international, federal, and state legislation to prevent human trafficking. Graduation Restriction: Only one of WGS 4100 may count toward graduation.

SOC 4110: Social Change in Developing Countries

Credits: 3. Contact Hours: Lecture 3.

Social change and development in developing countries; international interdependence; causes and consequences of persistent problems in agriculture, city growth, employment, gender equality, basic needs; local and worldwide efforts to foster social change and international development. Meets International Perspectives Requirement. (Typically Offered: Spring)

SOC 4150: Agrifood Policy and Social Change

Credits: 3. Contact Hours: Lecture 3.

Prereq: SOC 1340 or SOC 2300 or SOC 3250

Historical and current agricultural and food policies are studied from domestic perspectives. Governance of agrifood systems by governments and other institutions are examined in terms of rationale, content, and consequences. Social science frameworks are used to assess the impacts of governance policies on agricultural producers, rural communities, and consumers. (Typically Offered: Spring)

SOC 4330: Strategies for Rural Resiliency and Vitality

(Dual-listed with SOC 5330).

Credits: 3. Contact Hours: Lecture 3.

Experiential learning course on community resiliency and vulnerability. Focus on economic, social, cultural, environmental, and spatial dimensions of communities. Examine impact of local strategies and state and national policies on resiliency. Project-based work with communities and agencies. Applications using data discovery and survey research methods. Offered odd-numbered years. (Typically Offered: Fall)

SOC 4440: Sociology of Food and Agricultural Systems

(Dual-listed with SOC 5440/ SUSAG 5440).

Credits: 3. Contact Hours: Lecture 3.

Social organization of food and fiber production, processing, and distribution systems. Sociological comparison of conventional and alternative production systems; gender roles in agriculture and food systems; local, national and global food systems; perspectives on food and agricultural research and policy. Offered even-numbered years. (Typically Offered: Fall)

SOC 4600: Criminal and Juvenile Justice Internship

(Cross-listed with CJ 4600).

Credits: 3-9. Repeatable, maximum of 9 credits.

Prereq: Junior or Senior classification; major or minor in Criminal Justice or Sociology

Study of the criminal and juvenile justice systems and social control processes. Supervised placement in a police department, prosecutor's office, court, probation and parole department, penitentiary, juvenile correctional institution, community-based rehabilitation program, or related agency. Assessed service-learning component. Graduation Restriction: No more than a total of 9 credits of 4600 can be counted toward graduation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

SOC 4640: Strategies for Community Engagement

Credits: 3. Contact Hours: Lecture 3.

Prereq: 6 credits in SOC

Project-focused engagement in community issues and initiatives. A broad range of strategies will be addressed, including popular education, applied research, network analysis and mapping, policy focused work, action research, curriculum development, community organizing, and organizational development. (Typically Offered: Spring, Summer)

SOC 4700X: Agricultural and Rural Policy Internship

Credits: 3-9. Repeatable, maximum of 9 credits.

Prereq: Junior or Senior classification; major in Agricultural and Rural Policy Studies

Study of the agricultural and rural policy in applied settings. Supervised placement in state and local government agencies, agricultural associations, conservation groups, rural development agencies, or related organizations. Assessed experiential learning component. Offered on a satisfactory-fail basis only. . Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

SOC 4800X: Special Topics in Sociology

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Seminar on special topics, research, methods, or theory in Sociology. Students must register for a different topic each time.

SOC 4820X: Issues in Agricultural and Rural Policy

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Seminar on current issues in agriculture and food, natural resources and the environment, and rural communities and economies from a social science perspective.

SOC 4900A: Independent Study: General Sociology

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: 6 credits in SOC; Permission of Instructor

Graduation Restriction: Students in the College of Agriculture must be of junior or senior classification and may use no more than 6 credits of SOC 4900 toward the total of 128 credits required for graduation. Students in the College of Liberal Arts and Sciences may count no more than 9 credits of 4900 toward graduation.

SOC 4900B: Independent Study: Rural Sociology

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: 6 credits in SOC; Permission of Instructor

Graduation Restriction: Students in the College of Agriculture must be of junior or senior classification and may use no more than 6 credits of SOC 4900 toward the total of 128 credits required for graduation. Students in the College of Liberal Arts and Sciences may count no more than 9 credits of 4900 toward graduation.

SOC 4900E: Independent Study: Senior Seminar

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: 6 credits in SOC; Permission of Instructor

Graduation Restriction: Students in the College of Agriculture must be of junior or senior classification and may use no more than 6 credits of SOC 4900 toward the total of 128 credits required for graduation. Students in the College of Liberal Arts and Sciences may count no more than 9 credits of 4900 toward graduation.

SOC 4900H: Independent Study: Honors

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: 6 credits in SOC; Permission of Instructor; Membership in the University Honors Program

Graduation Restriction: Students in the College of Agriculture must be of junior or senior classification and may use no more than 6 credits of SOC 4900 toward the total of 128 credits required for graduation. Students in the College of Liberal Arts and Sciences may count no more than 9 credits of 4900 toward graduation.

SOC 4960A: Travel Course: International

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable, maximum of 3 credits.

Prereq: Instructor Permission for Course

Tour and study of international topics in sociology and rural sociology. Locations and duration of tour will vary. Limited enrollment. (Typically Offered: Spring)

SOC 4960X: Travel Course: International

Credits: 1-3. Contact Hours: Lecture 3.

Prereq: Instructor Permission for Course

Tour and study of international topics in sociology and rural sociology. Locations and duration of tour will vary. Limited enrollment. (Typically Offered: Spring)

Courses primarily for graduate students, open to qualified undergraduates:

SOC 5060: Classical Sociological Theory

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

The origins of the canonical works of sociology in the mid-Industrial Revolution period including Karl Marx, Max Weber, Emile Durkheim and others.

SOC 5090: Agroecosystems Analysis

(Cross-listed with AGRON 5090/ SUSAG 5090).

Credits: 4. Contact Hours: Lecture 3, Laboratory 4.

Prereq: Graduate Standing or Permission of Instructor

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

SOC 5100: Human Trafficking

(Dual-listed with SOC 4100/ WGS 4100). (Cross-listed with WGS 5100).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Issues related to human trafficking and modern-day slavery in the US and world. History of and concepts defining forms of violence experienced by trafficking victims and methods used to recruit and control victims. Students will learn how to educate others about this crime against humanity. Examines international, federal, and state legislation to prevent human trafficking. Graduation Restriction: Only one of WGS 4100 may count toward graduation.

SOC 5110: Research Methodology for the Social Sciences

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Covers the philosophy and the techniques of research methods in sociology and other social sciences, including the ethics and politics of social science, validity issues, conceptualization and operationalization, sampling strategies, appropriate research designs for different questions, survey construction, and various data collection and analysis techniques.

SOC 5120: Applied Multivariate Statistics for Social and Behavioral Research

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Applied techniques of multivariate analysis including cluster analysis, principal components and factor analysis, multivariate analysis of variance and covariance binomial and multinomial regression, multi-level random coefficient models, and spatial regression. Conceptual and mathematical grounding for nonstatisticians. Instruction in Mplus and SAS.

SOC 5130: Qualitative Research Methods

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Applied qualitative research methods in sociology. Design and implementation of a course-based research project including data collection, analysis, and presentation of results. Qualitative data gathering techniques using observational, historical, in-depth interviewing or content analysis approaches. Laboratory emphasis on completion of data gathering, analysis, and report writing. (Typically Offered: Fall, Spring, Summer)

SOC 5200: Social Psychology: A Sociological Perspective

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Examination of cognitive, symbolic interaction, exchange, role-reference group, and dramaturgical approaches. Assessment of contemporary issues in social psychology. (Typically Offered: Fall, Spring, Summer)

SOC 5250A: Seminar in Social Psychology: Small Groups

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

(Typically Offered: Fall, Spring, Summer)

SOC 5250B: Seminar in Social Psychology: Attitudes and Attitude Change

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

(Typically Offered: Fall, Spring, Summer)

SOC 5250C: Seminar in Social Psychology: Symbolic interactionism

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

(Typically Offered: Fall, Spring, Summer)

SOC 5250D: Seminar in Social Psychology: Self and Identity

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

(Typically Offered: Fall, Spring, Summer)

SOC 5270A: Seminar in Social Inequality: Sociology of Race and Ethnicity

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Analysis of racial and ethnic inequality in the United States and the world; focus on the implications of the changing world social and economic order for differences in racial and ethnic groups relative to wealth, status, and power; a critical examination of majority-group domination of minority groups in various societies. (Typically Offered: Fall, Spring, Summer)

SOC 5270B: Seminar in Social Inequality: Sociology of Gender

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Analysis of racial and ethnic inequality in the United States and the world; focus on the implications of the changing world social and economic order for differences in racial and ethnic groups relative to wealth, status, and power; a critical examination of majority-group domination of minority groups in various societies. (Typically Offered: Fall, Spring, Summer)

SOC 5330: Strategies for Rural Resiliency and Vitality

(Dual-listed with SOC 4330).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate classification

Experiential learning course on community resiliency and vulnerability. Focus on economic, social, cultural, environmental, and spatial dimensions of communities. Examine impact of local strategies and state and national policies on resiliency. Project-based work with communities and agencies. Applications using data discovery and survey research methods. Offered odd-numbered years. . (Typically Offered: Fall)

SOC 5340: Race, Class and Gender Inequality

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Critical examination of the causes and consequences of social stratification and inequality; classical theories, contemporary frameworks, and recent empirical studies; international stratification patterns.

SOC 5360: Strategies for Community Engagement in Food and Farming Systems

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Project-focused community practice using diverse approaches and perspectives.

SOC 5400: Comparative Social Change

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Contemporary theories of social change, modernization, dependency, and development are critically examined; methodological issues identified; supporting research explored; applicability of theoretical models, concepts, and strategies to current national and international needs are evaluated.

SOC 5430A: Seminar in Social Change and Development: Strategies of Community Engagement

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

(Typically Offered: Fall, Spring, Summer)

SOC 5430B: Seminar in Social Change and Development: Sociology of Adoption and Diffusion

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

(Typically Offered: Fall, Spring, Summer)

SOC 5430C: Seminar in Social Change and Development: Technological Innovation, Social Change and Development

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

(Typically Offered: Fall, Spring, Summer)

SOC 5440: Sociology of Food and Agricultural Systems

(Dual-listed with SOC 4440). (Cross-listed with SUSAG 5440).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate classification

Social organization of food and fiber production, processing, and distribution systems. Sociological comparison of conventional and alternative production systems; gender roles in agriculture and food systems; local, national and global food systems; perspectives on food and agricultural research and policy. Offered even-numbered years. (Typically Offered: Fall)

SOC 5490: Sociology of the Environment

(Cross-listed with SUSAG 5490).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Social causes and social consequences of environmental problems. Interrelationship between social inequality and environmental inequality. Social construction and social experience of the environment. Contemporary developments in the social theory of the environment. International and domestic implications.

SOC 5510B: Seminar in Economy, Organization, and Work: Complex Organizations

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

(Typically Offered: Fall, Spring, Summer)

SOC 5840: Current Issues in Crime and Justice

(Cross-listed with CJ 5840).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 3 credits.

Prereq: Graduate Standing or Permission of Instructor

Discussion of current research and theory in crime and delinquency; topics include the purpose and role of law in social life; emerging theoretical directions in criminology; recent work on specific forms of criminality; controversies in the criminal justice system. Offered odd-numbered years. (Typically Offered: Fall)

SOC 5900A: Special Topics: General Sociology

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

SOC 5900B: Special Topics: Rural Sociology

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

SOC 5910: Orientation to Sociology

Credits: 1. Contact Hours: Lecture 1.

Prereq: Graduate Standing or Permission of Instructor

Introduction to the department, current graduate student policies at department and university levels, departmental administrative procedures. Required of graduate students. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

SOC 5990A: Research for Master's Thesis: General Sociology

Credits: 1-6. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

SOC 5990B: Research for Master's Thesis: Rural Sociology

Credits: 1-6. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

Courses for graduate students:**SOC 6070: Contemporary Sociological Theory**

Credits: 3. Contact Hours: Lecture 3.

Provides a review of modern sociological thought, issues, and controversies as they affect current research and discourse in the discipline.

SOC 6100: Foundations of Sustainable Agriculture

(Cross-listed with ABE 6100/ AGRON 6100/ ANTHR 6100/ SUSAG 6100).

Credits: 3. Contact Hours: Lecture 3.

Historical, biophysical, socioeconomic, and ethical dimensions of agricultural sustainability. Strategies for evaluating existing and emerging agricultural systems in terms of the core concepts of sustainability and their theoretical contexts. (Typically Offered: Fall)

SOC 6130: Structural Equation Models for Social and Behavioral Research

Credits: 3. Contact Hours: Lecture 3.

Specification, identification, and interpretation of structural equation models. Techniques include structural or path models, measurement or confirmatory factor models, structural models with latent variables, and multi-level structural models. Conceptual and mathematical grounding for non-statisticians. Instruction in AMOS, MPLUS, and SAS.

SOC 6980L: Seminars in Sociology: Community Studies and Development

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

(Typically Offered: Fall, Spring, Summer)

SOC 6980M: Seminars in Sociology: Criminology

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

(Typically Offered: Fall, Spring, Summer)

SOC 6980N: Seminars in Sociology: The Economy, Organizations, and Work

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

(Typically Offered: Fall, Spring, Summer)

SOC 6980O: Seminars in Sociology: Food Systems, Agriculture, and the Environment

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

(Typically Offered: Fall, Spring, Summer)

SOC 6980P: Seminars in Sociology: Methodology

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

(Typically Offered: Fall, Spring, Summer)

SOC 6980Q: Seminars in Sociology: Social Change and Development

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

(Typically Offered: Fall, Spring, Summer)

SOC 6980R: Seminars in Sociology: Social Inequality

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

(Typically Offered: Fall, Spring, Summer)

SOC 6980S: Seminars in Sociology: Social Psychology

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

(Typically Offered: Fall, Spring, Summer)

SOC 6980T: Seminars in Sociology: Sociology of Families

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

(Typically Offered: Fall, Spring, Summer)

SOC 6980U: Seminars in Sociology: Theory

Credits: 3. Contact Hours: Lecture 3.

(Typically Offered: Fall, Spring, Summer)

SOC 6990A: Dissertation Research: General Sociology

Credits: 1-8. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

SOC 6990B: Dissertation Research: Rural Sociology

Credits: 1-8. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

Software Engineering (SE)

Courses primarily for undergraduates:**SE 1010: Software Engineering Orientation**

Credits: Required. Contact Hours: Lecture 1.

Introduction to the procedures, policies, and resources of Iowa State University and the Software Engineering Program. Offered on a satisfactory-fail basis only.

SE 1660: Careers in Software Engineering

Credits: Required. Contact Hours: Lecture 1.

Overview of the nature and scope of the software engineering profession, relationship of coursework to careers, and program of study planning.

Offered on a satisfactory-fail basis only.

SE 1850: Problem Solving in Software Engineering

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Credit or concurrent enrollment in MATH 1430 (or satisfactory scores on mathematics placement examinations)

Introduction to software engineering and computer programming.

Systematic thinking process for problem solving in the context of software engineering. Group problem solving. Solving software engineering problems and presenting solutions through computer programs, written documents and oral presentations. Introduction to principles of programming, software design, and extensive practice in design, writing, running, debugging, and reasoning about programs.

Satisfactory placement scores can be found at: <https://math.iastate.edu/academics/undergraduate/aleks/placement/>. Graduation Restriction: Only one of ENGR 1600, ABE 1600, AERE 1600, BME 1600, CE 1600, CHE 1600, CPRE 1850, EE 1850, IE 1480, ME 1600, and SE 1850 may count towards graduation.

SE 1860: Problem Solving in Software Engineering II

Credits: 1. Contact Hours: Laboratory 2.

Prereq: SE 1850

Group projects in software engineering. Work effectively in teams to solve problems and provide technical reports and presentations. Self-directed team based projects that are representative of problems faced by software engineers. (Typically Offered: Spring)

SE 3090: Software Development Practices

(Cross-listed with COMS 3090).

Credits: 3. Contact Hours: Lecture 3, Discussion 1.

Prereq: Minimum of C- in (COMS 2280; MATH 1650)

Practical introduction to methods for managing software development. Software engineering concepts, practices and tools. Requirements analysis, structured and object-oriented design, coding, testing, and maintenance. Software process models, software tools and environments. Programming projects that provide exposure to information management techniques, client/server model, networking and communication. (Typically Offered: Fall, Spring)

SE 3170: Introduction to Software Testing

Credits: 3. Contact Hours: Lecture 3.

Prereq: (COMS 2300 or CPRE 3100); (COMS 3090 or SE 3090)

Basic principles and techniques for software testing. Test requirements and management. Test design techniques, evaluation metrics, model-based testing, unit testing, system and integration testing. Software testing tools and programming projects.

SE 3190: Construction of User Interfaces

(Cross-listed with COMS 3190).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 2280

Overview of user interface design. Evaluation and testing of user interfaces. Review of principles of object orientation, object oriented design and analysis using UML in the context of user interface design. Design of windows, menus and commands. Developing Web and Windows-based user-interfaces. Event-driven programming. Introduction to Frameworks and APIs for the construction of user interfaces. (Typically Offered: Fall, Spring)

SE 3290: Software Project Management

(Cross-listed with CPRE 3290).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 3090

Process-based software development. Capability Maturity Model (CMM). Project planning, cost estimation, and scheduling. Project management tools. Factors influencing productivity and success. Productivity metrics. Analysis of options and risks. Version control and configuration management. Inspections and reviews. Managing the testing process. Software quality metrics. Modern software engineering techniques and practices.

SE 3390: Software Architecture and Design

(Cross-listed with CPRE 3390).

Credits: 3. Contact Hours: Lecture 3.

Prereq: SE 3190

Modeling and design of software at the architectural level. Architectural styles. Basics of model-driven architecture. Object-oriented design and analysis. Iterative development and unified process. Design patterns. Design by contract. Component based design. Product families. Measurement theory and appropriate use of metrics in design. Designing for qualities such as performance, safety, security, reliability, reusability, etc. Analysis and evaluation of software architectures. Introduction to architecture definition languages. Basics of software evolution, reengineering, and reverse engineering. Case studies. Introduction to distributed system software.

SE 3420: Principles of Programming Languages

(Cross-listed with COMS 3420).

Credits: 3. Contact Hours: Lecture 3, Discussion 1.

Prereq: Minimum of C- in COMS 2280 and MATH 1650; COMS 2300 or CPRE 3100

Study of concepts in programming languages, especially functional programming concepts. Overview of major programming paradigms, their relationship, and tradeoffs among paradigms enabling sound choices of programming language for application-specific development. Programming projects. (Typically Offered: Fall, Spring)

SE 3620: Object-Oriented Analysis and Design

(Cross-listed with COMS 3620).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500 and Minimum of C- in COMS 2280 and MATH 1650

Object-oriented requirements analysis and systems design. Analysis and design methodologies including use case and Unified Modeling Language (UML). Design principles, heuristics, and patterns. Architectural patterns and alternative programming paradigms. Group design and programming project. (Typically Offered: Fall, Spring)

SE 4090: Software Requirements Engineering

(Dual-listed with COMS 5090). (Cross-listed with COMS 4090).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 3090

The requirements engineering process including elicitation, requirements analysis fundamentals, requirements specification and communication, and requirements evaluation. Modeling of functional requirements and nonfunctional requirements, traceability, and requirements change management. Case studies and software projects.

SE 4120: Formal Methods in Software Engineering

(Dual-listed with COMS 5120). (Cross-listed with CPRE 4120/ COMS 4120).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 3110; (STAT 3050 or STAT 3300 or STAT 3410)

A study of formal techniques for model-based specification and verification of software systems. Topics include logics, formalisms, graph theory, numerical computations, algorithms and tools for automatic analysis of systems. Graduate credit requires in-depth study of concepts.

SE 4130: Program Analysis

(Dual-listed with COMS 5130/ CPRE 5130). (Cross-listed with COMS 4130).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (COMS 3270 or CPRE 2880); COMS 3420

Algorithms, AI techniques and tools for automatically reasoning about code and program executions. Theory and foundations related to control flow analysis, dataflow analysis, abstract interpretation, and symbolic execution. Applications of program analysis to bug detection, test input generation, debugging, program repair, specification inference and trustworthy AI engineering. Concepts, algorithms, tools, benchmarks, methodologies for solving problems using program analysis and for preparing research in program analysis.

SE 4160: Software Evolution and Maintenance

(Cross-listed with CPRE 4160).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 3090

Practical importance of software evolution and maintenance, systematic defect analysis and debugging techniques, tracing and understanding large software, impact analysis, program migration and transformation, refactoring, tools for software evolution and maintenance, experimental studies and quantitative measurements of software evolution. Written reports and oral presentation.

SE 4170: Software Testing

(Cross-listed with COMS 4170).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 3090; (COMS 2300 or CPRE 3100); ENGL 2500

An introduction to software testing principles and techniques. Test models, test design, test adequacy criteria; regression, integration, and system testing; and software testing tools.

SE 4190: Software Tools for Large Scale Data Analysis

(Cross-listed with CPRE 4190).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: COMS 3630 or COMS 3520 or CPRE 3080; COMS 2280

Software tools for managing and manipulating large volumes of data, external memory processing, large scale parallelism, and stream processing, data interchange formats. Weekly programming labs that involve the use of a parallel computing cluster.

SE 4210: Software Analysis and Verification for Safety and Security

(Cross-listed with CPRE 4210).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (COMS 2300 or CPRE 3100); (COMS 3090 or SE 3090)

Significance of software safety and security; various facets of security in cyber-physical and computer systems; threat modeling for software safety and security; and categorization of software vulnerabilities. Software analysis and verification: mathematical foundations, data structures and algorithms, program comprehension, analysis, and verification tools; automated vs. human-on-the-loop approach to analysis and verification; and practical considerations of efficiency, accuracy, robustness, and scalability of analysis and verification. Cases studies with application and systems software; evolving landscape of software security threats and mitigation techniques. Understanding large software, implementing software analysis and verification algorithms. (Typically Offered: Fall, Spring)

SE 4220: Cloud Computing - Software Development

Credits: 3. Contact Hours: Lecture 3.

Prereq: (SE 3090 or SE 3390); (CPRE 3810 or COMS 3210)

A comprehensive view of cloud computing with respect to software development from platforms and services to programming and infrastructure. Virtualization and containerization; cloud computing platforms, with examples from currently available cloud services; cloud services for data analytics, machine learning, and devops; programming frameworks for parallel computing in the cloud; distributed storage in the cloud; Container management. Includes homeworks and programming assignments. The programming assignments will be done in AWS.

(Typically Offered: Fall)

SE 4230X: Software Refactoring

Credits: 3. Contact Hours: Lecture 3.

Pragmatic challenges of refactoring source-code in software development life cycle. Understanding software refactoring step-by-step using example. Identifying code smells and applying different software refactoring tools and techniques. Building tests, refactoring catalog, simplifying conditional logic, refactoring APIs, dealing with encapsulation and inheritance. (Typically Offered: Fall)

SE 4390: Applied Software Design: Theory and Practice

Credits: 3. Contact Hours: Lecture 3.

Prereq: SE 3090 and SE 3190

Software design from an objective viewpoint. Focus on design principles, processes, activities and deliverables. Multiple design challenges are given. Students will learn design as an 'optimization' problem with several human and technical factors. Topics include code-, architecture-, and user-level design as well as intelligent and autonomous software design. (Typically Offered: Fall)

SE 4400: Principles and Practice of Compiling

(Dual-listed with COMS 5400). (Cross-listed with COMS 4400).

Credits: 3. Contact Hours: Laboratory 1, Lecture 3.

Prereq: COMS 3310 or COMS 3420 and COMS 3090 and ENGL 2500

Theory of compiling and implementation issues of programming languages. Programming projects leading to the construction of a compiler. Projects with different difficulty levels will be given for 4400 and 5400. Topics include: lexical, syntactic and semantic analyses, syntax-directed translation, code generation, runtime environment and library support.

SE 4900: Independent Study

Credits: 1-30. Repeatable.

Prereq: Senior classification in software engineering; Permission of Instructor

Investigation of an approved topic.

SE 4910: Senior Design Project I and Professionalism

(Cross-listed with CPRE 4910/ EE 4910).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: [(EE, CPRE, or CYBE MAJOR) AND (CPRE 3940 or EE 3940 or CPRE 2320 or EE 2320 or CPRE 2340 or CYBE 2340) AND (ENGL 3090 or ENGL 3140 or ENGL 3240H) AND (Credit or enrollment in CPRE 3080 or EE 3220)] OR [(SE MAJOR) AND (ENGL 3090 or ENGL 3140 or ENGL 3140H) AND (SE 3390) AND (Credit or enrollment in COMS 3520 or CPRE 3080)]

Preparing for entry to the workplace. Selected professional topics. Use of technical writing skills in developing project plan and design report; design review presentation. First of two-semester team-oriented, project design and implementation experience. (Typically Offered: Fall, Spring)

SE 4920: Senior Design Project II

(Cross-listed with EE 4920/ CPRE 4920).

Credits: 2. Contact Hours: Lecture 1, Laboratory 3.

Prereq: CPRE 4910 or EE 4910

Second semester of a team design project experience. Emphasis on the successful implementation and demonstration of the design completed in EE 4910, CPRE 4910, or SE 4910 and the evaluation of project results. Technical writing of final project report; oral presentation of project achievements; project poster. (Typically Offered: Fall, Spring)

Spanish (SPAN)

Courses primarily for undergraduates:

SPAN 1010: Elementary Spanish I

Credits: 4. Contact Hours: Lecture 4.

A communicative approach to grammar and vocabulary within the context of Hispanic culture. For students whose native language is not Spanish. Students Who Have Completed One Or More Years Of High School Spanish May Not Enroll In 101. Testout Not Available If Also Registered. (Typically Offered: Fall, Summer)

SPAN 1020: Elementary Spanish II

Credits: 4. Contact Hours: Lecture 4.

Prereq: SPAN 1010 or SPAN 0970 or placement by departmental exam

Continuation of Spanish 1010. A communicative approach to grammar and vocabulary within the context of Hispanic culture. For students whose native language is not Spanish. Meets International Perspectives Requirement. (Typically Offered: Spring, Summer)

SPAN 1950: Study Abroad

Credits: 3. Contact Hours: Lecture 3.

Supervised instruction in Spanish and Hispanic culture; formal class instruction at level appropriate to student's training, augmented by practical living experience. Taught in Spanish. Consult the department regarding equivalency with SPAN 1010 or 1020. Meets International Perspectives Requirement.

SPAN 1970X: Accelerated Elementary Spanish

Credits: 4. Contact Hours: Lecture 4.

A communicative approach to grammar and vocabulary within the context of Hispanic culture. Intensive, accelerated combination course that includes coursework from SPAN 1010 and SPAN 1020. It is strongly recommended that students enrolling in this course have completed at least two years of high-school Spanish. Course completed with a passing grade fulfills the LAS World Language Requirement. (Typically Offered: Fall, Spring). (Typically Offered: Fall, Spring)

SPAN 2010: Intermediate Spanish I

Credits: 4. Contact Hours: Lecture 4.

Prereq: SPAN 1020 or placement by departmental exam

Intensive review of basic grammar and conversation. For students whose native language is not Spanish. Practice in oral and written communication. Development of fluency with idiomatic expressions. Selected readings on culture and literature. Meets International Perspectives Requirement. (Typically Offered: Fall)

SPAN 2020: Intermediate Spanish II

Credits: 4. Contact Hours: Lecture 4.

Prereq: SPAN 2010 or placement by departmental exam

Continuation of Spanish 2010. Intensive review of basic grammar. Practice in oral and written communication. Development of fluency with idiomatic expressions. Selected readings on culture and literature. For students whose native language is not Spanish. (Typically Offered: Spring)

SPAN 2950: Study Abroad

Credits: 3. Contact Hours: Lecture 3.

Prereq: SPAN 1020

Supervised instruction in Spanish and Hispanic culture; formal class instruction at level appropriate to student's training, augmented by practical living experience. Taught in Spanish. Consult the department regarding equivalency with SPAN 2010 or 2020. Meets International Perspectives Requirement. (Typically Offered: Summer)

SPAN 2970: Intensive Intermediate Spanish

Credits: 4. Contact Hours: Lecture 4.

Prereq: SPAN 2010 or placement by departmental exam

Bridge course between 2000- and 3000-level Spanish courses that focuses on application of advanced grammatical concepts within the context of Hispanic culture. Accelerated review of SPAN 2010 and SPAN 2020 designed for students who want to continue at the 3000 level. Taught in Spanish for students whose native language is not Spanish. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

SPAN 3020A: Mini-Modules for Global Professionals: Tourism and Hospitality

Credits: 1.

Prereq: SPAN 2020 or SPAN 2970 or placement by departmental exam

Introduction to professional communication within specific professional cultures with strong preparation of relevant vocabulary related to professional fields in which high degrees of Spanish are spoken. Taught in Spanish. Each topic may only be taken once for credit. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

SPAN 3020B: Mini-Modules for Global Professionals: Health and Medicine

Credits: 1.

Prereq: SPAN 2020 or SPAN 2970 or placement by departmental exam

Introduction to professional communication within specific professional cultures with strong preparation of relevant vocabulary related to professional fields in which high degrees of Spanish are spoken. Taught in Spanish. Each topic may only be taken once for credit. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

SPAN 3020C: Mini-Modules for Global Professionals: Criminal Justice and the Law

Credits: 1.

Prereq: SPAN 2020 or SPAN 2970 or placement by departmental exam

Introduction to professional communication within specific professional cultures with strong preparation of relevant vocabulary related to professional fields in which high degrees of Spanish are spoken. Taught in Spanish. Each topic may only be taken once for credit. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

SPAN 3030A: Spanish Conversation and Composition: through Culture

Credits: 3. Contact Hours: Lecture 3.

Prereq: SPAN 2020 or SPAN 2970 or placement by departmental exam

Intensive oral practice and improvement of oral proficiency. Application of specific grammatical concepts for development of conversational and writing skills within the context of Hispanic culture. Taught in Spanish. For students whose native language is not Spanish. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

SPAN 3030B: Spanish Conversation and Composition: for Professionals

Credits: 3. Contact Hours: Lecture 3.

Prereq: SPAN 2020 or SPAN 2970 or placement by departmental exam

Intensive oral practice and improvement of oral proficiency. Application of specific grammatical concepts for development of conversational and writing skills within the context of Hispanic culture. Taught in Spanish. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

SPAN 3040: Spanish for Global Professionals

Credits: 3. Contact Hours: Lecture 3.

Prereq: SPAN 2020 or placement by departmental exam

Introduction to professional vocabulary and communication within cultural contexts of the Spanish-speaking world. Taught in Spanish. SPAN 3030B recommended. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

SPAN 3050: Spanish for Heritage Speakers

(Cross-listed with USLS 3050).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Instructor Permission for Course

Intensive study and application of grammar concepts in the development of writing and reading skills in a dynamic cultural context centered on Hispanics in the U.S. Designed for native or heritage Spanish speakers with oral proficiency in Spanish but with little or no formal academic training in the language. Taught exclusively in Spanish. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Spring)

SPAN 3060X: Spanish for Medical and Health Professions

Credits: 3. Contact Hours: Lecture 3.

Prereq: SPAN 2020 or SPAN 2970 or placement by departmental exam

SPAN 3060 is intended to meet the needs of students who plan to work in a medical and health related professional environment. This course is designed to provide students with a comprehensive understanding of medical terminology and cultural competency in healthcare settings. Through a combination of lectures, interactive exercises, and simulated real-world scenarios, students will develop the language skills necessary to communicate effectively with patients, colleagues, and other healthcare professionals. Taught in Spanish. (Typically Offered: Fall, Spring)

SPAN 3140: Textual and Media Analyses

Credits: 3. Contact Hours: Lecture 3.

Prereq: SPAN 3030A or 3030B

Critical reading of Hispanic cultural texts. Presentation of techniques and terminology of textual criticism. Study of basic genres and media-generated artifacts and literary texts. Taught in Spanish. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

SPAN 3210: Spanish Civilization

Credits: 3. Contact Hours: Lecture 3.

Prereq: 1 SPAN course at the 3000 level

A survey of the social, political, religious, and cultural history of Spain. Taught in Spanish. Meets International Perspectives Requirement.

SPAN 3220: Latin American Civilization

Credits: 3. Contact Hours: Lecture 3.

Prereq: 1 SPAN course at the 3000 level

A survey of the social, political, religious, and cultural history of Spanish America. Taught in Spanish. Meets International Perspectives Requirement.

SPAN 3230: Spain Today

Credits: 3. Contact Hours: Lecture 3.

Prereq: 1 SPAN course at the 3000 level

A survey of social, political, economic, and cultural topics relevant to contemporary Spain. Taught in Spanish. Meets International Perspectives Requirement.

SPAN 3240: Latin America Today

Credits: 3. Contact Hours: Lecture 3.

Prereq: 1 SPAN course at the 3000 level

A survey of social, political, economic, and cultural topics relevant to contemporary Latin America. Taught in Spanish. Meets International Perspectives Requirement.

SPAN 3250: Culture and Community: Iowa and Midwest Latino/as

(Cross-listed with USLS 3250).

Credits: 3. Contact Hours: Lecture 3.

Prereq: USLS 2110

Analysis and discussion of interdisciplinary texts examining the local and regional Latino/a immigration experience. Exploring Latino/a culture through participation in a community project. Assessed service learning component. (Typically Offered: Spring)

SPAN 3260: Studies in Hispanic Art or Film

(Dual-listed with SPAN 5260).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 1 SPAN course at the 3000 level

Survey of major currents and figures in Spanish and Latin American art and/or film. Taught in Spanish. Meets International Perspectives Requirement.

SPAN 3270: Valencia Through the Centuries

Credits: 3. Contact Hours: Lecture 3.

Prereq: 1 SPAN course at the 3000 level

Exploration of the history and culture of Valencia, Spain and an understanding of its geography, history, politics, people, festivals and pastimes, art, architecture, literature, media and other important areas; insight into various cultural and historical aspects that distinguish Valencia, Spain, from other parts of Spain. (Typically Offered: Summer)

SPAN 3300: Studies in Spanish Literature

Credits: 3. Contact Hours: Lecture 3.

Prereq: SPAN 3140

Introduction to Spanish literature and techniques of literary criticism from the earliest times through the present. Lectures, discussion, and analysis of individual selections in Spanish. Taught in Spanish. Meets International Perspectives Requirement.

SPAN 3320: Studies in Latin American Literature

Credits: 3. Contact Hours: Lecture 3.

Prereq: SPAN 3140

Introduction to Latin American literature and techniques of literary criticism from the earliest times through the present. Lectures, discussion, and analysis of individual selections in Spanish. Taught in Spanish. Meets International Perspectives Requirement.

SPAN 3510: Introduction to Spanish-English Translation

(Cross-listed with LING 3510/ USLS 3510).

Credits: 3. Contact Hours: Lecture 3.

Prereq: SPAN 3030A or SPAN 3030B or SPAN 3040 or SPAN 3050

Introduction to the theory, methods, techniques, and problems of translation. Consideration of material from business, literature, and the social sciences. Taught in Spanish. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

SPAN 3520: Spanish Pronunciation

(Cross-listed with LING 3520).

Credits: 3. Contact Hours: Lecture 3.

Prereq: SPAN 3030A or SPAN 3030B or SPAN 3040 or SPAN 3050

An introductory study of the articulation, classification, distribution, and regional variations of the sounds of the Spanish language. Taught in Spanish. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

SPAN 3540: Introduction to Spanish-English Interpretation

(Dual-listed with SPAN 5540/ LING 5540). (Cross-listed with LING 3540).

Credits: 3. Contact Hours: Lecture 3.

Prereq: SPAN 3510

Introduction to the theory, methods, techniques, and problems of consecutive and simultaneous interpretation. Consideration of material from business, agriculture, law, design, medicine, literature, advertisement, and sports. Taught in Spanish. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

SPAN 3700A: Hispanic Topics in English Translation: Agriculture

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Topics vary according to faculty interest. Knowledge and understanding of major cultural, ethical, sociopolitical and economic issues directly related to agriculture and agribusiness in Latin America, Spain, and/or Equatorial Guinea. Readings, discussions, and papers in English. May not be counted as a prerequisite.

SPAN 3700S: Studies in English Translation: Hispanic Topics on Women or Feminism

(Cross-listed with WGS 3700S).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Topics vary according to faculty interest. Author, genre or period study, women writers, cinema, or contemporary theory. Readings, discussions, and papers in English. May not be counted as a prerequisite. Meets International Perspectives Requirement.

SPAN 3770: Latina/o/x Life Stories: Memoirs and Oral History

(Cross-listed with ENGL 3770/ USLS 3770).

Credits: 3. Contact Hours: Lecture 3.

Prereq: USLS 2110 or ENGL 2500

Study and archive Latinx life stories through traditional coursework, digital humanities and community outreach with local schools. Analysis of the extensive realities of Latinx communities in Iowa through the study, writing, tutorial work, and production of memoirs and oral histories.

SPAN 3780: Hispanic Film Studies in English

Credits: 3. Contact Hours: Lecture 3.

Analysis and interpretation of cinema in the Spanish-speaking world.

Topics vary and may include, but are not limited to, film directors, genres, movements, historical survey, aesthetics, and cinematography.

Readings, discussions, and papers in English. Does not count towards Spanish major or minor requirements. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

SPAN 3950: Study Abroad

Credits: 1-10. Contact Hours: Lecture 10.

Repeatable.

Prereq: 12 credits in SPAN

Supervised instruction in Spanish and Hispanic culture; formal class instruction at level appropriate to students' training, enhanced by practical living experience. Meets International Perspectives Requirement.

SPAN 4010: Advanced Composition and Grammar

(Dual-listed with SPAN 5010).

Credits: 3. Contact Hours: Lecture 3.

Prereq: SPAN 3140 and one course at the 3200-level or above

Advanced study of Spanish grammar and syntax. Students' writing of compositions incorporates an advanced understanding of grammar, syntax, and principles of organization of thought and ideas. Taught in Spanish. Meets International Perspectives Requirement. (Typically Offered: Fall)

SPAN 4400: Seminar on the Literatures and Cultures of Spain

(Dual-listed with SPAN 5400).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: SPAN 3300 or SPAN 3320

Discussion and analysis of selected topics in Spanish literature and culture from the Middle Ages to the Present. Taught in Spanish. SPAN 3300 recommended. Meets International Perspectives Requirement.

SPAN 4410: Seminar on Cervantes and the Golden Age

(Dual-listed with SPAN 5410).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: SPAN 3300 or SPAN 3320

Discussion and analysis of selected works of Cervantes within the social and cultural context of the Golden Age. Taught in Spanish. SPAN 3300 recommended. Meets International Perspectives Requirement.

SPAN 4450: Seminar on the Literatures and Cultures of Latin America

(Dual-listed with SPAN 5450).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: SPAN 3300 or SPAN 3320

Discussion and analysis of selected topics in Latin American literature and culture from Pre-Colonial times to the Present. Taught in Spanish. SPAN 3320 recommended. Meets International Perspectives Requirement.

SPAN 4620: Contrastive Analysis of Spanish/ English for Translators

(Cross-listed with LING 4620).

Credits: 3. Contact Hours: Lecture 3.

Prereq: SPAN 3510

Linguistic study of the major differences between the Spanish and English grammatical systems and their applications in the translation of Spanish to English. Taught in Spanish.

SPAN 4630: Contemporary Spanish Linguistics

(Dual-listed with SPAN 5630/ LING 5630). (Cross-listed with LING 4630).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: SPAN 3520

Study of various topics related to the Spanish language. Topics may include bilingualism, historical linguistics and dialectology, Spanish in the U.S., language assessment, computer-assisted language learning and instruction, and second language acquisition. Taught in Spanish. Meets International Perspectives Requirement.

SPAN 4900: Independent Study

Credits: 1-6. Repeatable, maximum of 6 credits.

Prereq: 6 credits in Spanish and permission of department chair

Designed to meet the needs of students in areas other than those in which courses are offered, or who desire to integrate a study of literature or language with special problems in major fields. Graduation Restriction: No more than 6 credits in SPAN 4900 may be counted toward graduation.

SPAN 4990: Internship in Spanish

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: 9 credits in SPAN at the 3000-level; Permission of Advisor and WLC Internship Coordinator

Work experience using Spanish language skills in the public or private sector, combined with academic work under faculty supervision.

Graduation Restriction: Up to 3 credits may apply toward the major.

Available only to majors and minors. (Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

SPAN 5010: Advanced Composition and Grammar

(Dual-listed with SPAN 4010).

Credits: 3. Contact Hours: Lecture 3.

Prereq: SPAN 3140 and one course at the 3200-level or above

Advanced study of Spanish grammar and syntax. Students' writing of compositions incorporates an advanced understanding of grammar, syntax, and principles of organization of thought and ideas. Taught in Spanish.

SPAN 5260: Studies in Hispanic Art or Film

(Dual-listed with SPAN 3260).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 1 SPAN course at the 3000 level

Survey of major currents and figures in Spanish and Latin American art and/or film. Taught in Spanish. Meets International Perspectives Requirement.

SPAN 5400: Seminar on the Literatures and Cultures of Spain

(Dual-listed with SPAN 4400).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: Graduate Standing or Permission of Instructor

Discussion and analysis of selected topics in Spanish literature and culture from the Middle Ages to the Present. Taught in Spanish. SPAN 3300 recommended.

SPAN 5410: Seminar on Cervantes and the Golden Age

(Dual-listed with SPAN 4410).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: Graduate Standing or Permission of Instructor

Discussion and analysis of selected works of Cervantes within the social and cultural context of the Golden Age. Taught in Spanish. SPAN 3300 recommended.

SPAN 5450: Seminar on the Literatures and Cultures of Latin America

(Dual-listed with SPAN 4450).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: Graduate Standing or Permission of Instructor

Discussion and analysis of selected topics in Latin American literature and culture from Pre-Colonial times to the Present. Taught in Spanish. SPAN 3320 recommended.

SPAN 5540: Introduction to Spanish-English Interpretation

(Dual-listed with SPAN 3540/ LING 3540). (Cross-listed with LING 5540).

Credits: 3. Contact Hours: Lecture 3.

Prereq: SPAN 3510

Introduction to the theory, methods, techniques, and problems of consecutive and simultaneous interpretation. Consideration of material from business, agriculture, law, design, medicine, literature, advertisement, and sports. Taught in Spanish. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

SPAN 5630: Contemporary Spanish Linguistics

(Dual-listed with SPAN 4630/ LING 4630). (Cross-listed with LING 5630).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: SPAN 3520

Study of various topics related to the Spanish language. Topics may include bilingualism, historical linguistics and dialectology, Spanish in the U.S., language assessment, computer-assisted language learning and instruction, and second language acquisition. Taught in Spanish.

SPAN 5900A: Special Topics in Spanish: Literature or Literary Criticism

Credits: 1-4. Repeatable.

Prereq: Permission of Instructor; 6 credits of 4000 level Spanish

SPAN 5900B: Special Topics in Spanish: Linguistics

Credits: 1-4. Repeatable.

Prereq: Permission of Instructor; 6 credits of 4000 level Spanish

SPAN 5900C: Special Topics in Spanish: Language Pedagogy

Credits: 1-4. Repeatable.

Prereq: Permission of Instructor; 6 credits of 4000 level Spanish

SPAN 5900D: Special Topics in Spanish: Civilization

Credits: 1-4. Repeatable.

Prereq: Permission of Instructor; 6 credits of 4000 level Spanish

Special Education (SPED)

Courses primarily for undergraduates:

SPED 2100X: Disability in a Diverse Society

Credits: 3.

Disability does not discriminate on the basis of gender, ethnicity, SES, religion, or sexual preferences. Disability is the only group anyone can join at any time. This course is designed to increase awareness, sensitivity, and understanding of the individual, social-cultural, policies, and legal aspects of disability in our society. During the course, students will explore and analyze personal, historical, political, economic, and societal perspectives on individuals with disabilities in our society. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall, Spring, Summer)

SPED 2500: Education of the Exceptional Learner

Credits: 3. Contact Hours: Lecture 3.

An overview of students with diverse learning needs, including students with disabilities, English Learners, students who are at risk, and gifted learners. Emphasis is on early identification; educational programming and implications; and legal foundations. Includes Individual Education Programs, Least Restrictive Environment, Functional Behavioral Assessment, and Behavior Intervention Plans. (Typically Offered: Fall, Spring)

SPED 3300: Introduction to Instruction for Students with Mild/Moderate Disabilities

Credits: 3. Contact Hours: Lecture 3.

Educational services and programming for students with mild/moderate disabilities examined from an historical perspective. Current trends, issues, impact of federal and state laws, and identification procedures. Characteristics of students with mild/moderate disabilities. (Typically Offered: Fall)

SPED 3340: Teaching Exceptional Learners in the General Classroom

Credits: 3. Contact Hours: Lecture 3.

Evidence-based strategies for inclusive education. Emphasis on principles of behavior, classroom management, differentiation, and accommodations. (Typically Offered: Fall)

SPED 3650: Classroom Assessment for Special Education

Credits: 3. Contact Hours: Lecture 3.

Prereq: Admitted to the Educator Preparation Program

Formal and informal academic and behavioral assessment.

Determination of special education needs. Planning, adaptation, and formative evaluation of instructional programs for students with mild/moderate disabilities. (Typically Offered: Fall, Spring)

SPED 4010: Teaching Secondary Students with Exceptionalities in General Education

Credits: 3. Contact Hours: Lecture 3.

Prereq: Admitted to the Educator Preparation Program

Characteristics and needs of youth with exceptionalities, including appropriate service delivery options. Emphasis on legal foundations, co-teaching models, differentiated instruction, accommodations for instruction and assessment, strategies to address challenging behaviors, and collaboration among professionals and families. Includes Individual Education Programs, Least Restrictive Environment, Functional Behavioral Assessment, and Behavior Intervention Plans. (Typically Offered: Fall, Spring)

SPED 4050: Assessment and Instructional Methods in Inclusive Primary Settings (K-3)

Credits: 4. Contact Hours: Lecture 4.

Examination and application of strategies to determine specialeducational needs, planning and evaluating instructional programs, and monitoring student progress. Evidence-based instructional strategies in academic and social areas that support learning of students with diverse learning needs. Emphasis on accommodations and alternative teaching strategies to meet individual student needs. (Typically Offered: Fall, Spring)

SPED 4160: Supervised Student Teaching

Credits: 1-30. Repeatable.

Prereq: Admitted to the Educator Preparation Program

Reservation required. (Typically Offered: Fall, Spring)

SPED 4360: Instructional Methods for Students with Mild/Moderate Disabilities

Credits: 3. Contact Hours: Lecture 3.

Evidence-based instructional strategies in academic areas, as well as class, group, and individual behavior management for elementary students with mild/moderate disabilities. (Typically Offered: Spring)

SPED 4580: Pre-Student Teaching Experience III: Mild/Moderate Disabilities in Primary Grades (K-3)

Credits: 1. Contact Hours: Laboratory 2.

Prereq: Admitted to the Educator Preparation Program

Observation and involvement with students with mild/moderate disabilities in the primary grades (K-3). Concurrent enrollment in SPED 4050. Half a day of time needed. Clinical Experience Level 3. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

SPED 4590: Pre-Student Teaching Experience III: Mild/Moderate Disabilities

Credits: 1.

Prereq: Admitted to the Educator Preparation Program

Observation and involvement with students with mild/moderate disabilities in school settings. Concurrent enrollment in SPED 4600. 1/2 day of time needed. Clinical Experience Level 3. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

SPED 4600: Special Education Seminar

Credits: 1. Contact Hours: Lecture 1.

Prereq: SPED 4360, concurrent enrollment in SPED 4590

Application of evidence-based instructional strategies/techniques in academic and behavioral areas with students who have mild/moderate disabilities. Discussion of professional practices. (Typically Offered: Fall, Spring, Summer)

SPED 4640: Collaborative Partnerships in Special Education

Credits: 3. Contact Hours: Lecture 3.

Prereq: SPED 3650 and SPED 4360

Collaborative skills used in education of students with mild/moderate disabilities. Includes collaboration between general and special education teachers, families, para-educators, and other education professionals and agencies. Development of Individual Education Programs for students with mild/moderate disabilities. (Typically Offered: Fall)

SPED 4900: Independent Study

Credits: 1-5. Repeatable.

Prereq: Instructor Permission for Course

Topics vary. (Typically Offered: Fall, Spring)

Courses primarily for graduate students, open to qualified undergraduates:

SPED 5010: Teaching Secondary Students with Exceptionalities in General Education

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Characteristics and needs of exceptional children/youth, including appropriate service delivery options. Emphasis on legal foundations, co-teaching models, differentiated instruction, accommodations for instruction and assessment, and collaboration among professionals and parents. Includes Individual Education Programs, Least Restrictive Environment, Functional Behavioral Assessment, and Behavior Intervention Plans. (Typically Offered: Summer)

SPED 5100: Foundations in Mild/Moderate Disabilities

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Historical and legal foundations for special education. Characteristics, prevalence, and etiology of mild/moderate disabilities. Historical and contemporary models of programming for students with disabilities. (Typically Offered: Spring)

SPED 5110: Foundations of Behavior Disorders and Learning Disabilities

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Theory, characteristics, and special education service delivery models to students with moderate/severe behavior/learning disabilities in the public schools and residential settings. (Typically Offered: Spring)

SPED 5150: Assessment of Children and Youth with Disabilities

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Formal and informal methods of assessment for identification/eligibility and progress monitoring. Formative evaluation of academic and behavioral skills, including curriculum-based measurement and functional behavioral assessment. (Typically Offered: Fall)

SPED 5170: Research Review

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Critical review of recent research in education and related behavioral sciences as applied to education of students with disabilities. Examination of multiple research methodologies. (Typically Offered: Summer)

SPED 5200: Evidence-based Practices for Mild/Moderate Disabilities

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Evidence-based strategies for meeting the academic and behavioral needs of students with mild/moderate disabilities, including instructional and behavior management strategies appropriate for students with mild or moderate disabilities. (Typically Offered: Fall, Spring, Summer)

SPED 5300: Evidence-based Practices in Behavior Disorders

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Current research on evidence-based interventions designed to improve the behavior and social skills of students with moderate/severe behavior disorders. Particular emphasis on positive behavioral supports and behavior change strategies. (Typically Offered: Spring)

SPED 5400: Evidence-based Practices in Learning Disabilities

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Current research on evidence-based interventions designed to improve the academic performance of students with moderate/severe learning disabilities. Particular emphasis on methods for improving reading, written expression, and mathematics, as well as performance in content-area instruction. (Typically Offered: Spring)

SPED 5530: Teaching Adolescent Readers with Reading Difficulties

(Cross-listed with EDUC 5530).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Instructional strategies for enhancing the fluency, vocabulary and comprehension of adolescents with reading difficulties. Attention to content-area reading materials and strategies. (Typically Offered: Fall, Spring)

SPED 5550: Career Education and Transition for Youth with Disabilities

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Examination of the academic, personal, social, employability, and daily living skills. Exploration of assessments, curricula, programs, and services to meet these needs. (Typically Offered: Summer)

SPED 5600: Classroom Management/Behavior Support

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Emphasis on positive behavioral supports and understanding behavior and its context through a functional behavioral approach. Design and development of carefully planned behavioral intervention programs for groups and individual students in general and special education settings. (Typically Offered: Fall)

SPED 5640: Collaborative Consultation

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Characteristics and methods to promote effective collaboration and/or consultation with families, paraprofessionals, other school personnel, and representatives of other agencies. Role of consultants/collaborators in various settings. Includes specific attention to IEP development as a collaborative process. (Typically Offered: Fall)

SPED 5670: Teaching Secondary Learners with Mathematics Difficulties
(Cross-listed with EDUC 5670).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Instructional methods and assessment techniques for secondary students struggling to learn mathematics. Particular emphasis on current research, practices, and trends in mathematics interventions for at-risk students and students with disabilities.

SPED 5700: Systems-level Supports for Youth with Behavior and Learning Disabilities

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Overview of support systems (education, juvenile justice, mental health, communities) that serve students with special education needs. Identify resources to work with and support families. (Typically Offered: Summer)

SPED 5900: Special Topics

Credits: 1-5. Repeatable.

Prereq: Instructor Permission for Course

Topics vary. (Typically Offered: Fall, Spring)

SPED 5910G: Supervised Field Experience: Mild/Moderate Disabilities, K-8

Credits: 1-6. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Supervised on-the-job field experience in special areas. (Typically Offered: Fall, Spring, Summer)

SPED 5910H: Supervised Field Experience: Mild/Moderate Disabilities, 5-12

Credits: 1-6. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Supervised on-the-job field experience in special areas. (Typically Offered: Fall, Spring, Summer)

SPED 5910K: Supervised Field Experience: Behavior Disorders/Learning Disabilities, Ages 5-21

Credits: 1-6. Repeatable.

Prereq: Instructor Permission for Course

Supervised on-the-job field experience in special areas. (Typically Offered: Fall, Spring, Summer)

SPED 5910L: Supervised Field Experience: Special Education, Non-licensure

Credits: 1-6. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Supervised on-the-job field experience in special areas. (Typically Offered: Fall, Spring, Summer)

SPED 5990: Creative Component

Credits: 1-5. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

Courses for graduate students:

SPED 6150: Seminar

Credits: 1. Contact Hours: Lecture 1.

Repeatable, maximum of 2 credits.

Selected topics in special education. Analysis of current special education research. Evaluation of impact upon the profession.

Implications for additional research.

SPED 6900: Advanced Special Topics

Credits: 1-5. Contact Hours: Lecture 5.

Repeatable, maximum of 4 times.

Guided reading and/or study on special topics of an advanced nature.

(Typically Offered: Spring, Summer)

SPED 6990: Research

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Speech Communication (SPCM)

Courses primarily for undergraduates:

SPCM 1100: Listening

Credits: 3. Contact Hours: Lecture 3.

Theory, principles, and competency development in comprehensive, therapeutic, critical, consumer, and appreciative listening. The impact of listening in relationships and partnerships. (Typically Offered: Fall, Spring)

SPCM 2120: Fundamentals of Public Speaking

Credits: 3. Contact Hours: Lecture 3.

Prereq: [(Score of 2+ on EPT for ENGL 0990S OR Credit in ENGL 0990S) AND (Membership in EPT Advisory Group)] OR [No Membership in EPT Advisory Group]

Theory and practice of basic speech communication principles applied to public speaking. Practice in the preparation and delivery of extemporaneous speeches. (Typically Offered: Fall, Spring, Summer)

SPCM 2160: America Speaks: Great Speakers and Speeches in US History

Credits: 3. Contact Hours: Lecture 3.

Survey of great speeches examined within their political and cultural contexts. Analysis of the rhetorical strategies of diverse speakers with an emphasis on texts from social movements in the United States. Meets U.S. Cultures and Communities Requirement.

SPCM 2750: Analysis of Popular Culture Texts

(Cross-listed with ENGL 2750).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or concurrent enrollment in ENGL 2500

Analysis of how information and entertainment forms persuade and manipulate audiences. Study of several forms that may include newspapers, speeches, television, film, advertising, fiction, and magazines. Special attention to verbal and visual devices. (Typically Offered: Fall, Spring)

SPCM 2900: Special Projects

Credits: 1-2. Repeatable, maximum of 4 credits.

Prereq: 3 credits in SPCM; Department Permission

(Typically Offered: Fall, Spring, Summer)

SPCM 3100: Rhetorical Analysis

(Cross-listed with ENGL 3100).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500

Fundamental principles of rhetorical criticism. Focus on selected theories for analyzing cultural texts, including essays, speeches, film, technical and scientific documents, and websites. Emphasis on identifying artifacts, formulating research questions, applying methodologies, and understanding and practicing critical analysis through discussion and in writing. (Typically Offered: Fall, Spring)

SPCM 3120: Business and Professional Speaking

Credits: 3. Contact Hours: Lecture 3.

Theory, principles, and competency development in the creation of coherent, articulate business and professional oral presentations. SPCM 2120 or prior public speaking experience recommended. (Typically Offered: Fall, Spring)

SPCM 3230: Gender and Communication

(Cross-listed with WGS 3230).

Credits: 3. Contact Hours: Lecture 3.

Examination of how understanding and enactment of gender identity is shaped by communication. Verbal and nonverbal communication across various contexts including personal relationships and the media. Explores discourse of social movements aiming to transform cultural definitions of gender. Meets U.S. Cultures and Communities Requirement.

SPCM 3240: Legal Communication

Credits: 3. Contact Hours: Lecture 3.

Prereq: SPCM 2120

Speech communication in the legal system inside and outside the trial process: interviewing and counseling, negotiating and bargaining, voir dire, opening statements, examination of witnesses, closing arguments, judge's instructions, jury behavior, and appellate advocacy.

SPCM 3500: Rhetorical Traditions

(Cross-listed with CLST 3500/ ENGL 3500).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500

Ideas about the relationship between rhetoric and society in contemporary and historical contexts. An exploration of classical and contemporary rhetorical theories in relation to selected topics that may include politics, gender, race, ethics, education, science, or technology. (Typically Offered: Spring)

SPCM 4170: Campaign Rhetoric

(Cross-listed with POLS 4170).

Credits: 3. Contact Hours: Lecture 3.

Prereq: SPCM 2120

Backgrounds of candidates for state and national elections; selected speeches and issues; persuasive strategies and techniques of individual speakers. Offered even-numbered years. (Typically Offered: Fall)

SPCM 4180: Seminar in Rhetoric and Writing

(Cross-listed with ENGL 4180).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 3100/SPCM 3100 and Junior classification

Intensive study of a selected topic that bridges theory and practice in rhetoric, writing studies, and related fields. Topics may include argumentation, public memory, rhetorical genre, critical/cultural rhetorics, and other topics. (Typically Offered: Spring)

SPCM 4900: Independent Study

Credits: 1-3. Repeatable, maximum of 9 credits.

Prereq: 18 credits in SPCM; Junior classification; Department Permission

Only one independent study enrollment is permitted within the department per semester. (Typically Offered: Fall, Spring, Summer)

SPCM 4950B: Independent Study: Teaching Speech

(Cross-listed with EDUC 4950B).

Credits: 3. Contact Hours: Lecture 3.

Problems, methods, and materials related to teaching speech, theatre, and media in secondary schools. (Typically Offered: Fall)

Courses primarily for graduate students, open to qualified undergraduates:

SPCM 5130: Teaching Fundamentals of Public Speaking

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to the teaching of public speaking. Exploration of pedagogical theory and methods related to SPCM 2120 objectives, pedagogical approaches, lesson planning, assignment development, and evaluation of student projects. Required of all new teaching assistants teaching SPCM 2120. (Typically Offered: Fall)

SPCM 5400: Drama

(Cross-listed with ENGL 5400).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: Graduate Standing or Permission of Instructor

Primary texts in dramatic genres from various literary periods, in critical and cultural contexts. Frequently concentrates on the English Renaissance and the Shakespearean stage.

SPCM 5470: The History of Rhetorical Theory from the Classical Era to the Present

(Cross-listed with ENGL 5470).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Rhetorical theory from the classical period of ancient Greece through to the 20th century; attention to rhetoric's relation to the nature of knowledge, communication, practice, and pedagogy.

SPCM 5480: Cultural and Critical Theories of Communication and Rhetoric

(Cross-listed with ENGL 5480).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Contemporary theories that address the production, reception, and critical evaluation of cultural artifacts and communicative events; these theories address power, ideology, and the norms of public discourse. Theories covered may include Postmodernism, Feminist Theory, Public Sphere Theory, as well as Critical Race Theory, Social Justice Theory, Disability Theory, Queer Theory, and/or Intercultural Theories of Communication and Rhetoric.

SPCM 5490: Multimedia and Interaction Design

(Cross-listed with ENGL 5490).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Rhetorical principles of interactive multimedia design, such as those in streaming multimedia as part of workplace documents. Practical understanding of the computer applications used in interactive multimedia development. Focus on theoretical and practical elements of producing multimedia for training in both education and industry. Work with interactive hypertext, digital audio, and nonlinear video editing.

SPCM 5900: Special Topics

Credits: 1-4. Repeatable, maximum of 12 credits.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

SPCM 5920A: Core Studies: Rhetoric

(Cross-listed with ENGL 5920A).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Prereq: Graduate Standing or Permission of Instructor

Seminar on topics central to the fields of rhetoric and professional communication or composition. (Typically Offered: Fall, Spring, Summer)

SPCM 5920B: Core Studies: Composition

(Cross-listed with ENGL 5920B).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Prereq: Graduate Standing or Permission of Instructor

Seminar on topics central to the fields of rhetoric and professional communication or composition. (Typically Offered: Fall, Spring, Summer)

SPCM 5920C: Core Studies: Professional Communication

(Cross-listed with ENGL 5920C).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Prereq: Graduate Standing or Permission of Instructor

Seminar on topics central to the fields of rhetoric and professional communication or composition. (Typically Offered: Fall, Spring, Summer)

Courses for graduate students:

SPCM 6110: Seminar in Rhetorical Theory

(Cross-listed with ENGL 6110).

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Rhetorical theory, criticism, and/or practice in relation to a historical period or a particular theoretical issue.

Sports Media and Communication (SMC)

Courses primarily for undergraduates:

SMC 2500: Principles of Sports Media and Communication

Credits: 3. Contact Hours: Lecture 3.

Exploration of the essential principles behind the interaction of sports and media communication. Students will understand the processes that shape how sports are portrayed, promoted, and analyzed in the media, increase their awareness of decision-making strategies within the industry, and engage in opportunities to apply theoretical concepts to practical scenarios surrounding sports media content. (Typically Offered: Fall, Spring)

SMC 3040: Sportswriting and Announcing

Credits: 3.

Prereq: JLMC 1100 and Minimum of C+ in JLMC 2010

Hands-on experiences develop skills needed to write various forms of sports journalism and to provide play-by-play and color commentating duties for radio and TV sports broadcasts. Reviews history of sports media and its development from the early days of print sports coverage and radio broadcasting to modern multimedia sports coverage, including social media and podcasting. (Typically Offered: Fall, Spring)

SMC 3510: Strategic Sports Communication

Credits: 3.

Prereq: JLMC 1100 and Minimum of C+ in JLMC 2010

Students create strategic brand-compliant written, creative and digital content to advocate on behalf of a specific sports team, conference or organization. Communications include game notes, game recaps, social media campaigns and feature stories. Media relations, website management, graphic design, statistics, video production, photography, crisis management and game-day operations will also be addressed. (Typically Offered: Fall, Spring)

SMC 3520: Sports Broadcast Production

Credits: 3.

Prereq: SMC 3040

Analysis and understanding of the processes and procedures in sports broadcast production. Students will explore the basics of creating engaging sports broadcasts for different platforms, with equal emphasis on established techniques and emerging trends. (Typically Offered: Fall, Spring)

SMC 3530: News Coverage of Sports Industries

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: SMC 3040

Reporting and writing about economic, regulatory and topical issues that shape and affect recreational, amateur and professional sports at the local, national and international levels. Developing stories for appropriate platforms. Issues may include those related to financial models, health and equity, including organizational, athlete and fan experiences. (Typically Offered: Fall, Spring)

SMC 3900: Professional Skills Development

(Cross-listed with ADVRT 3900/ PR 3900/ JLMC 3900).

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: (Minimum of C+ in JLMC 2010; JLMC major or ADVRT major or PR major or SMC major)

Check with Greenlee School for course availability. No More Than 3 Credits In JLMC/ADVRT/PR 3900 May Be Applied Toward Major Requirements For Graduation. (Typically Offered: Fall, Spring)

SMC 3910: Short Course Intensive

(Cross-listed with ADVRT 3910/ PR 3910/ JLMC 3910).

Credits: 1. Contact Hours: Lecture 1.

Repeatable, maximum of 6 credits.

Focused short courses on timely concepts. Check with Greenlee School for course availability. Offered on a satisfactory-fail basis only.

SMC 4230: Sports and the Media in a 24/7 Digital World

Credits: 3. Contact Hours: Lecture 3.

Exploration of how digital technology constantly changes advertising, journalism and public relations practices in the sports media industry. Examination of sociological, political, legal, ethical and technological issues in high school, collegiate, and professional sports. (Typically Offered: Fall, Spring)

SMC 4900: Independent Study in Media and Communication

(Cross-listed with ADVRT 4900/ PR 4900/ JLMC 4900).

Credits: 1-30. Repeatable.

Prereq: Junior or Senior classification; Instructor Permission

Projects during which students may study problems associated with a medium, a professional specialization, a philosophical or practical concern, a reportorial method or writing technique, or a special topic in their field. Credit is not given for working on student or professional media without an accompanying research component. Graduation Restriction: No more than 3 credits of ADVRT/JLMC/PR/SMC 4900 may be used toward a degree in the Greenlee School.

SMC 4910: Sports Fieldwork

Credits: 1-3. Repeatable, maximum of 3 credits.

Prereq: JLMC 2010

Students enrolled in the practicum would complete hands-on and professional-level experience in the sports media and communication field. With pre-approval from the course advisor/instructor, a student can choose to work in collaboration with a range of sports- and/or media-related organizations, dependent on the project's needs and skill set of the student. (Typically Offered: Fall, Spring)

SMC 4950: Senior Integrative Capstone

Credits: 3.

Prereq: SMC 3040 and SMC major

Students synthesize knowledge, ideas, courses and experiences of their undergraduate program with a multidisciplinary, project-based learning approach. During this intensive culmination of their academic work, students explore complex subjects and real-world issues related to the philosophical, sociological, ethical and legal aspects of sports communication. This process enables students to demonstrate research, critical thinking, creative and communication skills needed to prepare for careers in an integrated media environment. (Typically Offered: Fall, Spring)

SMC 4970: Special Topics in Communication

(Cross-listed with JLMC 4970/ PR 4970/ ADVRT 4970).

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: Junior classification

Seminars or one-time classes on topics of relevance to students in communication. See Schedule of Classes for topics.

SMC 4990A: Professional Media Internship: Required

(Cross-listed with ADVRT 4990A/ PR 4990A/ JLMC 4990A).

Credits: 3.

Prereq: ([JLMC major; JLMC 1100; minimum of C+ in JLMC 3020 or JLMC 3030] or [ADVRT major; JLMC 1100; ADVRT 3010 or PR 3010; minimum of C+ in JLMC 2010] or [PR major; JLMC 1100; ADVRT 3010 or PR 3010; minimum of C+ in PR 3210] or [SMC major; minimum of C+ in JLMC 2010; SMC 3040 or SMC 3510]); Advisor Approval

Initial, required internship. A 400-hour (for 3 credits) internship in the student's specialization. Assessment based on employer evaluations, student reports and faculty reviews. Available only to Greenlee School majors. Offered on a satisfactory-fail basis only.

SMC 4990B: Professional Media Internship: Optional

(Cross-listed with ADVRT 4990B/ PR 4990B/ JLMC 4990B).

Credits: 1-3. Repeatable.

Prereq: ([JLMC major; JLMC 1100; minimum of C+ in JLMC 3020 or JLMC 3030] or [ADVRT major; JLMC 1100; ADVRT 3010 or PR 3010; minimum of C+ in JLMC 2010] or [PR major; JLMC 1100; ADVRT 3010 or PR 3010; minimum of C+ in PR 3210] or [SMC major; minimum of C+ in JLMC 2010; SMC 3040 or SMC 3510]); Advisor Approval

Optional internship in the student's specialization. Assessment based on employer evaluations, student reports and faculty reviews. Available only to Greenlee School majors. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

Statistics (STAT)

Courses primarily for undergraduates:

STAT 1010: Principles of Statistics

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Statistical concepts in modern society; descriptive statistics and graphical displays of data; the normal distribution; data collection (sampling and designing experiments); elementary probability; elements of statistical inference; confidence intervals and hypothesis testing; linear regression and correlation; contingency tables. 1 1/2 years of high school algebra required. Graduation Restriction: Credit for only one of the following courses may be applied toward graduation: STAT 1010, STAT 1040, STAT 2010, or STAT 2260. (Typically Offered: Fall, Spring, Summer)

STAT 1040: Introduction to Statistics

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Statistical concepts and their use in science; collecting, organizing and drawing conclusions from data; elementary probability; binomial and normal distributions; regression; confidence intervals and hypothesis testing. For students in the agricultural and biological sciences. 1 1/2 years of high school algebra required. Graduation Restriction: Credit for only one of the following courses may be applied toward graduation: STAT 1010, STAT 1040, STAT 2010, or STAT 2260. (Typically Offered: Fall, Spring, Summer)

STAT 1100: Orientation in Statistics

Credits: 1. Contact Hours: Lecture 1.

Orientation to campus and the statistics major; Information about campus resources and opportunities available to students; Assistance with the transition to University life; Introduction to academic and career planning. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

STAT 2010: Introduction to Statistical Concepts and Methods

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: Credit or Enrollment in MATH 1650

Statistical thinking and applications of statistical concepts and methods in modern society. Display and summary of categorical and numerical data. Exploring relationships between variables, association, correlation, and regression. Observational studies and experiments. Probability concepts, random variables, discrete and continuous distributions. Elements of statistical inference; confidence intervals and hypothesis testing. Graduation Restriction: Credit for only one of the following courses may be applied toward graduation: STAT 1010, STAT 1040, STAT 2010, or STAT 2260. (Typically Offered: Fall)

STAT 2020: Career Development in Math and Statistics

(Cross-listed with MATH 2020).

Credits: 1. Contact Hours: Laboratory 2.

Career development in the mathematics and statistics disciplines with an emphasis on contemporary social issues. Presentations by professionals in STEM fields about occupations, decision-making strategies, and career goal implementation; development of job searching, resume writing, negotiating, and interviewing techniques. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

STAT 2260: Introduction to Business Statistics I

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 1040 or MATH 1500 or MATH 1510 or MATH 1600 or MATH 1650

Obtaining, organizing, and presenting statistical data; measures of location and dispersion; the Normal distribution; sampling and sampling distribution of the sample mean; elements of statistical inference; confidence intervals and hypothesis testing for the mean; describing bivariate relationships and inference for simple linear regression analysis; use of computers to visualize and analyze data. Graduation Restriction: Credit for only one of the following courses may be applied toward graduation: STAT 1010, STAT 1040, STAT 2010, or STAT 2260. (Typically Offered: Fall, Spring, Summer)

STAT 2310: Probability and Statistical Inference for Engineers

Credits: 4. Contact Hours: Lecture 4.

Prereq: Credit or Coenrollment in MATH 2650

Basic probability; random variables and probability distributions; joint and sampling distributions. Descriptive statistics; confidence intervals; hypothesis testing; simple linear regression; multiple linear regression; one-way analysis of variance; use of statistical software. Emphasis on engineering applications. (Typically Offered: Fall, Spring)

STAT 2610X: Statistics in Sports

Credits: 3. Contact Hours: Lecture 3.

Introduction the use of statistical, quantitative, and graphical techniques for analysis of sports data. Focus on understanding the types of data that arise in sports and the probability distributions associated with those data types including binomial, Poisson, and normal. Introduction to regression techniques that incorporate variables that affect these distributions. Discussion of head-to-head competitions and the inherent complexities in analyzing data of this type. (Typically Offered: Fall, Spring, Summer)

STAT 3010: Intermediate Statistical Concepts and Methods

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: One of STAT 1010, 1040, 1050, 2010, 2260, 2310, 3050, 3220, 3300

Statistical concepts and methods used in the analysis of observational data. Analysis of single sample, two sample and paired sample data. Simple and multiple linear regression including polynomial regression and use of indicator variables. Model building and analysis of residuals. Introduction to one-way ANOVA, tests of independence for contingency tables, and logistic regression. Graduation Restriction: Credit for only one of the following courses may be applied toward graduation: STAT 3010, STAT 3260, STAT 5101. (Typically Offered: Fall, Spring)

STAT 3050: Engineering Statistics

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 1650

Statistics for engineering problem solving. Principles of engineering data collection; descriptive statistics; elementary probability distributions; principles of experimentation; confidence intervals and significance tests; one-, two-, and multi-sample studies; regression analysis; use of statistical software. Graduation Restriction: Credit for both STAT 1050 and STAT 3050 may not be applied toward graduation. (Typically Offered: Fall, Spring, Summer)

STAT 3220: Probabilistic Methods for Electrical Engineers

(Cross-listed with EE 3220).

Credits: 3. Contact Hours: Lecture 3.

Prereq: EE 2240

Introduction to probability with applications to electrical engineering. Sets and events, probability space, conditional probability, total probability and Bayes' rule. Discrete and continuous random variables, cumulative distribution function, probability mass and density functions, expectation, moments, moment generating functions, multiple random variables, functions of random variables. Elements of statistics, hypothesis testing, confidence intervals, least squares. Introduction to random processes. (Typically Offered: Fall, Spring)

STAT 3260: Introduction to Business Statistics II

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: STAT 2260

Multiple regression analysis; regression diagnostics; model building; applications in analysis of variance and time series; random variables; distributions; conditional probability; use of computers to visualize and analyze data. Graduation Restriction: Credit for only one of the following courses may be applied toward graduation: STAT 3010, STAT 3260, STAT 5101. (Typically Offered: Fall, Spring, Summer)

STAT 3300: Probability and Statistics for Computer Science

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 1660

Topics from probability and statistics applicable to computer science. Basic probability; Random variables and their distributions; Stochastic processes including Markov chains; Queuing models; Basic statistical inference; Introduction to regression. (Typically Offered: Fall, Spring, Summer)

STAT 3320: Visual Communication of Quantitative Information

(Cross-listed with ENGL 3320).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500; (STAT 1010 or STAT 1040 or STAT 1050 or STAT 2010 or STAT 2310 or STAT 3050 or STAT 3220 or STAT 3300)

Communicating quantitative information using visual displays; visualizing data; interactive and dynamic data displays; evaluating current examples in the media; color, perception, and representation in graphs; interpreting data displays.

STAT 3410: Introduction to the Theory of Probability and Statistics I

(Cross-listed with MATH 3410).

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: MATH 2650 or MATH 2650H

Probability; distribution functions and their properties; classical discrete and continuous distribution functions; multivariate probability distributions and their properties; moment generating functions; transformations of random variables; simulation of random variables and use of the R statistical package. Graduation Restriction: Credit for only one of the following courses may be applied toward graduation: STAT 3410, STAT 3470, STAT 5147. (Typically Offered: Fall, Spring)

STAT 3420: Introduction to the Theory of Probability and Statistics II

(Cross-listed with MATH 3420).

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: (MATH 2070 or MATH 3170); (STAT 1010 or STAT 1040 or STAT 1050 or STAT 2010 or STAT 2260 or STAT 2310 or STAT 3050 or STAT 3220 or STAT 3300); STAT 3410

Sampling distributions; confidence intervals and hypothesis testing; theory of estimation and hypothesis tests; linear model theory; resampling methods; introduction to Bayesian inference; use of the R statistical package for simulation and data analysis. (Typically Offered: Fall, Spring)

STAT 3470: Probability and Statistical Theory for Data Science

Credits: 4. Contact Hours: Lecture 4.

Prereq: (MATH 2070 or MATH 3170); MATH 2650; (STAT 3010 or STAT 3260)

Introduction to probability; distribution functions and their properties; classical discrete and continuous distributions; sampling distributions; theory of estimation; theory of inference; use of R statistical package for simulation and data analysis. Graduation Restriction: Credit for only one of the following courses may be applied toward graduation: STAT 3410, STAT 3470, or STAT 5147. (Typically Offered: Fall)

STAT 3610: Statistical Quality Assurance

(Cross-listed with IE 3610).

Credits: 3. Contact Hours: Lecture 3.

Prereq: STAT 2310, STAT 3010, STAT 3260, or STAT 5870

Statistical methods for process improvement. Simple quality assurance principles and tools. Measurement system precision and accuracy assessment. Control charts. Process capability assessment. Experimental design and analysis for process improvement. Significant external project in process improvement. (Typically Offered: Fall, Spring)

STAT 3980: Cooperative Education

Credits: Required. Repeatable.

Prereq: Department Chair Permission for Course

Off-campus work periods for undergraduate students in a field of statistics. (Typically Offered: Fall, Spring, Summer)

STAT 4212: Experimental Design and Data Analysis

(Dual-listed with STAT 5212).

Credits: 3. Contact Hours: Lecture 3.

Prereq: STAT 3010, STAT 3260, or STAT 5101

The role of statistics in research and the principles of experimental design. Concepts of experimental and observational units, randomization, replication, blocking, subdividing and repeatedly measuring experimental units; factorial treatment designs and confounding; common designs including randomized complete block design, Latin square design, split-plot design, and analysis of data from such common designs; extensions of the analysis of variance to cover variance components. Determining sample size. Graduation Restriction: May not be used for graduate credit in the Statistics MS and PhD degree programs. (Typically Offered: Fall, Spring)

STAT 4215: Time Series Data Analysis

(Dual-listed with STAT 5215).

Credits: 3. Contact Hours: Lecture 3.

Prereq: STAT 3010, STAT 3260, STAT 5101, or STAT 5260

Methods for analyzing data collected over time; review of multiple regression analysis. Elementary forecasting methods: moving averages and exponential smoothing. Autoregressive-moving average (Box-Jenkins) models: identification, estimation, diagnostic checking, and forecasting. Transfer function models and intervention analysis. Introduction to multivariate time series methods. Graduation Restriction: May not be used for graduate credit in the Statistics MS and PhD degree programs. (Typically Offered: Spring)

STAT 4219: Bayesian Data Analysis

(Dual-listed with STAT 5219).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: (STAT 3010, STAT 3260, or STAT 5101); (STAT 3410, STAT 3470, or STAT 5147)

Probability models and prior distributions; updating priors through the likelihood function. Computational and simulation-based methods for deriving posterior distributions and for estimating parameters. Basic statistical and hierarchical models. Model adequacy and posterior predictive checks. Markov Chain Monte Carlo methods and introduction to JAGS and STAN or similar software. Emphasis on applications and examples from the social, biological and physical sciences. Graduation Restriction: May not be used for graduate credit in the Statistics MS and PhD degree programs. (Typically Offered: Spring)

STAT 4279: Statistical Computing for Data Analysis

(Dual-listed with STAT 5279).

Credits: 3. Contact Hours: Lecture 3.

Prereq: STAT 3010, STAT 3260, or STAT 5101

Modern statistical computing. Topics may include: basic and advanced R programming; data management; spread sheets; verifying data accuracy; transferring data between software packages; data and graphical analysis with statistical software packages; algorithmic programming concepts and applications; simulation studies and resampling methods; software reliability; statistical modeling and machine learning. Graduation Restriction: May not be used for graduate credit in the Statistics MS and PhD degree programs. (Typically Offered: Spring)

STAT 4610X: Sports Analytics

Credits: 3. Contact Hours: Lecture 3.

Sports analytics refers to the use of statistical, quantitative, and graphical techniques for analysis of sports data. Focus on head-to-head sports and the calculation of relevant statistics, e.g., plus-minus and adjusted plus-minus statistics that attempt to quantify individual contributions to a team's performance. Rating and ranking systems and their relationship to statistical models and estimation of these ratings will be described. (Typically Offered: Fall, Spring, Summer)

STAT 4730: Introduction to Survey Sampling

(Dual-listed with STAT 5730).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: (STAT 3010 or STAT 3260 or STAT 4010 or STAT 5870); (STAT 3410 or STAT 3470 or STAT 4470 or STAT 5880)

Concepts of sample surveys and the survey process; methods of designing sample surveys, including: simple random, stratified, systematic, probability proportional to size, and multistage sampling designs; methods of analyzing sample surveys including ratio, regression, domain estimation and nonresponse. (Typically Offered: Spring)

STAT 4750: Introduction to Multivariate Data Analysis

(Dual-listed with STAT 5750).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: STAT 3010 or STAT 3260 or STAT 5870

Statistical and graphical methods for displaying and analyzing multivariate data including plotting high-dimensional data using interactive graphics; organizing and summarizing analyses of multivariate data; comparing two group mean vectors; multivariate analysis of variance; reducing variable dimension with principal components; identifying factors with exploratory factor analysis; grouping observations with multidimensional scaling and cluster analysis; classification; R statistical software package and using Rstudio to create reports (RMarkdown and GGplot). Knowledge of linear algebra recommended. Graduation Restriction: Credit for only one of STAT 4070, STAT 4750, or STAT 5750 may be applied to graduation. May not be used for graduate credit in the Statistics MS and PhD degree programs. (Typically Offered: Fall)

STAT 4760: Introduction to Spatial Data Analysis

(Dual-listed with STAT 5760).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (STAT 3010 or STAT 3260 or STAT 4010 or STAT 5870); (STAT 3410 or STAT 3470 or STAT 4470 or STAT 5880)

The analysis of spatial data; geostatistical methods, mapping and spatial prediction; methods for areal data; models and methods for spatial point processes. Emphasis on application and practical use of spatial statistical analysis. Use of R and R packages for spatial data analysis. Graduation Restriction: Credit for only one of STAT 4060, STAT 4760, or STAT 5760 may be applied to graduation. May not be used for graduate credit in the Statistics MS and PhD degree programs.

STAT 4770: Introduction to Categorical Data Analysis

(Dual-listed with STAT 5770).

Credits: 3. Contact Hours: Lecture 3.

Prereq: STAT 3010 or STAT 3260 or STAT 5870

Statistical methods for the analysis of categorical data: graphical summaries, estimation and inference for proportions, sample size determination, chi-square tests, measures of relative risk, odds and association, analysis of paired data and measures of agreement, logistic regression models, log-linear models. Graduation Restriction: Credit for only one of STAT 4570, STAT 4770, or STAT 5770 may be applied to graduation. May not be used for graduate credit in the Statistics MS and PhD degree programs. (Typically Offered: Spring)

STAT 4780: Introduction to Stochastic Process Models

(Dual-listed with STAT 5780).

Credits: 3. Contact Hours: Lecture 3.

Prereq: STAT 2310 or STAT 3410 or STAT 3470 or STAT 4470 or STAT 5880

Probabilistic models in biological, engineering and the physical sciences. Markov chains; Poisson, birth-and-death, renewal, branching and queuing processes; applications to bioinformatics and other quantitative problems. Graduation Restriction: Credit for only one of STAT 4320, STAT 4780, or STAT 5780 may be applied to graduation. May not be used for graduate credit in the Statistics MS and PhD degree programs. Offered even number years. (Typically Offered: Fall)

STAT 4820: Regression for Social and Behavioral Research

(Dual-listed with STAT 5820).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: STAT 3010 or STAT 3260 or STAT 5870

Applications of generalized linear regression models to social science data. Assumptions of regression; diagnostics and transformations; analysis of variance and covariance; logistic, multinomial and Poisson regression. Graduation Restriction: Credit for only one of STAT 4040, STAT 4820, or STAT 5820 may be applied to graduation. May not be used for graduate credit in the Statistics MS and PhD degree programs. (Typically Offered: Fall, Spring)

STAT 4830: Empirical Methods for the Computational Sciences

(Dual-listed with STAT 5830).

Credits: 3. Contact Hours: Lecture 3.

Prereq: STAT 3300, MATH 1660

Statistical methods for research involving computers; exploratory data analysis; selected topics from analysis of designed experiments - analysis of variance, hypothesis testing, interaction among variables; linear regression, logistic regression, Poisson regression; parameter estimation, prediction, confidence regions, dimension reduction techniques, model diagnostics and sensitivity analysis; Markov chains and processes; simulation techniques and bootstrap methods; applications to computer science, bioinformatics, computer engineering - programs, models and systems as objects of empirical study; communicating results of empirical studies. Statistical software: R. Knowledge of linear algebra recommended. Graduation Restriction: Credit for only one of STAT 4300, STAT 4830, or STAT 5830 may be applied to graduation. May not be used for graduate credit in the Statistics MS and PhD degree programs. (Typically Offered: Fall)

STAT 4840: Computer Processing of Scientific Data

(Dual-listed with STAT 5840).

Credits: 3. Contact Hours: Lecture 3.

Prereq: STAT 3010 or STAT 3260 or STAT 5870

Structure, content and programming aspects of modern statistical software packages. Advanced techniques for data management, graphics, exploratory data analysis, and generalized linear models. Graduation Restriction: Credit for only one of STAT 4790, STAT 4840, or STAT 5840 may be applied to graduation. May not be used for graduate credit in the Statistics MS and PhD degree programs. (Typically Offered: Fall)

STAT 4900: Independent Study

Credits: 1-30. Repeatable, maximum of 9 credits.

Prereq: 10 credits in STAT; Permission of Instructor

Graduation Restriction: No more than 9 credits in STAT 4900 may be counted toward graduation. (Typically Offered: Fall, Spring, Summer)

STAT 4900H: Independent Study: Honors

Credits: 1-30. Repeatable, maximum of 9 credits.

Prereq: 10 credits in STAT; Permission of Instructor; Membership in the University Honors Program

Graduation Restriction: No more than 9 credits in STAT 4900 may be counted toward graduation. (Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

STAT 5000: Statistical Methods I

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: STAT 5880 or current enrollment in STAT 5420 or Graduate Classification

Analysis of data from designed experiments and observational studies. Randomization-based and model-based inference on group means; pairing/blocking and other uses of restricted randomization. Model assessment and diagnostics; remedial measures; alternative approaches based on ranks. Simple linear regression, multiple linear regression, and model selection criteria. Use of linear models to analyze data; least squares estimation; estimability; sampling distributions of estimators; general linear tests; inference for parameters and contrasts. (Typically Offered: Fall)

STAT 5010: Multivariate Statistical Methods

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Statistical methods for analyzing and displaying multivariate data; the multivariate normal distribution; inference in multivariate populations, simultaneous analysis of multiple responses, multivariate analysis of variance; summarizing high dimensional data with principal components, factor analysis, canonical correlations, classification methods, clustering, multidimensional scaling; introduction to basic nonparametric multivariate methods. Statistical software: SAS or R. (Typically Offered: Spring)

STAT 5020: Applied Modern Multivariate Statistical Learning

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

A Statistics-MS-level introduction to Modern Multivariate Statistical Learning. Theory-based methods for modern data mining and machine learning, inference and prediction. Variance-bias trade-offs and choice of predictors; linear methods of prediction; basis expansions; smoothing, regularization, kernel smoothing methods; neural networks and radial basis function networks; bootstrapping, model averaging, and stacking; linear and quadratic methods of classification; support vector machines; trees and random forests; boosting; prototype methods; unsupervised learning including clustering, principal components, and multi-dimensional scaling; kernel mechanics. Substantial use of R packages implementing these methods. Offered even-numbered years. (Typically Offered: Spring)

STAT 5030: Exploratory Methods and Data Mining

Credits: 3. Contact Hours: Lecture 3.

Prereq: STAT 5420 or 5880 or 5790 or 5860

Approaches to finding the unexpected in data; exploratory data analysis; pattern recognition; dimension reduction; supervised and unsupervised classification; interactive and dynamic graphical methods; computer-intensive statistical techniques for large or high dimensional data and visual inference. Emphasis is on problem solving, topical problems, and learning how so-called black-box methods actually work. Offered irregularly. (Typically Offered: Spring)

STAT 5050: Environmental Statistics

Credits: 3. Contact Hours: Lecture 3.

Prereq: (STAT 5420 or 5880); (STAT 5000 or 5870)

Statistical methods and models for environmental applications. Emphasis on environmental toxicology. Analysis of data with below detection-limit values. Dose-response curve modeling, including overdispersion and estimation of safe doses. Trend analysis; analysis of autocorrelated data. Equivalence testing.

STAT 5060: Statistical Methods for Spatial Data

Credits: 3. Contact Hours: Lecture 3.

Prereq: STAT 5420 or 5880

The analysis of spatial data; geostatistical methods and spatial prediction; discrete index random fields and Markov random field models; models for spatial point processes. Offered even-numbered years. (Typically Offered: Spring)

STAT 5100: Statistical Methods II

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Linear models and analysis of variance for multifactor experiments with balanced and unbalanced data. Likelihood analysis for general linear models and models with non-normal random components; linear model results in the context of likelihood; linear mixed models and their application; estimation, inference, and prediction. Introduction to generalized linear models and generalized linear mixed models. Case studies of applications including problem formulation, exploratory analysis, model development, estimation and inference, and model assessment. (Typically Offered: Spring)

STAT 5101: Statistical Methods for Data Analysis

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

A first course in statistics for graduate students from the applied sciences. Principles of data analysis and scientific inference, including estimation, hypothesis testing, and the construction of interval estimates. Statistical concepts and models, including group comparison, blocking, and linear regression. Different sections are designed for students in various disciplines, and additional methods covered may depend on the target audience. Topics covered may include basic experimental designs and analysis of variance for those designs, analysis of categorical data, logistic and log-linear regression, likelihood-based inference, and the use of simulation. Graduation Restriction: Credit for only one of the following courses may be applied to graduation: STAT 3010, STAT 3260, or STAT 5101. May not be used for graduate credit in the Statistics MS and PhD degree programs. (Typically Offered: Fall, Spring, Summer)

STAT 5120: Design of Experiments

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Basic techniques of experimental design developed in the context of the general linear model; completely randomized, randomized complete block, and Latin Square designs; factorial experiments, confounding, fractional replication; split-plot and incomplete block designs. (Typically Offered: Fall)

STAT 5130: Response Surface Methodology

Credits: 3. Contact Hours: Lecture 3.

Prereq: STAT 5120 or 5710

Analysis techniques for locating optimum and near-optimum operating conditions: standard experimental designs for first- and second-order response surface models; design performance criteria; use of data transformations; mixture experiments; optimization for multiple-response problems. Requires use of statistical software with matrix functions.

STAT 5147: Statistical Theory for Data Analysis

Credits: 4. Contact Hours: Lecture 4.

Prereq: Graduate Standing or Permission of Instructor

Provides an introduction to the theoretical basis of fundamental statistical methods for graduate students in the applied sciences. Probability and probability distributions, moments and moment generating functions, and transformation of random variables. Sampling distributions; estimation based on maximum likelihood, and properties of estimators. Development of inference. Use of simulation to verify and extend theoretical results. Graduation Restriction: May not be used for graduate credit in the Statistics MS and PhD degree programs. Credit for only one of the following courses may be applied toward graduation: STAT 3410, STAT 3470, STAT 5147. (Typically Offered: Fall, Spring, Summer)

STAT 5150: Theory and Applications of Nonlinear Models

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Construction of nonlinear statistical models; random and systematic model components, additive error nonlinear regression with constant and non-constant error variances, generalized linear models, transform both sides models. Iterative algorithms for estimation and asymptotic inference. Basic random parameter models, beta-binomial and gamma-Poisson mixtures. Requires use of instructor-supplied and student-written R functions.

STAT 5160: Statistical Design and Analysis of Gene Expression Experiments

Credits: 3. Contact Hours: Lecture 3.

Prereq: STAT 5000 and (STAT 5420 or STAT 5880)

Introduction to high-throughput technologies for gene expression studies (especially RNA-sequencing technology): the role of blocking, randomization, and biological and technical replication in the design of gene expression experiments; normalization methods; methods for identifying differentially expressed genes including mixed linear model analysis, generalized linear model analysis, generalized linear mixed model analysis, quasi-likelihood methods, and empirical Bayes analysis; procedures for controlling false discovery rate for multiple testing; clustering problems for gene expression data; testing gene categories; emphasis on current research topics for statistical analysis of high dimensional gene expression data.

STAT 5200: Statistical Methods III

Credits: 3. Contact Hours: Lecture 3.

Prereq: STAT 5100 AND (STAT 5430 or STAT 5880)

Nonlinear regression; generalized least squares; asymptotic inference. Generalized linear models; exponential dispersion families; maximum likelihood and inference. Designing Monte Carlo studies; bootstrap; cross-validation. Fundamentals of Bayesian analysis; data models, priors and posteriors; posterior prediction; credible intervals; Bayes Factors; types of priors; simulation of posteriors; introduction to hierarchical models and Markov Chain Monte Carlo methods. (Typically Offered: Fall)

STAT 5210: Theory and Applications of Sample Surveys

Credits: 3. Contact Hours: Lecture 3.

Prereq: (STAT 5420 or 5880); (STAT 5000 or 5870)

Practical aspects and basic theory of design and estimation in sample surveys for finite populations. Simple random, systematic, stratified, cluster multistage and unequal-probability sampling. Horvitz-Thompson estimation of totals and functions of totals: means, proportions, regression coefficients. Linearization technique for variance estimation. Model-assisted ratio and regression estimation. Two-phase sampling and sampling on two occasions. Non-response effects. Imputation. (Typically Offered: Spring)

STAT 5212: Experimental Design and Data Analysis

(Dual-listed with STAT 4212).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

The role of statistics in research and the principles of experimental design. Concepts of experimental and observational units, randomization, replication, blocking, subdividing and repeatedly measuring experimental units; factorial treatment designs and confounding; common designs including randomized complete block design, Latin square design, split-plot design, and analysis of data from such common designs; extensions of the analysis of variance to cover variance components. Determining sample size. Graduation Restriction: May not be used for graduate credit in the Statistics MS and PhD degree programs. (Typically Offered: Fall, Spring)

STAT 5215: Time Series Data Analysis

(Dual-listed with STAT 4215).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Methods for analyzing data collected over time; review of multiple regression analysis. Elementary forecasting methods: moving averages and exponential smoothing. Autoregressive-moving average (Box-Jenkins) models: identification, estimation, diagnostic checking, and forecasting. Transfer function models and intervention analysis. Introduction to multivariate time series methods. Graduation Restriction: May not be used for graduate credit in the Statistics MS and PhD degree programs. (Typically Offered: Spring)

STAT 5219: Bayesian Data Analysis

(Dual-listed with STAT 4219).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Probability models and prior distributions; updating priors through the likelihood function. Computational and simulation-based methods for deriving posterior distributions and for estimating parameters. Basic statistical and hierarchical models. Model adequacy and posterior predictive checks. Markov Chain Monte Carlo methods and introduction to JAGS and STAN or similar software. Emphasis on applications and examples from the social, biological and physical sciences. Graduation Restriction: May not be used for graduate credit in the Statistics MS and PhD degree programs. (Typically Offered: Spring)

STAT 5220: Advanced Applied Survey Sampling

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Advanced topics in survey sampling and methodology: clustering and stratification in practice, adjustments and imputation for missing data, variance estimation in complex surveys, methods of panel and/or longitudinal surveys, procedures to increase response rates, and computing. Examples are taken from large, well-known surveys in various subject areas. Offered irregularly. (Typically Offered: Fall)

STAT 5250: Statistical Methods for Mathematics Teachers

Credits: 6. Contact Hours: Lecture 6.

Prereq: Graduate Standing or Permission of Instructor

Descriptive statistics; data collection through experimentation and sampling; univariate statistical inference; contingency tables; design of experiments and ANOVA; simple linear regression; logistic regression; multiple linear regression; statistics pedagogy. (Offered on a 3-year cycle; offered SS 2020.).

STAT 5260: Applied Statistical Modeling

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Probability concepts and distributions used in statistical decision-making for business applications. Least-squares and maximum likelihood estimation, sampling distributions of estimators, formal statistical inference, analysis of variance, multiple regression models and strategies for model selection, logistic regression, and Poisson regression. Applications implemented with the R statistical package. Simulations used to investigate properties of inferential procedures and to assist in data analysis. (Typically Offered: Fall)

STAT 5279: Statistical Computing for Data Analysis

(Dual-listed with STAT 4279).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Modern statistical computing. Topics may include: basic and advanced R programming; data management; spread sheets; verifying data accuracy; transferring data between software packages; data and graphical analysis with statistical software packages; algorithmic programming concepts and applications; simulation studies and resampling methods; software reliability; statistical modeling and machine learning. Graduation Restriction: May not be used for graduate credit in the Statistics MS and PhD degree programs. (Typically Offered: Spring)

STAT 5280: Visual Business Analytics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Types of data displays; numerical and visual summaries of data; data structures for data displays; data vs info graphics; good practices of displaying data; human perception and cognition in data displays; graphics as tools of data exploration; graphical diagnostics of statistical models and machine learning procedures; strategies and techniques for data visualizations; basics of reproducibility and repeatability; web-based interactive applets for visual presentation of data and results; programming in R. (Typically Offered: Fall)

STAT 5310: Quality Control and Engineering Statistics

(Cross-listed with IE 5310).

Credits: 3. Contact Hours: Lecture 3.

Prereq: STAT 5870 and STAT 5880

Statistical methods and theory applicable to problems of industrial process monitoring and improvement. Statistical issues in industrial measurement; Shewhart, CUSUM, and other control charts; feedback control; process characterization studies; estimation of product and process characteristics; acceptance sampling, continuous sampling and sequential sampling; economic and decision theoretic arguments in industrial statistics.

STAT 5330: Reliability

(Cross-listed with IE 5330).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Probabilistic modeling and inference in engineering reliability; lifetime models, product limit estimator, probability plotting, maximum likelihood estimation for censored data, Bayesian methods in reliability, system reliability models, competing risk analysis, acceleration models and analysis of accelerated test data; analysis of recurrent events and degradation data; planning studies to obtain reliability data. Offered even-numbered years. (Typically Offered: Spring)

STAT 5340: Ecological Statistics

Credits: 3. Contact Hours: Lecture 3.

Prereq: STAT 5420 or 5880

Statistical methods for non-standard problems, illustrated using questions and data from ecological field studies. Estimation of abundance and survival from mark-recapture studies, deterministic and stochastic matrix models of population trends, integral projection models, and hierarchical modeling, especially of population dynamics. Additional topics vary based on student interest. Offered odd-numbered years. (Typically Offered: Fall)

STAT 5360: Statistical Genetics

(Cross-listed with GDCB 5360).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Statistical models and methods for genetics covering models of population processes: selection, mutation, migration, population structure, and linkage disequilibrium, and inference techniques: genetic mapping, linkage analysis, and quantitative trait analysis. Applications include genetic map construction, gene mapping, genome-wide association studies (GWAS), inference about population structure, phylogenetic tree construction, and forensic and paternity identification.

STAT 5420: Theory of Probability and Statistics I

Credits: 4. Contact Hours: Lecture 4.

Prereq: Graduate Standing or Permission of Instructor

Sample spaces, basic probability results, conditional probability. Random variables, univariate distributions, moment generating functions. Joint distributions, conditional distributions and independence, correlation and covariance. Probability laws and transformations. Introduction to the multivariate normal distribution. Sampling distributions, normal theory, sums and order statistics. Convergence concepts, the law of large numbers, the central limit theorem and delta method. Basics of stochastic simulation. (Typically Offered: Fall)

STAT 5430: Theory of Probability and Statistics II

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Point estimation including method of moments, maximum likelihood and Bayes. Properties of point estimators, mean squared error, unbiasedness, consistency, loss functions. Large sample properties of maximum likelihood estimators. Exponential families, sufficiency, completeness, ancillarity, Basu's theorem. Hypothesis tests, Neyman-Pearson lemma, uniformly most powerful tests, likelihood ratio tests, Bayes tests. Interval estimation, inverting tests, pivotal quantities. Nonparametric theory, bootstrap. (Typically Offered: Spring)

STAT 5440: Bayesian Statistics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Specification of probability models; subjective, conjugate, and noninformative prior distributions; hierarchical models; analytical and computational techniques for obtaining posterior distributions; model checking, model selection, diagnostics; comparison of Bayesian and traditional methods. (Typically Offered: Spring)

STAT 5460: Nonparametric Methods in Statistics

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Overview of parametric versus nonparametric methods of inference; introduction to rank-based tests and/or nonparametric smoothing methods for estimating density and regression functions; smoothing parameter selection. Offered odd-numbered years. (Typically Offered: Fall)

STAT 5470: Functional Data Analysis

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Theory and methods for analyzing functional data, which are data that take the forms of trajectories and images, possibly highly discretized and contaminated with noise. Topics include basic operations on functional data, necessary theoretical foundations, functional principal component analysis, kernel and spline smoothing, covariance modeling and estimation, dynamics modeling, concurrent regression models, functional linear models, inference for functional data, classification, and other optional topics. Offered even-numbered years. (Typically Offered: Spring)

STAT 5510: Time Series Analysis

Credits: 3. Contact Hours: Lecture 3.

Prereq: STAT 5420 or 5880

Concepts of trend and dependence in time series data; stationarity and basic model structures for temporal dependence; moving average and autoregressive error structures; analysis in time domain and in frequency domain; parameter estimation, prediction and forecasting; identification of appropriate model structure and model assessment techniques. Possible extended topics including non-linear models, dynamic models, state-space models. (Typically Offered: Fall)

STAT 5540: Stochastic Process Models

(Cross-listed with MATH 5540).

Credits: 3. Contact Hours: Lecture 3.

Markov chains on discrete spaces in discrete and continuous time (random walks, Poisson processes, birth and death processes) and their long-term behavior. Optional topics may include branching processes, renewal theory, introduction to Brownian motion. (Typically Offered: Fall)

STAT 5570: Statistical Methods for Counts and Proportions

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Statistical methods for analyzing simple random samples when outcomes are counts or proportions; measures of association and relative risk, chi-squared tests, loglinear models, logistic regression and other generalized linear models, tree-based methods. Maximum likelihood estimation and large sample theory. Extensions to longitudinal studies and complex survey designs, models with fixed and random effects. Use of statistical software: SAS or R. Offered odd-numbered years. (Typically Offered: Fall)

STAT 5585: Data Technologies for Statistical Analysis

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to computational methods for data analysis. Accessing and managing data formats: flat files, databases, web technologies based on mark-up languages (SML, KML, HTML), netCDF. Elements of text processing: regular expressions for cleaning data. Working with massive data, handling missing data, scaled computing. Efficient programming, reproducible code. (Typically Offered: Spring)

STAT 5590: Item Response Theory

Credits: 3. Contact Hours: Lecture 3.

Prereq: STAT 5000 or 5870

Statistical methods for analysis of binary and polytomous data using latent trait models. Application and theory of model selection and fit, dimensionality, differential item functioning and test development. Use of appropriate statistical software. Offered even-numbered years. (Typically Offered: Fall)

STAT 5650: Methods in Biostatistics and Epidemiology

(Cross-listed with TOX 5650).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Statistical methods commonly used in epidemiology and human and animal health studies. Overview of cohort studies, case-control studies and randomized clinical trials. Topics include inference procedures for disease risk factors, analysis of time-to-event and survival data, analysis of longitudinal studies of disease progression and health status, diagnostic test evaluation, and meta-analysis. Examples will come from recent studies of physical and mental health, nutrition and disease progression in human and animal populations. Use of statistical software: SAS or R. Offered even-numbered years. (Typically Offered: Fall)

STAT 5680: Statistical Bioinformatics

(Cross-listed with COMS 5680/ GDCB 5680/ BCB 5680).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Statistical models for sequence data, including applications in genome annotation, motif discovery, variant discovery, molecular phylogeny, gene expression analysis, and metagenomics. Statistical topics include model building, inference, hypothesis testing, and simple experimental design, including for big data/complex models. (Typically Offered: Spring)

STAT 5700: Systems Biology

(Cross-listed with COMS 5700/ CPRE 5700/ GDCB 5700/ BCB 5700).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Algorithmic and statistical approaches in computational functional genomics and systems biology. Analysis of high throughput biological data obtained using system-wide measurements. Topological analysis, module discovery, and comparative analysis of gene and protein networks. Modeling, analysis, and inference of transcriptional regulatory networks, protein-protein interaction networks, and metabolic networks. Dynamic systems and whole-cell models. Ontology-driven, network based, and probabilistic approaches to information integration. (Typically Offered: Spring)

STAT 5730: Introduction to Survey Sampling

(Dual-listed with STAT 4730).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: STAT 5870 and STAT 5880

Concepts of sample surveys and the survey process; methods of designing sample surveys, including: simple random, stratified, systematic, probability proportional to size, and multistage sampling designs; methods of analyzing sample surveys including ratio, regression, domain estimation and nonresponse. (Typically Offered: Spring)

STAT 5750: Introduction to Multivariate Data Analysis

(Dual-listed with STAT 4750).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Statistical and graphical methods for displaying and analyzing multivariate data including plotting high-dimensional data using interactive graphics; organizing and summarizing analyses of multivariate data; comparing two group mean vectors; multivariate analysis of variance; reducing variable dimension with principal components; identifying factors with exploratory factor analysis; grouping observations with multidimensional scaling and cluster analysis; classification; R statistical software package and using Rstudio to create reports (RMarkdown and GGplot). Knowledge of linear algebra recommended. Graduation Restriction: Credit for only one of STAT 4070, STAT 4750, or STAT 5750 may be applied to graduation. May not be used for graduate credit in the Statistics MS and PhD degree programs. (Typically Offered: Fall)

STAT 5760: Introduction to Spatial Data Analysis

(Dual-listed with STAT 4760).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (STAT 5870 and STAT 5880) or Permission of Instructor

The analysis of spatial data; geostatistical methods, mapping and spatial prediction; methods for areal data; models and methods for spatial point processes. Emphasis on application and practical use of spatial statistical analysis. Use of R and R packages for spatial data analysis. Graduation Restriction: Credit for only one of STAT 4060, STAT 4760, or STAT 5760 may be applied to graduation. May not be used for graduate credit in the Statistics MS and PhD degree programs.

STAT 5770: Introduction to Categorical Data Analysis

(Dual-listed with STAT 4770).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Statistical methods for the analysis of categorical data: graphical summaries, estimation and inference for proportions, sample size determination, chi-square tests, measures of relative risk, odds and association, analysis of paired data and measures of agreement, logistic regression models, log-linear models. Graduation Restriction: Credit for only one of STAT 4570, STAT 4770, or STAT 5770 may be applied to graduation. May not be used for graduate credit in the Statistics MS and PhD degree programs. (Typically Offered: Spring)

STAT 5780: Introduction to Stochastic Process Models

(Dual-listed with STAT 4780).

Credits: 3. Contact Hours: Lecture 3.

Prereq: STAT 5880

Probabilistic models in biological, engineering and the physical sciences. Markov chains; Poisson, birth-and-death, renewal, branching and queuing processes; applications to bioinformatics and other quantitative problems. Graduation Restriction: Credit for only one of STAT 4320, STAT 4780, or STAT 5780 may be applied to graduation. May not be used for graduate credit in the Statistics MS and PhD degree programs. Offered even number years. (Typically Offered: Fall)

STAT 5790: An Introduction to R

Credits: 1. Contact Hours: Laboratory 2.

Prereq: Credit or concurrent enrollment STAT 5000

An introduction to the logic of programming, numerical algorithms, and graphics. The R statistical programming environment will be used to demonstrate how data can be stored, manipulated, plotted, and analyzed using both built-in functions and user extensions. Concepts of modularization, looping, vectorization, conditional execution, and function construction will be emphasized. (Typically Offered: Fall)

STAT 5800: Statistical Computing

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to scientific computing for statistics using C: Introduction to C for computing and memory efficiency; design of statistical algorithms; use of algorithms in modern libraries, parallel computing. Interfacing R with C. Building statistical libraries. Statistical computing: solving nonlinear equations; optimization; integration; simulation methods, inversion of probability integral transformations, rejection sampling, importance sampling. (Typically Offered: Spring)

STAT 5810: Analysis of Gene Expression Data for the Biological Sciences

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to high-throughput technologies for gene expression studies (especially R-sequencing technology): the role of blocking, randomization, and biological and technical replication in the design of gene expression experiments; normalization methods; methods for identifying differentially expressed genes including mixed linear model analysis, generalized linear model analysis, generalized linear mixed model analysis, quasi-likelihood methods, empirical Bayes analysis, and resampling based approaches; procedures for controlling false discovery rate for multiple testing; clustering and classification problems for gene expression data; testing gene categories; emphasis on practical use of methods. Graduation Restriction: May not be used for graduate credit in the Statistics MS and PhD degree programs. Credit in STAT 4160 or STAT 5810, but not both, may be applied toward graduation. (Typically Offered: Spring)

STAT 5820: Regression for Social and Behavioral Research

(Dual-listed with STAT 4820).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Applications of generalized linear regression models to social science data. Assumptions of regression; diagnostics and transformations; analysis of variance and covariance; logistic, multinomial and Poisson regression. Graduation Restriction: Credit for only one of STAT 4040, STAT 4820, or STAT 5820 may be applied to graduation. May not be used for graduate credit in the Statistics MS and PhD degree programs. (Typically Offered: Fall, Spring)

STAT 5830: Empirical Methods for the Computational Sciences

(Dual-listed with STAT 4830).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Statistical methods for research involving computers; exploratory data analysis; selected topics from analysis of designed experiments - analysis of variance, hypothesis testing, interaction among variables; linear regression, logistic regression, Poisson regression; parameter estimation, prediction, confidence regions, dimension reduction techniques, model diagnostics and sensitivity analysis; Markov chains and processes; simulation techniques and bootstrap methods; applications to computer science, bioinformatics, computer engineering - programs, models and systems as objects of empirical study; communicating results of empirical studies. Statistical software: R. Knowledge of linear algebra recommended. Graduation Restriction: Credit for only one of STAT 4300, STAT 4830, or STAT 5830 may be applied to graduation. May not be used for graduate credit in the Statistics MS and PhD degree programs. (Typically Offered: Fall)

STAT 5840: Computer Processing of Scientific Data

(Dual-listed with STAT 4840).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Structure, content and programming aspects of modern statistical software packages. Advanced techniques for data management, graphics, exploratory data analysis, and generalized linear models. Graduation Restriction: Credit for only one of STAT 4790, STAT 4840, or STAT 5840 may be applied to graduation. May not be used for graduate credit in the Statistics MS and PhD degree programs. (Typically Offered: Fall)

STAT 5900A: Special Topics: Theory

Credits: 1-30. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

STAT 5900B: Special Topics: Methods

Credits: 1-30. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

STAT 5900C: Special Topics: Design of Experiments

Credits: 1-30. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

STAT 5900D: Special Topics: Sample Surveys

Credits: 1-30. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

STAT 5900E: Special Topics: Statistics Education

Credits: 1-30. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

STAT 5900F: Special Topics: Statistical Computing and Graphics

Credits: 1-30. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

STAT 5980: Cooperative Education

Credits: Required. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Off-campus work periods for graduate students in a field of statistics. (Typically Offered: Fall, Spring, Summer)

STAT 5990: Creative Component

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Offered on a satisfactory-fail basis only.

Courses for graduate students:

STAT 6010: Advanced Statistical Methods

Credits: 3. Contact Hours: Lecture 3.

Methods of constructing complex models including adding parameters to existing structures, incorporating stochastic processes and latent variables. Use of modified likelihood functions; quasi-likelihoods; profiles; compositemodels. Asymptotic normality as a basis of inference; Godambe information. Sample reuse; block bootstrap; resampling with dependence. Simulation for model assessment. Issues in Bayesian analysis. (Typically Offered: Spring)

STAT 6020: Modern Multivariate Statistical Learning

Credits: 3. Contact Hours: Lecture 3.

Statistical theory and methods for modern data mining and machine learning, inference, and prediction. Variance-bias trade-offs and choice of predictors; linear methods of prediction; basis expansions; smoothing, regularization, and reproducing kernel Hilbert spaces; kernel smoothing methods; neural networks and radial basis function networks; bootstrapping, model averaging, and stacking; linear and quadratic methods of classification; support vector machines; trees and random forests; boosting; prototype methods; unsupervised learning including clustering, principal components, and multi-dimensional scaling; kernel mechanics. Offered odd-numbered years. (Typically Offered: Spring)

STAT 6060: Advanced Spatial Statistics

Credits: 3. Contact Hours: Lecture 3.

Consideration of advanced topics in spatial statistics, including areas of recent development in modern spatial statistics. Topics may include spatial sampling design; spatial Markov random fields; non-Gaussian spatial models, including spatial generalized linear mixed effects model; spatial Bayesian hierarchical models, simulation of random fields; spatial-temporal process models; non-stationary process models; multivariate spatial process models; spectral methods for spatial data; computational methods for large spatial data, spatial models for stream networks. Use of R to analyze various real spatial data. Offered irregularly. (Typically Offered: Fall)

STAT 6110: Theory and Applications of Linear Models

Credits: 3. Contact Hours: Lecture 3.

Matrix preliminaries, estimability, theory of least squares and of best linear unbiased estimation, analysis of variance and covariance, distribution of quadratic forms, extension of theory to mixed and random effects models, restricted maximum likelihood estimation and inference for variance components. (Typically Offered: Fall)

STAT 6120: Advanced Design of Experiments

Credits: 3. Contact Hours: Lecture 3.

General theory of factorial experiments. Design optimality criteria, approximate design and general equivalence theory, computational approaches to constructing optimal designs for linear models, and extensions to nonlinear models. Advanced topics of current interest in the design of experiments, including one or more of: distance based design criteria and construction of spatial process models, screening design strategies for high- dimensional problems, and design problems associated with computational experiments. Offered irregularly. (Typically Offered: Spring)

STAT 6150: Advanced Bayesian Methods

Credits: 3. Contact Hours: Lecture 3.

Complex hierarchical and multilevel models, dynamic linear and generalized linear models, spatial models. Bayesian nonparametric methods. Specialized Markov chain Monte Carlo algorithms and practical approaches to increasing mixing and speed convergence. Summarizing posterior distributions, and issues in inference. Model assessment, model selection, and model averaging. Offered odd-numbered years. (Typically Offered: Fall)

STAT 6210: Advanced Theory of Survey Statistics

Credits: 3. Contact Hours: Lecture 3.

Advanced topics of current interest in the design of surveys and analysis of survey data, including: asymptotic theory for design and model-based estimators, use of auxiliary information in estimation, variance estimation techniques, small area estimation, non-response modeling and imputation. Offered irregularly. (Typically Offered: Fall)

STAT 6410: Foundations of Probability Theory

(Cross-listed with MATH 6410).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 4140 or MATH 5010 or Graduate Classification

Sequences and set theory; Lebesgue measure, measurable functions. Absolute continuity of functions, integrability and the fundamental theorem of Lebesgue integration. General measure spaces, probability measure, extension theorem and construction of Lebesgue-Stieljes measures on Euclidean spaces. Measurable transformations and random variables, induced measures and probability distributions. General integration and expectation, L_p -spaces and integral inequalities. Uniform integrability and absolute continuity of measures. Probability densities and the Radon-Nikodym theorem. Product spaces and Fubini-Tonelli theorems. (Typically Offered: Fall)

STAT 6420: Advanced Probability Theory

(Cross-listed with MATH 6420).

Credits: 3. Contact Hours: Lecture 3.

Probability spaces and random variables. Kolmogorov's consistency theorem. Independence, Borel-Cantelli lemmas and Kolmogorov's 0 - 1 Law. Types and characterizations of convergence for random variables. Sums of independent random variables, empirical distributions, weak and strong laws of large numbers. Convergence in distribution and its formulations, tightness, characteristic functions, central limit theorems and Lindeberg-Feller conditions. Conditional probability and expectation, discrete parameter martingales. (Typically Offered: Spring)

STAT 6430: Advanced Theory of Statistical Inference

Credits: 3. Contact Hours: Lecture 3.

Foundational concepts for likelihood, including sufficiency, completeness, exponential families, statistical information. Elements of decision theory, risk management strategies, theoretical properties of decision rules. Large-sample properties of maximum likelihood and Bayesian estimation, consistency, asymptotic normality, efficiency, likelihood ratios. Potential additional topics including M-estimation, U-statistics, nonparametric inference. (Typically Offered: Fall)

STAT 6440: Advanced Bayesian Theory

Credits: 3. Contact Hours: Lecture 3.

Exchangeability, parametric models, consistency and asymptotic normality of posterior distributions, posterior robustness, selection of priors using formal rules, improper priors and posterior propriety, Bayes factors, model selection, MCMC theory, irreducibility, Harris recurrence, regeneration, minorization and drift conditions, ergodicity, central limit theorems, Gibbs samplers, Metropolis Hastings samplers, techniques for speeding up convergence of certain MCMC algorithms. Offered even-numbered years. (Typically Offered: Fall)

STAT 6450: Advanced Stochastic Processes

(Cross-listed with MATH 6450).

Credits: 3. Contact Hours: Lecture 3.

Weak convergence. Random walks and Brownian motion. Martingales. Stochastic integration and Ito's Formula. Stochastic differential equations and applications. (Typically Offered: Spring)

STAT 6470: Advanced Multivariate Analysis

Credits: 3. Contact Hours: Lecture 3.

Classical and high dimensional multivariate methods and their theories; multivariate random vectors and their distributions (multivariate normal, elliptical contour distributions); dependence measures and copulas; Wishart distribution and distributions for quadratic form statistics; Hotelling's T square test and its derivation; high- dimensional inference for mean and covariance, concentration inequalities, random matrix theory, signal detection and identification. Offered even-numbered years. (Typically Offered: Fall)

STAT 6480: Seminar on Theory of Statistics and Probability

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

Seminar topics change with each offering. Offered irregularly. (Typically Offered: Fall)

STAT 6510: Advanced Time Series

Credits: 3. Contact Hours: Lecture 3.

Estimation and distributional theory for time series, generalized estimating functions, M-estimation, frequency domain estimation. Limit theorems under time dependence, mixing, long-memory. Approximations of sampling distributions and standard errors for time series statistics, bootstrap, subsampling. Offered even-numbered years. (Typically Offered: Fall)

STAT 6730X: Nonlinear Estimation in Astrodynamics

(Cross-listed with ECPE 6730X/ AERE 6730X/ MATH 6730X).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (AERE 5730 or EE 5080 or STAT 5440) or (two of the following: STAT 3050, STAT 5000, STAT 5100, STAT 5200, MATH 5540)

Transformation and propagation of random variables. Understanding and developing linear and nonlinear filters. Covering Gaussian Multiple Models, Particle Filtering, Particle Flow, and Polynomial Update. Applications to navigation and estimation in astrodynamics, such as orbit determination, station keeping, attitude determination, and relative pose estimation.

STAT 6800: Advanced Statistical Computing

Credits: 3. Contact Hours: Lecture 3.

Normal approximations to likelihoods. The delta-method and propagation of errors. Topics in the use of the E-M algorithm including; its use in the exponential family, computation of standard errors, acceleration. Resampling methods: brief theory and application of the jackknife and the bootstrap. Randomization tests. Stochastic simulation: Markov Chain, Monte Carlo, Gibbs' sampling, Hastings-Metropolis algorithms, critical slowing-down and remedies, auxiliary variables, simulated tempering, reversible-jump MCMC and multi-grid methods. Offered even-numbered years. (Typically Offered: Fall)

STAT 6900A: Advanced Special Topics: Theory

Credits: 1-30. Repeatable.

STAT 6900B: Advanced Special Topics: Methods

Credits: 1-30. Repeatable.

STAT 6900C: Advanced Special Topics: Design of Experiments

Credits: 1-30. Repeatable.

STAT 6900D: Advanced Special Topics: Sample Surveys

Credits: 1-30. Repeatable.

STAT 6900E: Advanced Special Topics: Statistical Computing

Credits: 1-30. Repeatable.

STAT 6900F: Advanced Special Topics: Graphics

Credits: 1-30. Repeatable.

STAT 6990: Research

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Supply Chain Management (SCM)

Courses primarily for undergraduates:

SCM 3010: Supply Chain Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 1010.

Introduction to a wide range of supply chain management (SCM) terminology, analytical tools, and theories as related to the supply chain operations reference model (SCOR). The SCOR model focuses on planning, sourcing, making, delivering, returning, and integrating key aspects within SCM. Using an analytical approach to solve real world problems, specific topics include: strategic sourcing, supply management, demand forecasting, inventory management, process management, logistics, process integration, and returns.

SCM 3030: Healthcare Quality Management

(Cross-listed with HCM 3030).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or enrollment in HCM 3010 or FS HN 4300

Addresses the manager's role in improving healthcare quality and outcomes, including clinical and organizational improvement, and quality improvement practices. Explores how healthcare delivery systems can better measure outcomes from both patient and organizational perspectives. Analyzes quality improvement programs and examines their adaptability to the healthcare environment. (Typically Offered: Fall, Spring)

SCM 3400: Project Management

(Cross-listed with MIS 3400).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or enrollment in MIS 3010

Equips students to support team activities in the general project management environment and better manage their careers. Practical experience using project management techniques and tools. Course topics include project initiation and execution, risk assessment, estimating and contracts, planning, human factors, and standard methods.

SCM 4240: Process Management, Analysis, and Improvement

Credits: 3. Contact Hours: Lecture 3.

Prereq: SCM 3010

The design, analysis, and management of production processes to improve performance. Performance measures and their relationships; process design and evaluation; and managerial levers for improving and controlling process performance.

SCM 4280: Special Topics in Operations Management

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: SCM 3010

In-depth analysis of current issues, problems, and systems in operations management with emphasis on new theoretical and methodological developments. Topics may include in different semesters, supply chain management, productivity and quality improvement, management of technology and innovation, information technology in operations management, quick response manufacturing, and service operations management.

SCM 4300: Supply Chain Analytics

Credits: 3. Contact Hours: Lecture 3.

Prereq: SCM 3010

Covers the multifaceted realm of supply chain analytics by exploring descriptive, predictive, and prescriptive analytics methodologies with real-world data across diverse supply chain contexts. Through immersive exercises, students harness the power of analytical insights to inform strategic decision-making and drive operational efficiency. With the training in tools and techniques such as ETL, SQL, Monte Carlo Simulation, Linear Programming, Forecasting, and Python-based machine learning, students gain proficiency in extracting actionable intelligence from complex datasets. Whether deciphering text data or analyzing quantitative metrics, the course fosters a comprehensive understanding of supply chain dynamics. (Typically Offered: Spring)

SCM 4340X: Implementing Process Improvement

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: SCM 4240

Provides hands-on opportunity to practice process improvement drawing on the most frequently used tools from Six Sigma and Lean. Students apply tool in local firms and use them in a final project. Emphasis on the practical application of Six Sigma and Lean techniques. (Typically Offered: Fall, Spring)

SCM 4400: Supply Chain Information Systems

(Cross-listed with MIS 4400).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MIS 3010, SCM 3010

Internal and inter-organizational information systems necessary for a supply chain to achieve competitive advantage. Topics include: design, development, implementation, and maintenance of supply chain information systems; enterprise resource planning; advanced planning and scheduling, manufacturing execution systems; and the interface between manufacturing planning and control processes, logistics processes, and the information system.

SCM 4500: Enterprise Resource Planning Systems in Supply Chain

(Cross-listed with MIS 4500).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (MIS 3010 and SCM 3010) or (IE 1480 and IE 3410)

Enterprise Resource Planning Systems in Supply Chain.

SCM 4530: Supply Chain Planning and Control

Credits: 3. Contact Hours: Lecture 3.

Prereq: SCM 3010

Supply chain planning and control is the process which synchronizes demand with manufacturing and distribution. This course will cover sales and operations planning with emphasis on forecasting, master scheduling, materials requirements planning, inventory management and demand planning. Linking business plans and information systems for integration and distribution channels are also covered. (Typically Offered: Fall)

SCM 4600: Decision Tools for Logistics and Operations Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: SCM 3010

Technical tools and skills required for problem solving and decision making in logistics and operations management. Transportation and network planning, inventory decision making, facility location planning, vehicle routing, scheduling, and production planning. Quantitative tools include linear and integer programming, non-linear programming, and simulation. Emphasis on the use of PC-based spreadsheet programs.

SCM 4610: Principles of Transportation

Credits: 3. Contact Hours: Lecture 3.

Prereq: SCM 3010

Economic, operating, and service characteristics of the various modes of transportation, with a special emphasis on freight transportation. Factors that influence transport demand, costs, market structures, carrier pricing, and carrier operating and service characteristics and their influence on other supply chain costs and supply chain performance.

SCM 4620: Transportation Carrier Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or enrollment in SCM 4610

Analysis of transport users' requirements. Carrier management problems involving ownership and mergers, routes, competition, labor, and other decision areas.

SCM 4660: Global Trade Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: SCM 3010

The global nature of a supply chain causes many sustainability issues. This course will consider how supply chain design and execution affect sustainability. Some discussion of governmental policy will be included. Offered irregularly. (Typically Offered: Fall, Spring)

SCM 4710: Sustainable Supply Chain Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: SCM 3010

The global nature of a supply chain causes many sustainability issues. This course will consider how supply chain design and execution affect sustainability. Some discussion of governmental policy will be included. Offered irregularly. (Typically Offered: Fall, Spring)

SCM 4730: War and Peace and Supply Chains

Credits: 3. Contact Hours: Lecture 3.

Prereq: SCM 3010

Explore how supply chains do or do not support sustainable peace and human flourishing. Topics include how supply chain operations affect peace; how supply chains can be incentivized to encourage peace; how supply chain choices affect peace and what affects these choices; how supply chain certifications affect peace; tools available to supply chain managers to evaluate their decisions with regard to peace; and what business or supply chain models encourage peace.

SCM 4860: Principles of Purchasing and Supply Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: SCM 3010

Sourcing strategies, concepts, tools and dynamics in the context of the integrated supply chain. Make or buy decision, supplier evaluation and selection, global sourcing, the total cost of ownership, contracts and legal terms, negotiation, purchasing ethics, and information systems requirements.

SCM 4900: Independent Study

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

SCM 4910: International Live Case and Study Tour

Credits: 3. Contact Hours: Lecture 1.

Prereq: SCM 3010

Students follow supply chain of major firm from overseas manufacturer to domestic point-of-sale. Students are expected to complete projects and present findings to senior leadership. (Typically Offered: Spring)

SCM 4950: Executive Analysis and Presentation

(Dual-listed with MIS 5950X/ SCM 5950X). (Cross-listed with MIS 4950).

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Sophomore classification in the Ivy College of Business

The development of professional skills with the focus on analyzing real business problems and developing strategic solutions for companies' senior management. Hands-on learning and practices through case studies and real-world examples. Key aspects include business issue identification, analysis and problem-solving, actional solution evaluation, proposal development, and presentation to senior executives. (Typically Offered: Fall)

Courses primarily for graduate students, open to qualified undergraduates:

SCM 5010: Supply Chain Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: Ivy College of Business Graduate Student or instructor permission

Introduction to supply chain management including aspects of operations, logistics and global supply chain strategy development. Topic areas include lean manufacturing and value stream mapping; supplier development and measurement; sustainable supply chain operations; process measurement, management and improvement; supply chain risk and uncertainty; visibility and integration in the supply chain; and inventory control.

SCM 5030: Healthcare Supply Chain Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Healthcare supply chain management presents unique challenges for administrators and providers. Exploration of common supply chain management topics in a healthcare context including purchasing, operations, and logistics. Specific topics include operations in a highly regulated environment, professional services outsourcing, clinical integration via information technologies, service process design, capacity management, and quality and process improvement in a healthcare setting. (Typically Offered: Fall)

SCM 5130: Biorenewables Supply Chain Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Qualified Undergraduate with Permission of Instructor

Evaluation of supply chain logistics related to the field of biorenewables. Unique challenges associated with the biorenewables supply chain are emphasized and examined: cost analysis, market demand & prices, life cycle analysis, environmental impacts, as well as the technological, social, and political factors related to society. (Typically Offered: Spring)

SCM 5200: Decision Models for Supply Chain Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: Ivy College of Business Graduate Student or instructor permission

The application of decision models for supply chain management. Topics include business applications of decision theory, inventory theory, business forecasting, optimization models, transportation and network models, routing problems, and project management.

SCM 5240: Strategic Process Analysis and Improvement

Credits: 3. Contact Hours: Lecture 3.

Prereq: Ivy College of Business graduate student or Engineering Management student or instructor permission

Analysis, management, and improvement of the business processes used to produce and deliver products and services that satisfy customer needs. Process attributes that managers can control to influence the key operational performance measures of throughput time, inventory, cost, quality, and flexibility are discussed. Topics such as theory of constraints, lean production, and six sigma are included.

SCM 5260: Lean Operations in Healthcare

Credits: 3. Contact Hours: Lecture 3.

Prereq: SCM 5030

Now more than ever, the healthcare industry is committed to providing better but cheaper care services, often characterized by increasing efficiency and reducing costs. Toward that goal, the identification and elimination of waste in health care delivery processes are necessary. Lean could be the answer. The course educates on the Lean tools and techniques, enabling the students to look for ways to heal health care from within. The course aims to combine rigor with relevance that prepares practitioners to identify waste in their health care delivery processes and then fabricate processes to reduce or eliminate that waste. Lean methodology has already helped health care organizations to realize many benefits, including reduced patient wait times, shorter hospital stays, decreased risk of medication errors, less inventory, and more patient-focused processes.

SCM 5300X: Applied Supply Chain Analytics

Credits: 3. Contact Hours: Lecture 3.

Prereq: College of Business Graduate Student

Supply chain analytics course showcasing real life applications of analytics (prescriptive, predictive, and descriptive) in various fields of supply chain management, including demand forecasting for supply chain planning, multi-echelon inventory management, and capacity planning for service and manufacturing operations. Students will be using various free software, such as R and AnyLogic, to learn key concepts and techniques in analytics. These learnt skills will then be applied to examples of supply chain decision making. (Typically Offered: Fall)

SCM 5400: Enterprise Supply Chain Information Systems

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

The purpose of this course is to examine the role of enterprise resource planning systems (ERP) in the supply chain. This course will provide students with hands-on experience with a major software application in use by many corporations to manage and improve the efficiency of their supply chain. In particular, this class will utilize an ERP system to help students develop a more process-centric perspective about how a supply chain operates. Students will have the opportunity to use the ORACLE and MICROSOFT ERP software package on key processes that most ERP systems utilize (i.e., purchasing, MRP, forecasting, order fulfillment and pricing). The course is also dedicated to understanding the tactical and operational management of supply chains. This course will discuss issues related to the creation of end-user value through supply chain cost reductions, service improvements, or both.

SCM 5530: Supply Chain Planning and Control

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Supply chain planning and control is the process which synchronizes demand with manufacturing and distribution. Sales and operations planning with emphasis on forecasting, master scheduling, materials requirements planning, inventory management and demand planning. Linking business plans and information systems for integration and distribution channels are also covered. Emphasis on the strategic advantages of linking business plans and demand forecasts. Offered irregularly. (Typically Offered: Fall, Spring)

SCM 5600: Strategic Logistics Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: Ivy College of Business Graduate Student or instructor permission

Positions logistics vis-a-vis supply chain management (SCM). Presents different perspectives on SCM vs. logistics. Describes primary logistics functions: transportation, warehousing, facility location, customer service, order processing, inventory management and packaging. Benefits of and obstacles to the integration of these functions.

SCM 5610: Transportation Management and Policy

Credits: 3. Contact Hours: Lecture 3.

Prereq: SCM 5010 or Permission of Instructor

Analysis of contemporary issues and strategies in transportation management and policy. Emphasis on evaluation of the impacts of transportation policies, new technologies, and strategic carrier and shipper management practices on the freight transportation industry and logistics systems.

SCM 5630: Purchasing and Supply Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: Ivy College of Business Graduate Student or instructor permission

Mechanics, procedures and tools used in purchasing. Recruiting, selecting, developing and managing supply chain partners in order to achieve competitive advantage via superior supply chain management. Factors and information needs for making supply management decisions.

SCM 5660X: Global Trade Management

Credits: 3. Contact Hours: Lecture 3.

Evaluation of the physical, informational, and behavioral flows involved in global trade. The analysis of international logistics as a vital part of the supply chain includes the study of the environment, structure, and management of international logistics systems and their application to channel management. Instruction will be delivered using online resources and assessments along with in-class lectures and activities.

SCM 5710X: Sustainable Supply Chain Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: Ivy College of Business Graduate Student or instructor permission

The global nature of a supply chain causes many sustainability issues. This course will consider how supply chain design and execution affect sustainability. Some discussion of governmental policy will be included. (Typically Offered: Fall)

SCM 5900: Special Topics

Credits: 1-3. Repeatable.

Prereq: Graduate classification and Permission of Instructor

For students who wish to do individual research in a particular area of supply chain management.

SCM 5950X: Executive Analysis and Presentation

(Dual-listed with MIS 4950/ SCM 4950). (Cross-listed with MIS 5950X).

Credits: 3. Contact Hours: Lecture 3.

This course prepares graduate students to analyze complex business issues, develop strategic recommendations, and compete in case competitions. Topics include analysis techniques, strategic decision-making, stakeholder management, and executive-level presentation skills, with a focus on presenting to C-suite executives. (Typically Offered: Fall, Spring)

Courses for graduate students:

SCM 6010: Theoretical Foundations of Supply Chain Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: MGMT 6010 or Permission of Instructor

An overview of the development of supply chain management (SCM) theory, including review of seminal articles in logistics, operations, and purchasing management and theories from allied disciplines (e.g., economics, marketing, sociology, strategic management). Analysis of trends in SCM research topics and methodologies. Identification of emerging and future areas for research and theory development.

SCM 6030: Seminar in Purchasing

Credits: 3. Contact Hours: Lecture 3.

Review of classic purchasing theories. Discussion of contemporary supply management strategy; the role of supply management and its relationship with other functional areas; its impact on logistics and transportation issues; management of supply uncertainties.

SCM 6040: Seminar in Logistics Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or enrollment in SCM 6010

Integration of network, economic, and systems theory in the design, management, and control of logistics systems in the context of integrated supply chain management. Functional areas addressed include transportation, inventory order fulfillment, distribution, and warehousing. Facility location analysis will also be covered.

SCM 6050: Seminar in Operations Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or enrollment in SCM 6010

Review of the research literature on methods of organizing, planning, controlling, and improving manufacturing systems to achieve the desired performance objectives related to cost, quality, speed, and flexibility. The relationship between the performance of the manufacturing system and the performance of the supply chain system will also be discussed.

SCM 6090: Special Topics in SCM

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: SCM 6010 or Permission of Instructor

Review of current issues in SCM. Provides opportunities to read and discuss research articles that made important contributions in SCM literature. Offered irregularly. (Typically Offered: Fall, Spring)

SCM 6500: Research Practicum I

Credits: 1.

Prereq: Ivy College of Business PhD student or instructor permission

Preparation of a research manuscript to be submitted to a peer-reviewed academic journal. Students will work with a faculty mentor on a research project.

SCM 6510: Research Practicum II

Credits: 1.

Prereq: Ivy College of Business PhD student or instructor permission

Preparation of a second research manuscript to be submitted to a peer-reviewed academic journal. Although students work under the supervision of a faculty mentor, the students will take independent responsibility for the research project.

SCM 6990: Dissertation

Credits: 12. Repeatable.

Prereq: Graduate classification and Permission of Instructor

Research.

Sustainable Agriculture (SUSAG)

Courses primarily for graduate students, open to qualified undergraduates:

SUSAG 5090: Agroecosystems Analysis

(Cross-listed with AGRON 5090/ SOC 5090).

Credits: 4. Contact Hours: Lecture 3, Laboratory 4.

Prereq: Graduate Standing or Permission of Instructor

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

SUSAG 5150: Integrated Crop and Livestock Production Systems

(Cross-listed with ABE 5150/ AGRON 5150/ ANS 5150).

Credits: 3. Contact Hours: Lecture 3.

Prereq: SUSAG 5090 or Graduate Classification

Methods to maintain productivity and minimize the negative ecological effects of agricultural systems by understanding nutrient cycles, managing manure and crop residue, and utilizing multispecies interactions. Crop and livestock production within landscapes and watersheds is also considered. Course includes a significant field component, with student teams analyzing Iowa farms. Offered odd-numbered years. (Typically Offered: Fall)

SUSAG 5300: Ecologically Based Pest Management Strategies

(Cross-listed with AGRON 5300/ ENT 5300/ PLP 5300).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Durable, least-toxic strategies for managing weeds, pathogens, and insect pests, with emphasis on underlying ecological processes. Offered odd-numbered years. (Typically Offered: Fall)

SUSAG 5440: Sociology of Food and Agricultural Systems

(Dual-listed with SOC 4440). (Cross-listed with SOC 5440).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate classification

Social organization of food and fiber production, processing, and distribution systems. Sociological comparison of conventional and alternative production systems; gender roles in agriculture and food systems; local, national and global food systems; perspectives on food and agricultural research and policy. Offered even-numbered years. (Typically Offered: Fall)

SUSAG 5460: Strategies for Diversified Food and Farming Systems

(Cross-listed with AGRON 5460/ HORT 5460).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Project-focused engagement in food and farming systems using tools and perspectives drawn from multiple disciplines. Includes a field component. Offered odd-numbered years. (Typically Offered: Spring)

SUSAG 5490: Sociology of the Environment

(Cross-listed with SOC 5490).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Social causes and social consequences of environmental problems. Interrelationship between social inequality and environmental inequality. Social construction and social experience of the environment. Contemporary developments in the social theory of the environment. International and domestic implications.

SUSAG 5710: Agroforestry Systems

(Dual-listed with NREM 4710/ SUSAG 4710). (Cross-listed with NREM 5710).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Concepts of sustainable land use, agroecological dynamics, and component interactions of agroforestry systems. Agroforestry systems in temperate and tropical regions. Design and evaluation techniques for agroforestry systems. Ecological, socioeconomic and political aspects of agroforestry. Offered even-numbered years. Meets International Perspectives Requirement. (Typically Offered: Spring)

SUSAG 5840: Organic Agricultural Theory and Practice

(Dual-listed with AGRON 4840/ HORT 4840/ SUSAG 4840). (Cross-listed with HORT 5840/ AGRON 5840).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Understanding of the historical origins and ecological theories underpinning the practices involved in organic agriculture. Interdisciplinary examination of crop and livestock production and socioeconomic processes and policies in organic agriculture from researcher and producer perspectives. Offered odd-numbered years. (Typically Offered: Spring)

SUSAG 5900: Special Topics

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

For students wishing to conduct in-depth study of a particular topic in sustainable agriculture. (Typically Offered: Fall, Spring, Summer)

SUSAG 5990: Creative Component

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Pre-enrollment contract required. For MS students pursuing the non-thesis degree option. Final product is a creative component. (Typically Offered: Fall, Spring, Summer)

Courses for graduate students:

SUSAG 6000: Sustainable Agriculture Colloquium

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Weekly seminar for graduate students in the Sustainable Agriculture program. (Typically Offered: Fall, Spring)

SUSAG 6100: Foundations of Sustainable Agriculture

(Cross-listed with ABE 6100/ AGRON 6100/ ANTHR 6100/ SOC 6100).

Credits: 3. Contact Hours: Lecture 3.

Historical, biophysical, socioeconomic, and ethical dimensions of agricultural sustainability. Strategies for evaluating existing and emerging agricultural systems in terms of the core concepts of sustainability and their theoretical contexts. (Typically Offered: Fall)

SUSAG 6990: Research

Credits: 1-30. Repeatable.

Prereq: Department Permission for Course

MS and PhD thesis and dissertation research. (Typically Offered: Fall, Spring, Summer)

Sustainable Environments (SUSE)

Courses primarily for graduate students, open to qualified undergraduates:

SUSE 5010: Sustainable Design in Communities

Credits: 5. Contact Hours: Lecture 2, Studio 6.

Prereq: Graduate Standing or Permission of Instructor

Exploring the challenges faced in implementing social, environmental, and economic sustainable solutions, this studio engages students in an interdisciplinary, team-oriented, and project-based learning environment through engagement with a Central Iowa community.

SUSE 5020: Sustainable Design Capstone Studio

Credits: 6. Contact Hours: Studio 12.

Prereq: Graduate Standing or Permission of Instructor

This advanced studio provides a community-based context for an interdisciplinary design team to work on a variety of self-directed, applied design research and intervention projects at multiple scales. Students utilize a common theoretical framework to organize their research and inform their interventions. Field trips.

SUSE 5110: Sustainable Design Colloquium I

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Study and discuss practices of sustainable design and design research. Investigate responsibilities, roles, technologies and methods for studying and advancing the art and science of designing sustainable environments.

SUSE 5120: Sustainable Design Seminar

Credits: 1. Contact Hours: Lecture 1.

Prereq: Graduate Standing or Permission of Instructor

Students begin design research in sustainability issues by learning how to build a network of professional and academic contacts related to their individual research topics. Assignments include developing and engaging in an immersion experience related to their research.

SUSE 5130: Sustainable Design Research Writing

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Students develop a comprehensive and conclusive research manuscript for submission to a conference or journal in their discipline. SUSE student manuscripts detail their capstone projects. Non-majors compose papers detailing completed research projects in their own discipline.

SUSE 5210: Foundation of Sustainable Design

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to the broad frameworks and tools for implementing sustainability among a variety of environments, industries, and enterprises. Investigates the role and opportunity for sustainable design strategies.

SUSE 5310: Human Dimensions of Sustainability

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

This interdisciplinary seminar uses applied research with communities to ground students in the issues and conditions impacting social and economic sustainability. Students develop a broad understanding of community sustainability through weekly readings, discussions, and small made objects. Topics of focus include university-community partnerships, participatory design, and social constructions of sustainability.

SUSE 5400: Methods for Sustainable Design

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Overview of qualitative, quantitative and design research methods. In-depth application of methods relevant to capstone project proposal development (SUSE 5020). Proposal must address research questions, articulation of research methods and preliminary findings grounded within contemporary theoretical discourse on Sustainable Environments. (Typically Offered: Spring)

SUSE 5500: Making Resilient Environments

(Cross-listed with CRP 5500).

Credits: 3. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Major theories and ideas revolving around the concept of resilience. Assessing the social and political processes associated with policy making for resilience. Application of the concept of resilience in order to understand and evaluate environments. Evaluate the different approaches toward resilience and develop an understanding of the relationship between sustainability and resilience. Case studies of communities that proactively prepare for, absorb, recover from, and adapt to actual or potential future adverse events. (Typically Offered: Spring)

Technology Systems Management (TSM)

Courses primarily for undergraduates:

TSM 1100: Introduction to Technology

Credits: 1. Contact Hours: Lecture 1.

Prereq: Agricultural Systems Technology or Industrial Technology major

Team-oriented introduction to agricultural systems technology and industrial technology. Internships, careers, competencies, academic success strategies, transition to academic life. (Typically Offered: Fall)

TSM 1110: Experiencing Technology

Credits: 1. Contact Hours: Lecture 1.

Prereq: Agricultural Systems Technology or Industrial Technology major

Team-oriented experiences in a spectrum of topics common to the practice of technology. Internships, faculty and alumni panels, industry visits, and lab demonstrations. (Typically Offered: Fall, Spring)

TSM 1150: Solving Technology Problems

Credits: 3.

Prereq: Credit or enrollment for credit in MATH 1400 or higher

Solving technology problems using modern hardware and software tools for data-driven solutions. Problem solving cycle, unit conversion, unit factor method, SI and engineering units, significant figures, data collecting and cleaning, error analysis, data visualization, curve fitting, and computer coding fundamentals (data types, flow control, I/O handling, visualization, debugging). Strong emphasis on critical thinking, systematic problem solving, and effective communication. (Typically Offered: Fall, Spring)

TSM 1160: Introduction to Design in Technology

Credits: 3.

Use of parametric solid modeling software to create three dimensional solid models and document parts and assemblies. Includes national and international standards for documentation, design projects, and teamwork. Rapid prototyping design creation, 3D printing, assemblies, rendering, and detailing technical drawings. (Typically Offered: Fall, Spring)

TSM 2010: Preparing for Workplace Seminar

(Cross-listed with ABE 2010).

Credits: 1. Contact Hours: Lecture 1.

Prereq: Major in AE, AST, BSE, or ITEC; Sophomore classification

8 week course. Professionalism in the context of the engineering/technical workplace. Development of intrapersonal and interpersonal qualities including talent assessment; key workplace competency demonstration; leadership practice assessment; preparation of resume; cover letter preparation and behavioral-based interviewing; readiness for internship attainment. (Typically Offered: Fall, Spring)

TSM 2100: Fundamentals of Technology

Credits: 3. Contact Hours: Lecture 3.

Prereq: (TSM 1150, ENGR 1600, ABE 1600, AER E 1600, CE 1600, CHE 1600, CPRE 1850, EE 1850, IE 1480, ME 1600, or SE 1850); MATH 1400 or higher
Introduction to problem solving related to fundamental agricultural and/or industrial technology systems and mathematical tools needed for data analysis. Basic laws of energy, force, and mass applied to technology systems such as: mechanical power transmission; heating, ventilation and air conditioning; electrical circuits. Introduction to engineering economics: using the time value of money to make economic decisions. (Typically Offered: Fall, Spring)

TSM 2140: Managing Technology Projects

Credits: 1. Contact Hours: Lecture 2.

Prereq: (ABE 2010 or TSM 2010); Sophomore classification

8 week course. Introduction to project management principles. Use of project management in technology-based projects for academic, industry, and personal use. (Typically Offered: Fall, Spring)

TSM 2160: Advanced Technical Graphics, Interpretation, and CAD

Credits: 2.

Prereq: TSM 1160

Advanced computer-aided-design topics incorporating 3D design and documentation used in manufacturing settings. Topics include: geometric dimensioning and tolerancing, weldments, sheet metal parts, advanced visualization, feature based design of parts and assemblies. (Typically Offered: Fall, Spring)

TSM 2400: Introduction to Advanced Manufacturing and Metals Processing

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: MATH 1450 or higher.

A study of selected materials, properties, and related processes used in metals manufacturing including: CNC lathes, Aluminum die casting, and welding. Introduction to engineering economic tools and their use in financial decision making. Lecture and laboratory activities focus on metals manufacturing processes. (Typically Offered: Fall, Spring)

TSM 2410: Introduction to Manufacturing Processes for Plastics

(Cross-listed with FSHN 2410).

Credits: 2. Contact Hours: Lecture 1, Laboratory 2.

Prereq: MATH 1450 or higher.

A study of selected materials and related processes used in plastics manufacturing. Lecture and laboratory activities focus on materials, properties, and processes. (Typically Offered: Fall, Spring)

TSM 2415: Introduction to Lean Manufacturing Systems

Credits: 3. Contact Hours: Laboratory 2, Lecture 2.

Prereq: TSM 1150

Introduction to Lean manufacturing tools and principles. Emphasis on minimizing waste and improving operational performance using Lean tools, concepts, and theories Lab will emphasize application of these topics using hands-on projects. (Typically Offered: Fall, Spring)

TSM 2700: Principles of Injury Prevention and Safety

Credits: 3. Contact Hours: Lecture 3.

Basic foundations of injury causation and prevention from a personal perspective in home, motor vehicle, and the public environment, and a management perspective within the work environment. Offered online only. (Typically Offered: Fall, Spring)

TSM 3100: Total Quality Improvement

Credits: 3. Contact Hours: Lecture 3.

Prereq: (STAT 1010 or STAT 1040); Junior classification

Introduction to the fundamental concepts of TQM - Deming style of management, statistical studies to understand the behavior of products, processes, or services, and how to define and document processes and customer focus. Introduction to continuous improvement tools and methods - emphasis on critical thinking and problem solving skills. (Typically Offered: Fall, Spring)

TSM 3220: Preservation of Grain Quality

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 1400 or Higher

Principles and management for grain quality preservation: quality measurement; drying and storage; fans and airflow through grain; handling methods; insect pest control; and grain quality monitoring. (Typically Offered: Spring)

TSM 3220L: Preservation of Grain Quality Laboratory

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Credit or enrollment for credit in TSM 3220

Hands-on experiences in the principles and management for grain quality preservation: Quality measurement; drying and storage; fans and airflow through grain; handling methods; system planning; insect pest control; grain quality monitoring. Industry tour. (Typically Offered: Spring)

TSM 3240: Soil and Water Conservation Management

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: MATH 1400 or higher.

Introduction to engineering and conservation principles applied to the planning of erosion control systems, water control structures, water quality management, and drainage and irrigation systems. (Typically Offered: Spring)

TSM 3250: Biorenewable Systems

(Cross-listed with ABE 3250).

Credits: 3. Contact Hours: Lecture 3.

Prereq: CHEM 1630 or higher; MATH 1400 or higher

Converting biorenewable resources into bioenergy and biobased products. Biorenewable concepts as they relate to drivers of change, feedstock production, processes, products, co-products, economics, and transportation/logistics. (Typically Offered: Fall)

TSM 3270: Livestock and Poultry Production: Facilities, Technology, and Management

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: TSM 2100 or (credit or concurrent enrollment in ABE 2160)

Systems-based planning and assessment of confined livestock facilities. Housing evaluation, planning, and management of ventilation, water, and feed systems. Principles of nutrient management planning, manure handling/storage design. Evaluating animal responses to their environment with traditional metrics and precision livestock technologies to enhance welfare and production. Species-specific assessment of production economics, environmental impact, and sustainability. (Typically Offered: Fall)

TSM 3300: Agricultural Machinery and Power Management

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: MATH 1450 or higher; TSM 2100

Selection, sizing, and operational principles of tractors and machinery systems. Cost analysis and computer techniques applied to planning and management of agricultural machine systems. Principles, operation, and application of agricultural machinery. (Typically Offered: Spring)

TSM 3350: Tractor Power

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: MATH 1450 or higher; TSM 2100

Theory and construction of tractor engines, mechanical power trains and hydraulic systems. Introduction to traction, chassis mechanics, and hydraulic power. (Typically Offered: Fall)

TSM 3370: Fluid Power Systems Technology

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: TSM 2100

Fundamental fluid power principles, symbols and schematics. Function and performance of components such as pumps, valves, actuators, and hydro static transmissions. Analysis of fluid power circuits and systems. Introduction to electrohydraulics. Hands on laboratory experiences building and troubleshooting hydraulic circuits. (Typically Offered: Fall, Spring)

TSM 3400: Advanced Automated Manufacturing Processes

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: MATH 1510 or higher; TSM 2100; TSM 2160; TSM 2400

NC programming operations and machining practices for CNC mills and lathes. Transfer of part descriptions into detailed process plans, tool selection, and NC codes. Use of CAD/CAM for automated NC programming in 2D/3D machining operations of student designed parts. (Typically Offered: Fall, Spring)

TSM 3630: Electrical Power and Electrical Machinery Systems

Credits: 3. Contact Hours: Lecture 3, Laboratory 3.

Prereq: MATH 1450 or higher; TSM 2100

Fundamentals of electrical theory, parameters, application, and safety. Measurement, design, and assessment of single-phase, split-phase, and three-phase circuits. AC motor selection and performance. Reactive power and correction. Circuit design and safety systems. Emphasis on agricultural and industrial applications. (Typically Offered: Fall, Spring)

TSM 3650: Electrical Controls and Sensor Systems

Credits: 3. Contact Hours: Laboratory 2, Lecture 2.

Prereq: TSM 3630

Fundamentals and applications of ladder and digital logic. Electric motors and controls. Sizing and measurement of sensory circuitry, including circuit conductors, breakers, and relays. Applications to agriculture and industry. . (Typically Offered: Fall, Spring)

TSM 3700: Occupational Safety

Credits: 3. Contact Hours: Lecture 3.

Prereq: TSM 2700; Junior classification

Identifies safety and health risks in industrial work environments. Focus on how managers and supervisors meet their responsibilities for providing a safe workplace for their employees. Includes the identification and remediation of workplace hazards. (Typically Offered: Fall, Spring)

TSM 3710: Occupational Safety Management

Credits: 2. Contact Hours: Lecture 2.

Introduction to occupational safety and health administration and management. Focus on development and management of safety programs and obtaining employee involvement in occupational safety programs. (Typically Offered: Spring)

TSM 3720: Legal Aspects of Occupational Safety and Health

Credits: 2. Contact Hours: Lecture 2.

Prereq: TSM 3710

A review of the common legal issues facing safety practitioners in the workplace. Includes OSHA, EPA and DOT regulations; workers' compensation, as well as common liability issues. (Typically Offered: Fall)

TSM 3760: Fire Protection and Prevention

Credits: 3. Contact Hours: Lecture 3.

An overview of the current problems and technology in the fields of fire protection and fire prevention, with emphasis on industrial needs, focusing on the individual with industrial safety responsibilities.
(Typically Offered: Fall)

TSM 3800: Fundamentals, Applications, and Modeling of Biological Systems

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: BIOL 2120; MICRO 2010

Analysis of biological systems, through the study of mass, energy, and information transport in microbial, plant, animal, and human systems. Fundamentals, applications and modeling of biological processes, ecological interactions, and biomanufacturing operations.

TSM 3930A: Topics in Technology: Agriculture and Biosystems Management

Credits: 1-4. Contact Hours: Lecture 4.

Offered as demand warrants. Web-based instruction. (Typically Offered: Fall, Spring, Summer)

TSM 3930B: Topics in Technology: Machine Systems

Credits: 1-4. Contact Hours: Lecture 4.

Offered as demand warrants. Web-based instruction. (Typically Offered: Fall, Spring, Summer)

TSM 3930C: Topics in Technology: Manufacturing

Credits: 1-4. Contact Hours: Lecture 4.

Offered as demand warrants. Web-based instruction. (Typically Offered: Fall, Spring, Summer)

TSM 3930D: Topics in Technology: Occupational Safety

Credits: 1-4. Contact Hours: Lecture 4.

Offered as demand warrants. Web-based instruction. (Typically Offered: Fall, Spring, Summer)

TSM 3930E: Topics in Technology: Chemical Application Systems

Credits: 1-4. Contact Hours: Lecture 4.

Offered as demand warrants. Web-based instruction. (Typically Offered: Fall, Spring, Summer)

TSM 3930F: Topics in Technology: Agricultural Safety and Health

Credits: 1-4. Contact Hours: Lecture 4.

Offered as demand warrants. Web-based instruction. (Typically Offered: Fall, Spring, Summer)

TSM 3930G: Topics in Technology: Electronic Integration for Agriculture and Production Systems

Credits: 1-4. Contact Hours: Lecture 4.

Offered as demand warrants. Web-based instruction. (Typically Offered: Fall, Spring, Summer)

TSM 3930I: Topics in Technology: Irrigation Systems Management

Credits: 1-4. Contact Hours: Lecture 4.

Offered as demand warrants. Web-based instruction. (Typically Offered: Fall, Spring, Summer)

TSM 3930J: Topics in Technology: Machinery Management Using Precision Agriculture Technology

Credits: 1-4. Contact Hours: Lecture 4.

Offered as demand warrants. Web-based instruction. (Typically Offered: Fall, Spring, Summer)

TSM 3970: Summer Internship in Technology

Credits: Required. Repeatable.

Prereq: Sophomore or higher classification; AST or ITEC major; Permission of Instructor

A supervised summer work experience in an approved learning setting with application to technology practices and principles. Written reports, self and employer evaluation, and reflection required. Minimum GPA requirement. (Typically Offered: Summer)

TSM 3990: Internship in Technology

Credits: Required. Repeatable.

Prereq: Internship Coordinator Permission

A supervised work experience that occurs during the fall or spring semester in an approved learning setting with application to technology practices and principles. Reporting during work experience, self and employer evaluation, and reflection required. Minimum GPA requirement. (Typically Offered: Fall, Spring)

TSM 4150: Applied Project Management in Technology

Credits: 2. Contact Hours: Lecture 1, Laboratory 2.

Prereq: Senior classification; TSM 2140; credit or concurrent enrollment in TSM 3100

Implementation of project management principles using case studies and teamwork; problem definition in a technology context; oral and written communication skills development; development of a charter for a technology capstone project. (Typically Offered: Fall, Spring)

TSM 4160: Technology Capstone

Credits: 3. Contact Hours: Lecture 1, Laboratory 4.

Prereq: TSM 4150

Application of project management tools to a technology capstone project; development and evaluation of potential solutions using tools from the technology curriculum; problem resolution emphasizing communication, critical analysis, and planning techniques; presentation of project through oral presentation and written reports with input from client, faculty, and other stakeholders. (Typically Offered: Fall, Spring)

TSM 4330: Precision Agriculture

(Dual-listed with TSM 5330).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Junior classification

Geographic information systems (GIS) and global positioning systems (GPS). Hardware systems for precision farming emphasized. Autosteering and automatic implement control systems. Collection and management of yield data. Sampling strategies for precision farming. Introduction to building fertilizer prescriptions and recommendations. Economic benefits of precision farming systems. (Typically Offered: Fall)

TSM 4400: Cellular Lean Manufacturing Systems

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: TSM 3100

Introduction to lean manufacturing tools and principles, which may include Just-In-Time (JIT), Value Stream Mapping (VSM), Kaizen, Single Minute Exchange of Die (SMED), 5S, Total Productive Maintenance, Standardized Work, Takt Time, and A3. Emphasis on minimizing waste and improving operational performance through tools such as Assembly Line Balancing, Little's Law, and Queuing Theory. Competency development through application using discrete event simulations, case studies, teamwork, industry-related lean projects, and industry guests. (Typically Offered: Fall, Spring)

TSM 4415: Lean Manufacturing Systems

Credits: 3. Contact Hours: Laboratory 2, Lecture 2.

Prereq: TSM 2415

Review of principles and concepts required for manufacturing system design to meet customer demand in production, quality, and on-time delivery, while continuously reducing manufacturing costs. Emphasis on application of Lean Manufacturing principles, simulation techniques, and Kaizen methodologies with hands-on projects. (Typically Offered: Fall, Spring)

TSM 4430: Statics and Strength of Materials for Technology

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: PHYS 1310 or above; MATH 1450 or higher

Application of standard analytic and computer based techniques of solving problems related to force and moments. The properties of materials and how to select appropriate materials for a particular design are reviewed. (Typically Offered: Fall, Spring)

TSM 4440: Facility Planning

Credits: 3. Contact Hours: Lecture 3.

Prereq: (STAT 1010 or STAT 1040); TSM 2160; TSM 2400

Fundamental principles and practices in designing, evaluating, and organizing new or existing facilities. Emphasis on AutoCAD-based facility design and production flow analysis, activity relationship analysis, lighting analysis, time studies, materials handling, supporting services design, and optimal facility location analysis. (Typically Offered: Fall, Spring)

TSM 4490: Applied Nondestructive Testing and Evaluation.

(Dual-listed with TSM 5490).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: PHYS 1310 or above; MATH 1450 or higher

Scientific principles and rationale for non-destructive testing and evaluation. Assessment of material condition and detection of defects in manufacturing or inservice. Testing methods and their application to agriculture and industry. Research project required for graduate credit. (Typically Offered: Fall)

TSM 4550: Feed Processing and Technology

(Dual-listed with TSM 5550).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Junior classification

Introduction to formula feed manufacturing and the animal feed industry. Overview of feed ingredients and formulation, understanding and operation of feed production processing equipment including principles of conveying, grinding, mixing, conditioning, pelleting, and other processing techniques, and the formulation of concentrates, premixes, and rations. Students will become knowledgeable about the manufacturing of various animal feed types such as pelleted and extruded feed, aqua (fish) feed, liquid feeds, poured and pressed blocks, steam flaked feed, and pet food, and their effect on animal performance and health. Students will gain hands-on experience in feed manufacturing during weekly lab sessions at a full-scale university owned feed mill and grain science complex. (Typically Offered: Fall)

TSM 4570: Feed Safety, Ingredient Quality and Analytics

(Dual-listed with TSM 5570).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Junior classification

Concepts of feed and grain safety and quality, including hazards and risks associated with common feeds and feed ingredients. Methods to monitor, manage, and mitigate hazards and risks in the context of feed and grain industries. Government regulations applicable to feed and grain safety. Differences between safety and quality factors, how they are measured and then used for decision-making (marketing, processing, or safe-use). (Typically Offered: Spring)

TSM 4650: Automation Systems

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: TSM 3630

Theory and applications of automation systems. Emphasizes features, capabilities, design and programming skills of Programmable Logic Controller (PLC) based industrial control systems. Introduction to industrial robots and sensors. (Typically Offered: Fall, Spring)

TSM 4700: Industrial Hygiene: Physical, Chemical, and Biological Hazards

(Dual-listed with TSM 5700).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 1510 or higher.

A qualitative and quantitative introduction to health effects of chemical, biological, and physical hazards in a workplace. (Typically Offered: Spring)

TSM 4710: Safety Laboratory

(Dual-listed with TSM 5710).

Credits: 1. Contact Hours: Laboratory 2.

Prereq: Credit or enrollment in TSM 4700

Introduction to equipment, methods, and strategies to measure, evaluate, control, and research hazards and risk in the workplaces. (Typically Offered: Spring)

TSM 4770: Risk Analysis and Management

(Dual-listed with TSM 5770).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 1510; (STAT 1010 or STAT 1040)

Risk analysis and management focuses on developing a risk oriented pattern of thinking that is appropriate for today's complex world. The tools that will be gained in this course will be helpful in recognizing, understanding, and analyzing hazards and risks in modern complex systems. (Typically Offered: Fall)

TSM 4900H: Independent Study: Honors

Credits: 1-4. Repeatable.

Prereq: Junior or Senior classification; Department Permission; Membership in the University Honors Program

Arranged: Additional meetings or activity required. (Typically Offered: Fall, Spring, Summer)

TSM 4900I: Independent Study: Manufacturing

Credits: 1-4. Repeatable.

Prereq: Junior or senior classification; permission of department

Arranged: Additional meetings or activity required. (Typically Offered: Fall, Spring, Summer)

TSM 4900J: Independent Study: Agriculture and Biosystems Management

Credits: 1-4. Repeatable.

Prereq: Junior or senior classification; permission of department

Arranged: Additional meetings or activity required. (Typically Offered: Fall, Spring, Summer)

TSM 4900M: Independent Study: Machine Systems

Credits: 1-4. Repeatable.

Prereq: Junior or senior classification; permission of department

Arranged: Additional meetings or activity required. (Typically Offered: Fall, Spring, Summer)

TSM 4900O: Independent Study: Occupational Safety

Credits: 1-4. Repeatable.

Prereq: Junior or senior classification; permission of department

Graduation Restriction: A maximum of 4 credits of TSM 4900 may be used toward the total credits required for graduation. (Typically Offered: Fall, Spring, Summer)

TSM 4930A: Workshop in Technology: Agriculture and Biosystems Management

Credits: 1-4. Contact Hours: Lecture 3.7.

Repeatable.

Offered as demand warrants. (Typically Offered: Fall, Spring, Summer)

TSM 4930B: Workshop in Technology: Machine Systems

Credits: 1-4. Repeatable.

Offered as demand warrants. (Typically Offered: Fall, Spring, Summer)

TSM 4930C: Workshop in Technology: Manufacturing

Credits: 1-4. Repeatable.

Offered as demand warrants. (Typically Offered: Fall, Spring, Summer)

TSM 4930D: Workshop in Technology: Occupational Safety

Credits: 1-4. Repeatable.

Offered as demand warrants. Offered on a satisfactory-fail basis only.

TSM 4950: Agricultural and Biosystems Engineering Department Study Abroad Preparation or Follow-up

(Cross-listed with ABE 4950).

Credits: 1-2. Repeatable.

Preparation for, or follow-up of, study abroad experience (4960). For preparation, course focuses on understanding the tour destination through readings, discussions, and research on topics such as the regional industries, climate, crops, culture, economics, food, geography, government, history, natural resources, and public policies. For follow-up, course focuses on presentations by students, report writing, and reflection. Students enrolled in this course intend to register for 4960 the following term or have had taken 4960 the previous term. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

TSM 4960: Agricultural and Biosystems Engineering Department Study Abroad

(Cross-listed with ABE 4960).

Credits: 1-4. Repeatable.

Prereq: Academic Advisor Permission for Course

Tour and study at international sites relevant to disciplines of industrial technology, biological systems engineering, agricultural systems technology, and agricultural engineering. Location and duration of tours will vary. Trip expenses paid by students. Pre-trip preparation and/or post-trip reflection and reports arranged through 4950. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

TSM 5330: Precision Agriculture

(Dual-listed with TSM 4330).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Geographic information systems (GIS) and global positioning systems (GPS). Hardware systems for precision farming emphasized. Autosteering and automatic implement control systems. Collection and management of yield data. Sampling strategies for precision farming. Introduction to building fertilizer prescriptions and recommendations. Economic benefits of precision farming systems. (Typically Offered: Fall)

TSM 5400: Advanced Design and Manufacturing

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Application of manufacturing process improvement and control methodologies; exploration of advanced manufacturing strategies and equipment; function and operation of advanced automated manufacturing equipment including water jets, wire EDMs and 5-axis mills. (Typically Offered: Spring)

TSM 5490: Applied Nondestructive Testing and Evaluation.

(Dual-listed with TSM 4490).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Scientific principles and rationale for non-destructive testing and evaluation. Assessment of material condition and detection of defects in manufacturing or inservice. Testing methods and their application to agriculture and industry. Research project required for graduate credit. (Typically Offered: Fall)

TSM 5550: Feed Processing and Technology

(Dual-listed with TSM 4550).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to formula feed manufacturing and the animal feed industry. Overview of feed ingredients and formulation, understanding and operation of feed production processing equipment including principles of conveying, grinding, mixing, conditioning, pelleting, and other processing techniques, and the formulation of concentrates, premixes, and rations. Students will become knowledgeable about the manufacturing of various animal feed types such as pelleted and extruded feed, aqua (fish) feed, liquid feeds, poured and pressed blocks, steam flaked feed, and pet food, and their effect on animal performance and health. Students will gain hands-on experience in feed manufacturing during weekly lab sessions at a full-scale university owned feed mill and grain science complex. (Typically Offered: Fall)

TSM 5570: Feed Safety, Ingredient Quality and Analytics

(Dual-listed with TSM 4570).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Concepts of feed and grain safety and quality, including hazards and risks associated with common feeds and feed ingredients. Methods to monitor, manage, and mitigate hazards and risks in the context of feed and grain industries. Government regulations applicable to feed and grain safety. Differences between safety and quality factors, how they are measured and then used for decision-making (marketing, processing, or safe-use). (Typically Offered: Spring)

TSM 5700: Industrial Hygiene: Physical, Chemical, and Biological Hazards

(Dual-listed with TSM 4700).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

A qualitative and quantitative introduction to health effects of chemical, biological, and physical hazards in a workplace. (Typically Offered: Spring)

TSM 5710: Safety Laboratory

(Dual-listed with TSM 4710).

Credits: 1. Contact Hours: Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Introduction to equipment, methods, and strategies to measure, evaluate, control, and research hazards and risk in the workplaces. (Typically Offered: Spring)

TSM 5750: Safety and Public Health Issues in Modern Society

Credits: 2. Contact Hours: Lecture 2.

Repeatable, maximum of 2 credits.

Prereq: Graduate Standing or Permission of Instructor

Exploration and analysis of current safety and public health issues impacting society. The focus will be on topics that impact individuals in work, public, and home environments.

TSM 5770: Risk Analysis and Management

(Dual-listed with TSM 4770).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Risk analysis and management focuses on developing a risk oriented pattern of thinking that is appropriate for today's complex world. The tools that will be gained in this course will be helpful in recognizing, understanding, and analyzing hazards and risks in modern complex systems. (Typically Offered: Fall)

TSM 5900A: Special Topics in Technology: Agriculture and Biosystems Management

Credits: 1-4. Repeatable, maximum of 4 credits.

Prereq: Instructor Permission for Course

Special Topics in Technology: Agriculture and Biosystems Management. (Typically Offered: Fall, Spring, Summer)

TSM 5900B: Special Topics in Technology: Machine Systems

Credits: 1-4. Repeatable, maximum of 4 credits.

Prereq: Instructor Permission for Course

Special Topics in Technology: Machine Systems. (Typically Offered: Fall, Spring, Summer)

TSM 5900C: Special Topics in Technology: Manufacturing

Credits: 1-4. Repeatable, maximum of 4 credits.

Prereq: Instructor Permission for Course

Special Topics in Technology: Manufacturing. (Typically Offered: Fall, Spring, Summer)

TSM 5900D: Special Topics in Technology: Occupational Safety

Credits: 1-4. Repeatable, maximum of 4 credits.

Prereq: Instructor Permission for Course

Special Topics in Technology: Occupational Safety. (Typically Offered: Fall, Spring, Summer)

TSM 5930: Workshop in Technology

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Workshop in Technology.

TSM 5990: Creative Component

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

A discipline-related problem to be identified and completed under the direction of the program advisor. Three credits required for all nonthesis master's degree students. (Typically Offered: Fall, Spring, Summer)

Courses for graduate students:

TSM 6010: Graduate Seminar

(Cross-listed with ABE 6010).

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Keys to starting a successful graduate research project. Effective literature review, formulating research questions, and setting goals. Practicing effectively communicating research and science. Effective strategies for scholarly writing, professional development, responding to feedback, peer-reviewing, successful publishing in journals, and curating scholarly output. (Typically Offered: Fall)

TSM 6520: Program and Learner Evaluation

Credits: 3. Contact Hours: Lecture 3.

Techniques for evaluating learners, facilities, programs, and staff utilizing theories for developing measurement instruments. Outcomes assessment is emphasized.

TSM 6550: Academic Leadership in Technology and Engineering

Credits: 3. Contact Hours: Lecture 3.

A discussion of faculty roles in technology and engineering disciplines, including strategies for dealing with programs, personnel, and constituencies. Leadership skills involving team formation, team operation, and conflict resolution are addressed. Emphasis is placed on the servant leadership model.

TSM 6570: Curriculum Development in Technology and Engineering

Credits: 3. Contact Hours: Lecture 3.

Basic concepts, trends, practices, and factors influencing curriculum development, techniques, organization and procedures. Emphasis will be given to course development using the backward design process.

TSM 6940: Teaching Practicum

(Cross-listed with ABE 6940).

Credits: 1-3.

Graduate student experience in the agricultural and biosystems engineering departmental teaching programs. (Typically Offered: Fall, Spring)

TSM 6970: Internship in Technology

Credits: Required. Repeatable.

One semester and one summer maximum per academic year professional work period. (Typically Offered: Fall, Spring, Summer)

TSM 6990: Research

Credits: 1-6. Repeatable.

Prereq: Instructor Permission for Course

Research. (Typically Offered: Fall, Spring, Summer)

Theatre (THTRE)

Courses primarily for undergraduates:

THTRE 1060: Introduction to the Performing Arts

Credits: 3. Contact Hours: Lecture 3.

An audience oriented, broad-based, survey of the performing arts which emphasizes theatre and includes segments on television, radio and podcasts, film, dance, music, and video games. (Typically Offered: Fall, Spring)

THTRE 1100: Theatre and Society

Credits: 3. Contact Hours: Lecture 3.

An introduction to Theatre focusing on its relationship with society throughout history. (Typically Offered: Fall, Spring)

THTRE 1510: Actor's Voice and Movement

Credits: 3. Contact Hours: Lecture 3.

Study, exploration, and practice of physical and vocal techniques that build expressiveness for the performing artist. (Typically Offered: Fall, Spring)

THTRE 1550: Introduction to Theatrical Drafting

Credits: 1. Contact Hours: Lecture 1.

Repeatable, maximum of 2 times.

An introduction to the basic concepts and techniques utilized in Computer-Aided (CAD) Drafting. Students will learn a variety of techniques utilizing the Vectorworks and/or other drafting software through a series of in-class training and workbook exercises designed to build a foundation of skills that students will require in future theatrical design courses. (Typically Offered: Fall, Spring, Summer)

THTRE 2240: Concert and Theatre Dance

(Cross-listed with DANCE 2240).

Credits: 0.5-2. Contact Hours: Laboratory 3.

Repeatable, maximum of 6 credits.

Choreography, rehearsal, and performance in campus dance concerts and/or musical theatre productions. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

THTRE 2500: Technical Theatre Practicum

Credits: 1-2. Repeatable, maximum of 6 credits.

Practice in various aspects of technical theatre production. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

THTRE 2510: Acting Foundations

Credits: 3. Contact Hours: Lecture 3.

Theory and practice in fundamentals of acting. (Typically Offered: Fall, Spring)

THTRE 2550: Introduction to Theatrical Production

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Standard structure and procedures, historical overview of performing arts production including the design and creation of scenery, costumes and lighting. (Typically Offered: Fall, Spring)

THTRE 2630: Script Analysis

Credits: 3. Contact Hours: Lecture 3.

Theory, analysis, and interpretation of play scripts for production. (Typically Offered: Fall, Spring)

THTRE 2800: Special Topics

Credits: 1-4. Contact Hours: Lecture 4.

Repeatable, maximum of 12 credits.

Special topics in Theatre and Performing Arts.

THTRE 2900: Special Projects

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: 3 credits in THTRE; Permission of Instructor
(Typically Offered: Fall, Spring, Summer)

THTRE 3010: Theatre Performance Practicum

Credits: 1-3. Repeatable, maximum of 12 credits.

Study, rehearsal, and performance of fully produced theatrical works. Engage in staging, ensemble building, character analysis, and performance while participating in the process of mounting a fully realized theatrical production. (Typically Offered: Fall, Spring)

THTRE 3160: Creative Writing: Playwriting

(Cross-listed with ENGL 3160).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500; Sophomore classification

Progresses from production of scenes to fully developed one-act plays. Emphasis on action, staging, writing, analytical reading, workshop criticism, and individual conferences. (Typically Offered: Spring)

THTRE 3510: Acting: Contemporary Scene Study

Credits: 3. Contact Hours: Lecture 3.

Prereq: THTRE 2510, THTRE 2630 or permission of instructor

Theory and practice of techniques of acting with emphasis on character, process, and scene analysis. (Typically Offered: Spring)

THTRE 3520: Puppetry Design and Performance

Credits: 3. Contact Hours: Lecture 3.

Through hands-on explorations of puppet design, construction, performance techniques and traditions, students will investigate the intersection of material, design, movement, and sound that is inherent in the art of puppetry. Offered odd-numbered years. (Typically Offered: Fall)

THTRE 3530: Acting for the Camera

Credits: 3. Contact Hours: Lecture 3.

Theory, practice, and exploration of acting on camera with particular focus on professional terms, techniques, and practical experience. (Typically Offered: Spring)

THTRE 3540: Musical Theatre History and Performance

Credits: 3. Contact Hours: Lecture 3.

Prereq: THTRE 2510 or Permission of Instructor

Theory, history and practice of musical theatre. Designed to develop the musical theatre performance skills of singers, dancers, and actors.

THTRE 3550: Musical Theatre Auditions and Performance

Credits: 3. Contact Hours: Lecture 3.

Prereq: THTRE 3540 or Permission of Instructor

Theory and practice of musical theatre audition and performance styles.

THTRE 3580: Oral Interpretation

Credits: 3. Contact Hours: Lecture 3.

Principles of oral interpretation and storytelling, with practice in literary analysis and performance. (Typically Offered: Fall, Spring)

THTRE 3800: Special Topics

Credits: 1-4. Contact Hours: Lecture 4.

Repeatable, maximum of 12 credits.

Advanced topics in Theatre and Performing Arts. (Typically Offered: Fall, Spring, Summer)

THTRE 3930A: Studies in Theatre Design and Production Workshop: Costume Design

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 12 credits.

Studies in Theatre Design and Production. THTRE 2550 recommended. (Typically Offered: Fall, Spring, Summer)

THTRE 3930B: Studies in Theatre Design and Production Workshop: Scenic Design

Credits: 3. Contact Hours: Lecture 4.5.

Repeatable, maximum of 12 credits.

Prereq: THTRE 1550

Studies in Theatre Design and Production. THTRE 2550 recommended. (Typically Offered: Fall, Spring, Summer)

THTRE 3930C: Studies in Theatre Design and Production Workshop: Lighting Design

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 12 credits.

Prereq: THTRE 1550

Studies in Theatre Design and Production. THTRE 2550 recommended. (Typically Offered: Fall, Spring, Summer)

THTRE 3930D: Studies in Theatre Design and Production Workshop: Sound Design

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 12 credits.

Studies in Theatre Design and Production. THTRE 2550 recommended. (Typically Offered: Fall, Spring, Summer)

THTRE 3930E: Studies in Theatre Design and Production Workshop: Stagecraft

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 12 credits.

Studies in Theatre Design and Production. THTRE 2550 recommended. (Typically Offered: Fall, Spring, Summer)

THTRE 3930F: Studies in Theatre Design and Production Workshop: Costume Draping and Patterning

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 12 credits.

Studies in Theatre Design and Production. THTRE 2550 recommended. (Typically Offered: Fall, Spring, Summer)

THTRE 3930G: Stage Makeup

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 12 credits.

Studies in Theatre Design and Production. THTRE 2550 recommended. (Typically Offered: Fall, Spring, Summer)

THTRE 3930I: Studies in Theatre Design and Production Workshop: Stage Management

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 12 credits.

Studies in Theatre Design and Production. THTRE 2550 recommended.
(Typically Offered: Fall, Spring, Summer)

THTRE 3930J: Studies in Theatre Design and Production Workshop: Technical Direction

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 12 credits.

Studies in Theatre Design and Production. THTRE 2550 recommended.
(Typically Offered: Fall, Spring, Summer)

THTRE 3930K: Studies in Theatre Design and Production Workshop: Arts Management

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 12 credits.

Studies in Theatre Design and Production. THTRE 2550 recommended.
(Typically Offered: Fall, Spring, Summer)

THTRE 3930L: Studies in Theatre Design and Production Workshop: Scenic Painting

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 12 credits.

Studies in Theatre Design and Production. THTRE 2550 recommended.
(Typically Offered: Fall, Spring, Summer)

THTRE 3930M: Studies in Theatre Design and Production Workshop: Costume Construction

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 12 credits.

Studies in Theatre Design and Production. THTRE 2550 recommended.
(Typically Offered: Fall, Spring, Summer)

THTRE 4510: Acting: Period Styles

Credits: 3. Contact Hours: Lecture 3.

Prereq: (THTRE 2510; THTRE 2630) or Permission of Instructor

Analysis and practice of period scenes. Offered even-numbered years.
(Typically Offered: Fall)

THTRE 4550: Directing

Credits: 3. Contact Hours: Lecture 3.

Prereq: (THTRE 2550; THTRE 2630) or Permission of Instructor

Theory, techniques, and practice of directing. THTRE 2510 recommended. (Typically Offered: Fall)

THTRE 4560: Advanced Directing

Credits: 3. Contact Hours: Lecture 3.

Prereq: THTRE 4550

Advanced practical and theoretical exploration in directing. Offered even-numbered years. (Typically Offered: Spring)

THTRE 4650: Theatre History: Ancient to 19th Century

Credits: 3. Contact Hours: Lecture 3.

Theatre history from ancient times to the 19th Century. HIST 2010 or equivalent recommended. (Typically Offered: Fall)

THTRE 4660: Theatre History: 19th Century to Present

Credits: 3. Contact Hours: Lecture 3.

Theatre history from 19th century to present. HIST 2010 or equivalent recommended. (Typically Offered: Spring)

THTRE 4690: Advanced Technical Theatre Practicum

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: 9 credits in theatre courses; junior classification

Practicum in production with ISU Theatre, with opportunities for specialization within various areas. Required: Approval of written proposal. (Typically Offered: Fall, Spring, Summer)

THTRE 4900: Independent Study

Credits: 1-3. Repeatable, maximum of 9 credits.

Prereq: 9 credits in THTRE; Junior classification; Department Permission

Only one independent study enrollment within the department is permitted per semester. Approved written proposal required for enrollment. Graduation Restriction: No more than 9 credits in THTRE 4900 may be counted toward graduation. (Typically Offered: Fall, Spring, Summer)

THTRE 4990: Theatre Internship

Credits: 1-8. Repeatable, maximum of 8 credits.

Prereq: 12 credits in THTRE; Department Permission

Supervised application of theatre in professional settings. (Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:**THTRE 5040A: Seminar: Musical Theatre**

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: 9 credits in theatre courses or Permission of Instructor

Topics may include the following: (Typically Offered: Fall, Spring, Summer)

THTRE 5040B: Seminar: Acting Techniques

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: 9 credits in theatre courses or Permission of Instructor

Topics may include the following:. (Typically Offered: Fall, Spring, Summer)

THTRE 5040C: Seminar: Acting Styles

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: 9 credits in theatre courses or Permission of Instructor

Topics may include the following:. (Typically Offered: Fall, Spring, Summer)

THTRE 5040D: Seminar: Design and Technical Theatre

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: 9 credits in theatre courses or Permission of Instructor

Topics may include the following:. (Typically Offered: Fall, Spring, Summer)

THTRE 5040E: Seminar: Arts Management

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: 9 credits in theatre courses or Permission of Instructor

Topics may include the following:. (Typically Offered: Fall, Spring, Summer)

THTRE 5900: Special Topics

Credits: 1-4. Repeatable, maximum of 12 credits.

Prereq: 9 credits in theatre courses or Permission of Instructor

(Typically Offered: Fall, Spring, Summer)

Toxicology (TOX)

Courses primarily for undergraduates:

TOX 4010: Principles of Toxicology

(Dual-listed with TOX 5010).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BBMB 4040

Principles of toxicology governing entry, fate, and effects of toxicants on living systems. Includes toxicokinetics and foreign compound metabolism relative to toxification or detoxification. Fundamentals of foreign compound effects on metabolism, physiology, and morphology of different cell types, tissues, and organ systems. (Typically Offered: Fall)

TOX 4190: Foodborne Hazards

(Cross-listed with MICRO 4190/ FSHN 4190).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MICRO 2010 or MICRO 3020; 3 credits in BBMB

Pathogenesis of human microbiological foodborne infections and intoxications, principles of toxicology, major classes of toxicants in the food supply, governmental regulation of foodborne hazards. Assessed service-learning component. Offered even-numbered years. Graduation Restriction: Only one of FSHN 4190 and FSHN 5190 may count toward graduation. (Typically Offered: Spring)

TOX 4200: Food Microbiology

(Cross-listed with MICRO 4200/ FSHN 4200).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MICRO 2010 or MICRO 3020

Effects of microbial growth in foods. Methods to control, detect, and enumerate microorganisms in food and water. Foodborne infections and intoxications. (Typically Offered: Fall)

TOX 4500: Pesticides in the Environment

(Dual-listed with ENT 5500/ TOX 5500). (Cross-listed with ENT 4500).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 6 credits of BIOL or Permission of Instructor

Fate and significance of pesticides in soil, water, plants, animals, and the atmosphere. (Typically Offered: Spring)

TOX 4900: Independent Study

Credits: 1-2. Repeatable.

Prereq: Instructor Permission for Course

Independent study with a faculty mentor. Intended for students enrolled in the Pharmacology and Toxicology minor. Graduation Restriction: Students in the Pharmacology and Toxicology minor may use no more than 9 credits of university-wide 4900 credits towards the total of 120 credits required for graduation. (Typically Offered: Fall, Spring, Summer)

TOX 4990: Undergraduate Research

Credits: 1-3. Repeatable, maximum of 3 credits.

Prereq: Instructor Permission for Course

Independent research under faculty guidance. Intended for students enrolled in the Pharmacology and Toxicology minor. Graduation Restriction: Students may use no more than 9 credits of university-wide 4990 credits towards the total of 120 credits required for graduation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

TOX 5010: Principles of Toxicology

(Dual-listed with TOX 4010).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Principles of toxicology governing entry, fate, and effects of toxicants on living systems. Includes toxicokinetics and foreign compound metabolism relative to toxification or detoxification. Fundamentals of foreign compound effects on metabolism, physiology, and morphology of different cell types, tissues, and organ systems. (Typically Offered: Fall)

TOX 5020: Toxicology Methods

Credits: 3.

Prereq: Graduate Standing or Permission of Instructor

Provides demonstrations or laboratory experience in the application of methods used in toxicology, including safety procedures, calculation and data analysis, teratologic and morphologic evaluation, cellular/molecular toxicological techniques, electrophysiologic measures, in vitro enzyme induction/biotransformation, neural and behavioral toxicology testing. Offered even-numbered years. (Typically Offered: Spring)

TOX 5040: Toxicology Seminar

Credits: 1. Contact Hours: Lecture 1.

Repeatable, maximum of 2 credits.

Prereq: Graduate Standing or Permission of Instructor

Presentation of a seminar about a current topic in toxicology as part of a weekly series of seminars by graduate students, faculty, and guest lecturers from off campus. Graduate student speakers will meet with the instructor at least one week prior to their formal presentation. (Typically Offered: Fall, Spring, Summer)

TOX 5150: Regulatory Toxicology

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

A survey course on risk analysis approaches used by toxicologists and other life and social scientists in government, industry and non-governmental organizations to inform regulatory policies and decisions under U.S. Federal statutes, including the Federal Food Drug and Cosmetic Act; the Food Quality Protection Act; the Federal Fungicide, Insecticide and Rodenticide Act; the Endangered Species Act; the Plant Protection Act; the National Environmental Policy Act; and the Toxic Substances Control Act. Topics covered include an overview of the roles and responsibilities of different U.S. Government Departments and Agencies in analyzing human; livestock and companion animal; and/or environmental risks and benefits of food products and food additives, cosmetics, drugs, pesticides, and consumer and industrial products. Offered odd-numbered years. (Typically Offered: Fall)

TOX 5290: Foodborne Toxicants

(Cross-listed with FSHN 5290).

Credits: 2. Contact Hours: Lecture 2.

Mechanisms of action, metabolism, sources, remediation/detoxification, risk assessment of major foodborne toxicants of current interest, design of HACCP plans for use in food industries targeting foodborne toxicants, discussion of toxicants from a food defense perspective. Offered online only. (Typically Offered: Fall, Spring, Summer)

TOX 5440: Aquatic Toxicology

Credits: 2. Contact Hours: Lecture 1, Discussion 1.

Prereq: Graduate Standing or Permission of Instructor

An overview of interactions between anthropogenic chemicals and aquatic ecosystems. Topics include history of aquatic toxicology, methods of toxicity testing, and species responses to toxicants. Emphasis is on aquatic pollutants of emerging concern (e.g., nanoparticles, microplastics). Offered odd-numbered years. (Typically Offered: Spring)

TOX 5460: Clinical and Diagnostic Toxicology

(Cross-listed with VDPAM 5460).

Credits: 1-3. Contact Hours: Laboratory 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Advanced study of current problems and issues in veterinary toxicology. Emphasis on problem solving and interpreting clinical cases while utilizing clinical, epidemiological, and laboratory resources. Course consists highly of clinical case based material. (Typically Offered: Fall, Spring, Summer)

TOX 5500: Pesticides in the Environment

(Dual-listed with ENT 4500/ TOX 4500). (Cross-listed with ENT 5500).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 9 credits in BIOL or Graduate Classification

Fate and significance of pesticides in soil, water, plants, animals, and the atmosphere. (Typically Offered: Spring)

TOX 5540: General Pharmacology

(Cross-listed with BMS 5540).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

General principles; drug disposition; drugs acting on the nervous, cardiovascular, renal, gastrointestinal, and endocrine systems. (Typically Offered: Spring)

TOX 5650: Methods in Biostatistics and Epidemiology

(Cross-listed with STAT 5650).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Statistical methods commonly used in epidemiology and human and animal health studies. Overview of cohort studies, case-control studies and randomized clinical trials. Topics include inference procedures for disease risk factors, analysis of time-to-event and survival data, analysis of longitudinal studies of disease progression and health status, diagnostic test evaluation, and meta-analysis. Examples will come from recent studies of physical and mental health, nutrition and disease progression in human and animal populations. Use of statistical software: SAS or R. Offered even-numbered years. (Typically Offered: Fall)

TOX 5690: Reproductive and Developmental Toxicology

(Cross-listed with ANS 5690).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Chemical agents that target developmental and reproductive systems in animals and humans, both male and female. The influence that timeline of developmental in utero and what part of reproductive organ have on outcome of environmental exposures will be developed. The physiological changes due to exposure, and mechanistic pathways activated by xenobiotics will be defined and the consequences of these changes will be explored. Offered even-numbered years. (Typically Offered: Fall)

TOX 5700: Risk Assessment for Food, Agriculture and Veterinary Medicine

(Cross-listed with AGRON 5700/ VDPAM 5700).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Risk assessment principles as applied to biological systems. Exposure and effects characterization in human and animal health and ecological risk assessment. Risk analysis frameworks and regulatory decision-making. Introduction to quantitative methods for risk assessment using epidemiological and distributional analysis. Uncertainty analysis. Offered odd-numbered years. (Typically Offered: Fall)

TOX 5750: Cell Biology

(Cross-listed with BMS 5750).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

A multi-instructor course covering major topics in cell structure and function, including: universal features of prokaryotic and eukaryotic cells, types of utilization and conversion of energy, genetic control of cell shape and functionality, internal organization of cells, communication between cells and their environment, development of multicellular systems. Students have to write a term paper. (Typically Offered: Fall)

TOX 5900: Special Topics

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Contact individual faculty for special projects or topics. Graded.

Courses for graduate students:**TOX 6260: Advanced Food Microbiology**

(Cross-listed with MICRO 6260/ FSHN 6260).

Credits: 3. Contact Hours: Lecture 3.

Prereq: FSHN 4200 or FSHN 4210 or FSHN 5040

Topics of current interest in food microbiology, including new foodborne pathogens, rapid identification methods, effect of food properties and new preservation techniques on microbial growth, and mode of action of antimicrobials. Offered odd-numbered years. (Typically Offered: Spring)

TOX 6560: Cellular and Molecular Pathology II

(Cross-listed with VPTH 6560).

Credits: 3. Contact Hours: Lecture 3.

Cellular and molecular mechanisms of carcinogenesis. Offered even-numbered years. (Typically Offered: Spring)

TOX 6750: Insecticide Toxicology

(Cross-listed with ENT 6750).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: ENT 5550 or TOX 5010 or Graduate Classification

Principles of insecticide toxicology; classification, mode of action, metabolism, and environmental effects of insecticides. Offered even-numbered years. (Typically Offered: Fall)

TOX 6890: Current Topics in Toxicology

Credits: Required. Contact Hours: Lecture 1.

Repeatable.

Lecture and discussion participation on current topics in toxicology.

An 80% attendance is expected to satisfactorily complete the course.

Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

TOX 6970: Graduate Research Rotation

Credits: 1-12. Contact Hours: Laboratory 12.

Repeatable, maximum of 12 credits.

Graduate research projects performed under the supervision of selected faculty members in the graduate Toxicology major. (Typically Offered: Fall, Spring, Summer)

TOX 6990: Research

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Research. (Typically Offered: Fall, Spring, Summer)

Courses primarily for professional curriculum students:

TOX 7354: General Pharmacology

(Dual-listed with TOX 3540). (Cross-listed with BMS 7354).

Credits: 3. Contact Hours: Lecture 3.

General principles; drug disposition; drugs acting on the nervous, cardiovascular, renal, gastrointestinal, and endocrine systems. (Typically Offered: Spring)

Transportation (TRANS)

Courses primarily for graduate students, open to qualified undergraduates:

TRANS 5990: Creative Component

Credits: 1-3. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Advanced topic for creative component report in lieu of thesis.

Courses for graduate students:

TRANS 6990: Research

Credits: 1-30. Repeatable.

U.S. Latino/a Studies Program (USLS)

Courses primarily for undergraduates:

USLS 2110: Introduction to U.S. Latino/a Studies

Credits: 3. Contact Hours: Lecture 3.

History and current lives of the Latino/a peoples in the United States, including Mexican, Cuban, Puerto Rican, Dominican, and South and Central Americans, as well as information specific to Iowa Latino/as, will be covered. Through readings, class discussions, writing assignments, and guest speakers, students will acquire accurate information and a solid understanding of the US Latino/a population and cultural perspectives. Elements of Latino/a culture to be covered include historical, sociological, educational, psychological, economic, and political facets. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall, Spring)

USLS 3050: Spanish for Heritage Speakers

(Cross-listed with SPAN 3050).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Instructor Permission for Course

Intensive study and application of grammar concepts in the development of writing and reading skills in a dynamic cultural context centered on Hispanics in the U.S. Designed for native or heritage Spanish speakers with oral proficiency in Spanish but with little or no formal academic training in the language. Taught exclusively in Spanish. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Spring)

USLS 3230A: Latin American Anthropology: Violence and Memory

(Dual-listed with ANTHR 5230A). (Cross-listed with ANTHR 3230A).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Exploration of key contemporary and historical issues in Latin American Anthropology; discussion of current anthropological approaches to studying Latin American social issues in a global context. Topics vary each time offered. ANTHR 2010 or ANTHR 3060 recommended. Meets International Perspectives Requirement. (Typically Offered: Spring)

USLS 3230B: Latin American Anthropology: Social movements and Democracy

(Dual-listed with ANTHR 5230B). (Cross-listed with ANTHR 3230B).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Exploration of key contemporary and historical issues in Latin American Anthropology; discussion of current anthropological approaches to studying Latin American social issues in a global context. Topics vary each time offered. ANTHR 2010 or ANTHR 3060 recommended. Meets International Perspectives Requirement. (Typically Offered: Spring)

USLS 3230C: Latin American Anthropology: Race, Class and Gender

(Dual-listed with ANTHR 5230C). (Cross-listed with ANTHR 3230C).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Exploration of key contemporary and historical issues in Latin American Anthropology; discussion of current anthropological approaches to studying Latin American social issues in a global context. Topics vary each time offered. ANTHR 2010 or ANTHR 3060 recommended. Meets International Perspectives Requirement. (Typically Offered: Spring)

USLS 3230D: Latin American Anthropology: Regional Focus

(Dual-listed with ANTHR 5230D). (Cross-listed with ANTHR 3230D).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Exploration of key contemporary and historical issues in Latin American Anthropology; discussion of current anthropological approaches to studying Latin American social issues in a global context. Topics vary each time offered. ANTHR 2010 or ANTHR 3060 recommended. Meets International Perspectives Requirement. (Typically Offered: Spring)

USLS 3230E: Latin American Anthropology: Culture and Sport

(Dual-listed with ANTHR 5230E). (Cross-listed with ANTHR 3230E).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Exploration of key contemporary and historical issues in Latin American Anthropology; discussion of current anthropological approaches to studying Latin American social issues in a global context. Topics vary each time offered. ANTHR 2010 or ANTHR 3060 recommended. Meets International Perspectives Requirement.

USLS 3250: Culture and Community: Iowa and Midwest Latino/as

(Cross-listed with SPAN 3250).

Credits: 3. Contact Hours: Lecture 3.

Prereq: USLS 2110

Analysis and discussion of interdisciplinary texts examining the local and regional Latino/a immigration experience. Exploring Latino/a culture through participation in a community project. Assessed service learning component. (Typically Offered: Spring)

USLS 3330: Latinos/as/x in the Criminal Justice Complex

(Cross-listed with CJ 3330).

Credits: 3. Contact Hours: Lecture 3.

Intersections of ethnicity, culture, assimilation, immigration/migration, crime, and the criminal justice system in the United States. Topics include: criminality among Latinos/as and the challenges they face within the CJ complex (cops, courts, corrections, as well as immigration and border control) situated within mass incarceration; the use of criminalization as a form of social control; and Latino/as' human and civil rights and the role that race, ethnicity, gender, class, and immigration status play in the criminal justice system and border control enforcement. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall)

USLS 3430: Latin American Government and Politics

(Cross-listed with POLS 3430).

Credits: 3. Contact Hours: Lecture 3.

Political institutions, processes, and contemporary issues. Selected countries examined intensively to illustrate generalizations. Role of parties, military, church, human rights, women, environmental issues, interest groups, ideology, and globalization. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

USLS 3470: U.S. Latino/a Psychology

(Cross-listed with PSYCH 3470).

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 1010; 1 additional PSYCH course

Historical, political, and social contexts of psychological and mental health constructs in terms of their validity and utility for use with Latino/a people in the U.S. Unique aspects of psychological functioning particular to Latino/a people in the U.S. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Spring)

USLS 3510: Introduction to Spanish-English Translation

(Cross-listed with LING 3510/ SPAN 3510).

Credits: 3. Contact Hours: Lecture 3.

Prereq: SPAN 3030A or SPAN 3030B or SPAN 3040 or SPAN 3050

Introduction to the theory, methods, techniques, and problems of translation. Consideration of material from business, literature, and the social sciences. Taught in Spanish. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

USLS 3600: Latinas and Victimization

(Cross-listed with CJ 3600).

Credits: 3. Contact Hours: Lecture 3.

Intersections of race/ethnicity, class, gender, culture, acculturation, and immigration/migration in the victimization experiences of Latina women interacting with criminal justice systems and services. Topics include: domestic/intimate partner violence, sexual assault, human trafficking among Hispanic, Latina, and Chicana women, and the impact of language barriers, abuser threats of deportation, social and institutional discrimination and racism, cultural norms, and cultural insensitivity among first responders and service providers on help-seeking, well-being, and interactions with the criminal justice system. Meets U.S. Cultures and Communities Requirement.

USLS 3710: Mexican American History

(Cross-listed with HIST 3710).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

History of the Mexican American community in the U.S. from the 1820s to the present. Topics include community development, employment, social marginalization, racism/discrimination, depression and world wars, civil rights, ethnic power and politics. Offered even-numbered years. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall)

USLS 3720: Latina/o History

(Cross-listed with HIST 3720).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Historical and cultural heritage of Latinas/os in the United States. The histories of Mexican, Puerto Rican, Cuban, and other Latin American peoples in the U.S. emphasizing political and cultural convergence and congruencies. Meets U.S. Cultures and Communities Requirement.

USLS 3770: Latina/o/x Life Stories: Memoirs and Oral History

(Cross-listed with SPAN 3770/ ENGL 3770).

Credits: 3. Contact Hours: Lecture 3.

Prereq: USLS 2110 or ENGL 2500

Study and archive Latinx life stories through traditional coursework, digital humanities and community outreach with local schools. Analysis of the extensive realities of Latinx communities in Iowa through the study, writing, tutorial work, and production of memoirs and oral histories.

USLS 4200: Bilingualism & The Education of Latinx Youth

(Dual-listed with EDUC 5200). (Cross-listed with EDUC 4200).

Credits: 3. Contact Hours: Lecture 3.

Introduction to research on bilingualism and examination of the social, historical, and political contexts of Spanish/English education in the U.S. Attention to policy environment, school program structure, mode of classroom instruction, family and community context, and attainment of bilingualism and biculturalism for Latinx youth. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall)

USLS 4730: Civil Rights and Ethnic Power

(Cross-listed with AFAM 4730/ HIST 4730).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Comparative history of the civil rights and ethnic power movements (African American, Chicano, American Indian, Puerto Rican, among others) in the U.S. from World War II to the present. Topics include institutional foundations, leadership, gender and racial dynamics, and the convergences and divergences of these differing ethnic struggles for rights. Meets U.S. Cultures and Communities Requirement.

USLS 4900: Independent Study

Credits: 1-3. Repeatable, maximum of 9 credits.

Prereq: Instructor Permission for Course

Independent study under supervision of instructor. Graduation

Restriction: No more than 3 credits may count towards the U.S. Latino/a Studies certificate.

USLS 4990: Internship in US Latino/a Studies

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

Supervised practice working with US Latino/a communities in the public or private sector, combined with academic work under faculty supervision. Graduation Restriction: Up to 3 credits may apply toward USLS minor. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

University Studies (UST)

ASSOCIATE PROVOST FOR ACADEMIC PROGRAMS

Certain interdisciplinary courses are offered through university studies, at the discretion of the associate provost for academic programs and upon the advice of the Faculty Senate Curriculum Committee. No major is available in university studies, but credit obtained through university studies offerings may be applied toward a degree in any of the colleges, consistent with the stipulations of the student's curriculum.

Requests to make use of UST 2900 and UST 4900 should be directed to the associate provost for academic programs and should be

accompanied by a positive recommendation from the department chairs of the instructor(s) making the request. Requests can be submitted to Academic-Programs@iastate.edu.

Courses primarily for undergraduates:

UST 1010A: First Year Seminar I: Hixson Scholars

Credits: 1. Contact Hours: Discussion 0.5, Lecture 0.5.

Orientation to the university focusing on student transition, acclimation to university, exposure to campus resources, and student success strategies. Exploration of topical issues associated with specific learning community or program focus. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

UST 1010B: First Year Seminar I: MVP Award

Credits: 1. Contact Hours: Lecture 1.

Orientation to the university focusing on student transition, acclimation to university, exposure to campus resources, and student success strategies. Exploration of topical issues associated with specific learning community or program focus. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

UST 1010C: First Year Seminar I: Science Bound

Credits: 1. Contact Hours: Lecture 1.

Orientation to the university focusing on student transition, acclimation to university, exposure to campus resources, and student success strategies. Exploration of topical issues associated with specific learning community or program focus. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

UST 1010D: First Year Seminar I: Student Athlete Experience

Credits: 1. Contact Hours: Lecture 1.

Orientation to the university focusing on student transition, acclimation to university, exposure to campus resources, and student success strategies. Exploration of topical issues associated with specific learning community or program focus. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

UST 1010E: First Year Seminar I: Student Support Services Program

Credits: 1. Contact Hours: Lecture 1.

Orientation to the university focusing on student transition, acclimation to university, exposure to campus resources, and student success strategies. Exploration of topical issues associated with specific learning community or program focus. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

UST 1010F: First Year Seminar I: Academic Program for Excellence (APEX)

Credits: 1. Contact Hours: Lecture 1.

Orientation to the university focusing on student transition, acclimation to university, exposure to campus resources, and student success strategies. Exploration of topical issues associated with specific learning community or program focus. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Summer)

UST 1020A: First Year Seminar I: First Cyclone Program

Credits: 1. Contact Hours: Lecture 1.

Acceptance/participation in appropriate learning community. Continued exploration of university services, strategies for student success, leadership, and acclimation to university. Exploration of issues associated with learning community focus. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

UST 1020B: First Year Seminar II: Science Bound

Credits: 1. Contact Hours: Lecture 1.

Acceptance/participation in appropriate learning community. Continued exploration of university services, strategies for student success, leadership, and acclimation to university. Exploration of issues associated with learning community focus. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

UST 1050: Carver Academy Seminar: Freshmen

Credits: 1. Contact Hours: Lecture 1.

Orientation to the university for Carver Academy students focusing primarily on transition and acclimation to the university environment. Individual and group identity development. Life and legacy of George Washington Carver. Meets 1 cr. of U.S. Cultures and Communities Requirement. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

UST 1060: Carver Academy Seminar: Freshmen

Credits: 1. Contact Hours: Lecture 1.

Introduction for Carver Academy students to resources at ISU to supplement classroom learning. Exploration of topical issues associated with the Academy and leadership opportunities at ISU. Meets 1 cr. of U.S. Cultures and Communities Requirement. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

UST 1100: International First-Year Experience Seminar

Credits: 1. Contact Hours: Lecture 1.

Topics to help international students transition to the United States and academic culture including classroom culture, campus and community resources, learning styles, study skills, U.S. laws and safety, and student health and wellness. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

UST 2050: GWC/MVP Scholar Seminar

Credits: 1. Contact Hours: Lecture 1.

Prereq: UST 1060 or UST 1020A

Expanded exploration of topical issues associated with specific learning community or program focus. Introduction of leadership concepts and leadership opportunities. Meets 1 cr. of U.S. Cultures and Communities Requirement. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

UST 2070: Science Bound Pre-Professional Seminar

Credits: 1. Contact Hours: Lecture 1.

Repeatable, maximum of 2 credits.

Prereq: UST 1020B

Seminar topics prepare sophomore and upper-division students to pursue research and internship experiences in science, technology, engineering and math fields. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

UST 2900: Independent Study

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Independent study on topics of an interdisciplinary nature. Intended primarily for freshmen and sophomores.

UST 3010: McNair Program: Introduction to Research I

Credits: 2. Contact Hours: Lecture 2.

Introduction to academic research focusing on the initial stages of research with lessons on how to define a research idea, formulate a research question or hypothesis, gather, critique, analyze and synthesize the literature on the subject of inquiry, and understand and be able to apply a number of methodologies to gather data. (Typically Offered: Fall)

UST 3020: McNair Program: Introduction to Research II

Credits: 2. Contact Hours: Lecture 2.

Prereq: UST 3010

Continuation of research preparation focusing on methodologies and the relevance to specific research questions, data collection and analysis processes, and scientific research writing and presentation. Lessons on how to determine appropriate methodology and design a scientific protocol, gather and analyze data, and understand findings so as to effectively report and present findings and conclusions. (Typically Offered: Spring)

UST 3030: CALM Life Skills Seminar

Credits: 1. Contact Hours: Lecture 1.

Prereq: UST 1010D

CALM After the Storm is a course designed to assist student-athletes successfully transition to life after Iowa State University and collegiate athletics. Topics include career preparation, adulthood, life after athletics, and money management. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

UST 3110A: Leaders Seminar I: Leaders in Hixson Seminar

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

For students serving as peer mentor first-year seminar leaders under faculty supervision. Development of course facilitation and peer leadership skills. Offered on a satisfactory-fail basis only.

UST 3120A: Leaders Seminar II: Leaders in Hixson Seminar

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

For students serving as leaders in Hixson Seminar or MVP Seminar under faculty supervision. Development of course facilitation and peer leadership skills. Offered on a satisfactory-fail basis only.

UST 3150: Cyclone Aide Leaders Seminar

Credits: 2. Repeatable, maximum of 4 credits.

Development of public speaking, group facilitation, and peer leadership skills. Exploration of issues associated with student transition to college, university organizational structures, and processes associated with student matriculation. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

UST 3160: Leadership in Peer Education

Credits: 2. Contact Hours: Lecture 2.

Provides emerging student leaders, preparing to be peer educators or peer mentors, an introduction to foundational theories of peer education and behavior change. Provides opportunity to learn and practice essential peer education skills. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

UST 4010: McNair Senior Seminar I

Credits: 1. Contact Hours: Lecture 1.

Prereq: UST 3010

Comprehensive approach to choosing and applying to graduate school including drafting and finalizing the personal and research essay, understanding graduate funding, preparing for the grad interview, and standardized exam preparation. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

UST 4020: McNair Senior Seminar II

Credits: 1.

Prereq: UST 4010

Continuation of graduate school preparation focusing on transitioning, navigating the critical first year, and succeeding in graduate school. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

UST 4900: Independent Study

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Independent study on topics of an interdisciplinary nature. Intended primarily for juniors and seniors.

Urban Design (URBD)

Courses primarily for graduate students, open to qualified undergraduates:

URBD 5010: Urban Design Local Studio

Credits: 6.

Prereq: Graduate Standing or Permission of Instructor

Analysis and observation of urban morphology, culture, and infrastructure through urban design projects set in Midwestern cities. Students learn, interpret, and propose design interventions to address urban challenges related to changing socio-political, economic, and environmental contexts. Field trips.

URBD 5020: Urban Design Global Studio

Credits: 6. Contact Hours: Lecture 1, Studio 10.

Prereq: Graduate Standing or Permission of Instructor

Students develop proposals for urban design interventions in an international context at multiple scales using investigation, analysis, observation, and interaction. Field trips.

URBD 5110: North American Urbanization

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Focus on the historical role of planning and urban design in the shaping of North American cities and regions, from the colonial period to the late twentieth century. Examine the legacy of planning and design by exploring the intersection of geographic space, politics, and policy. Investigate the factors and the processes that produce the built environment.

URBD 5120: Urban Design Colloquium

Credits: Required. Contact Hours: Lecture 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Special topics and guest speakers. Offered on a satisfactory-fail basis only.

URBD 5130: Urbanism Research

Credits: 3.

Prereq: Graduate Standing or Permission of Instructor

Research expands and integrates discourse and design findings from various Urban Design degree courses. Students develop independently-defined research to produce a comprehensive and conclusive final document that incorporates text, visuals and/or other media.

URBD 5210: Foundations of Urban Design

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to the ways that urban designers think about the city with a focus on how history, theory, and a wide range of contextual factors inform urban design practice. Field trip.

URBD 5220: Contemporary Urban Design Practices

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Study of emerging trends and practices in urban design using a range of current media communication platforms. Course will be conducted in a combination of lecture, seminar formats. Graduate level readings, discussions, research, and development of projective scenarios.

URBD 5310: Methods of Urban Design Workshop

Credits: 3.

Prereq: Graduate Standing or Permission of Instructor

An exploration of contemporary urban design methods derived from significant urban projects and (re)development initiatives. Selected case studies to articulate and evaluate methods for implementing urban design goals and objectives in a variety of urbanized contexts. Case studies will build on a combination of analytical research, lectures, student presentations, and field trips.

URBD 5320: Urban Design Media Workshop

Credits: 3.

Prereq: Graduate Standing or Permission of Instructor

An introduction to visual representation tools and techniques for generating and communicating urban design concepts, processes, and analytics. Project and exercises utilize traditional and contemporary approaches to drawing, modeling, and mapping, as well as desktop publishing tools.

URBD 5330: Urbanism Theory and Methods

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

This course examines how socio-political and economic forces shape the contemporary built environment. The course highlights various methods urban designers use to affect change and, in turn, how these impact stakeholders and communities. Students develop critical awareness of the impact of their decision making on the city.

Veterinary Clinical Sciences (VCS)

Courses primarily for graduate students, open to qualified undergraduates:

VCS 5900A: Special Topics: Medicine

Credits: 1-3. Repeatable.

*Prereq: Instructor Permission for Course***VCS 5900B: Special Topics: Surgery**

Credits: 1-3. Repeatable.

*Prereq: Graduate Standing or Permission of Instructor***VCS 5900C: Special Topics: Theriogenology**

Credits: 1-3. Repeatable.

*Prereq: Graduate Standing or Permission of Instructor***VCS 5900D: Special Topics: Radiology**

Credits: 1-3. Repeatable.

*Prereq: Graduate Standing or Permission of Instructor***VCS 5900E: Special Topics: Anesthesiology**

Credits: 1-3. Repeatable.

*Prereq: Graduate Standing or Permission of Instructor***VCS 5900F: Special Topics - Ophthalmology**

Credits: 1-3. Repeatable, maximum of 3 credits.

Prereq: Graduate Standing or Permission of Instructor

Special topics in Ophthalmology. (Typically Offered: Fall, Spring)

VCS 5960: International Preceptorship

Credits: 1-12. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

International Preceptorships and Study Abroad Group programs.

Provides opportunities for students to be involved in applied clinical, production, and/or research experiences in international locations. The course consists of 40 hour per week experiential learning opportunities. (Typically Offered: Fall, Spring, Summer)

VCS 5990: Creative Component

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Courses for graduate students:

VCS 6040: Seminar

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

(Typically Offered: Fall, Spring)

VCS 6400: Advanced Radiology

Credits: 2. Contact Hours: Lecture 2.

Detailed principles of clinical radiology with particular reference to radiographic interpretation.

VCS 6760: Advanced Medicine

Credits: 2. Contact Hours: Lecture 2.

Principles of general medicine. A study in depth of factors that contribute to the development of clinical signs as related to the pathogenesis of disease.

VCS 6770: Advanced Medicine

Credits: 2. Contact Hours: Lecture 2.

An advanced study of metabolic diseases.

VCS 6990A: Research: Medicine

Credits: 1-30. Repeatable.

VCS 6990B: Research: Surgery

Credits: 1-30. Repeatable.

VCS 6990C: Research: Theriogenology

Credits: 1-30. Repeatable.

VCS 6990E: Research: Anesthesiology

Credits: 1-30. Repeatable.

VCS 6990F: Research: Ophthalmology

Credits: 1-30. Repeatable.

Graduate Level Research.

VCS 6990G: Research: Cardiology

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Graduate Level Research.

Courses primarily for professional curriculum students:

VCS 7305: Shelter Medicine

Credits: 1. Contact Hours: Lecture 1.

An elective course designed to educate the veterinary student about issues of relevance to companion animal population and shelter medicine and welfare. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

VCS 7311: Careers in Veterinary Medicine

Credits: 1. Contact Hours: Lecture 1.

Introduction to the veterinary profession and the various career opportunities available. (Typically Offered: Fall)

VCS 7313: Veterinary Medical Ethics

Credits: 1. Contact Hours: Lecture 1.

A continuation of the Veterinarian in Society series. The course covers selected topics on moral and ethical issues affecting the practice of veterinary medicine. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

VCS 7314: Communication and Leadership in Veterinary Medicine

Credits: 1. Contact Hours: Lecture 1.

A continuation of the Veterinarian in Society series. This course will focus on helping students develop their communication, leadership, team building and conflict resolution skills. (Typically Offered: Fall)

VCS 7315: Veterinary Law

Credits: 1. Contact Hours: Lecture 1.

A continuation of the Veterinarian in Society series. This course will emphasize veterinary law. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

VCS 7318: Advanced Small Animal Oncology

Credits: 1.

Provide advanced instruction in medical oncology, radiation oncology, and surgical oncology. General learning objectives include demonstrating the ability to utilize information from the physical exam and historical findings to direct appropriate diagnostics and staging based on a specific cancer diagnosis. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

VCS 7319X: Veterinary Military Practicum

Credits: 1-6. Repeatable, maximum of 6 credits.

Allows students to gain veterinary experience through military service. (Typically Offered: Fall, Spring, Summer)

VCS 7339: Clinical Foundations I

(Cross-listed with BMS 7339).

Credits: 1. Contact Hours: Lecture 1, Laboratory 2.

Canine physical examination; basic behavior, animal handling and restraint; medical record keeping. (Typically Offered: Fall)

VCS 7346X: Clinical Neurology

Credits: 2. Contact Hours: Lecture 2.

SEAT - Veterinary Medicine Students

This course is intended to provide students with foundational concepts of clinical evaluation and management of animals with suspected neurologic disease. Focused discussions include the neurologic examination process, problem identification, neuroanatomical localization, formation of an appropriate differential diagnosis, disease discussion and formation of an appropriate diagnostic plan. The emphasis in this course is increasing skills, knowledge, and confidence when diagnosing and treating dogs and cats with neurologic conditions using relevant case examples. (Typically Offered: Fall)

VCS 7385: Grand Rounds

Credits: Required. Contact Hours: Lecture 1.

Repeatable.

Seminars and case presentations on selected clinical subjects by fourth-year students of the College of Veterinary Medicine. Attendance is required for a passing grade. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

VCS 7391: Clinical Imaging

Credits: 1. Contact Hours: Lecture 1.

Evaluation of morphologic anatomy of the dog and cat utilizing clinical imaging methods - radiography, ultrasonography, computed tomography, magnetic resonance imaging and nuclear imaging. Emphasis will be placed on normal radiographic anatomy. (Typically Offered: Fall)

VCS 7393: Principles of Surgery I

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

General principles of surgery of companion animals. (Typically Offered: Fall)

VCS 7394: Principles of Surgery II

Credits: 1. Contact Hours: Lecture 1, Laboratory 2.

General principles of surgery of companion animals. (Typically Offered: Spring)

VCS 7395: Small Animal Surgery

Credits: 2. Contact Hours: Lecture 2.

Small animal surgery. (Typically Offered: Spring)

VCS 7396: Fundamentals in Equine Practice

Credits: 2. Contact Hours: Lecture 2.

This elective course is an introduction and overview of the clinical aspects of common conditions in horses and related conditions, including pathogenesis, clinical manifestations, diagnosis, treatment and prognosis. It is not designed to teach the student how to perform specific procedures, but rather to improve knowledge base of students interested in equine or mixed animal practice. Class will include lecture, photos, video presentations, and other formats. (Typically Offered: Spring)

VCS 7398: Anesthesiology

Credits: 2. Contact Hours: Lecture 2.

Anesthetic equipment, agents and procedures, including pain management for core species. (Typically Offered: Spring)

VCS 7399: Ophthalmology

Credits: 1. Contact Hours: Lecture 1.

Principles and techniques of medical and surgical ophthalmology. (Typically Offered: Spring)

VCS 7402: Clinical Cardiology I

Credits: 1. Contact Hours: Lecture 1.

Elective course in diagnosis and management of cardiac diseases. Emphasis on interpretation of electrocardiography. (Typically Offered: Fall)

VCS 7403: Clinical Cardiology II

Credits: 1. Contact Hours: Lecture 0.5, Discussion 0.5.

Elective course in clinical cardiology. Emphasis on common congenital and acquired cardiac diseases of companion animals. Builds on foundation of basic clinical cardiac knowledge obtained in VCS 7444; expands to cover additional diseases in greater depth (e.g. infective endocarditis, systemic and pulmonary hypertension, heartworm disease, feline arterial thromboembolism, bradyarrhythmias and cardiac pacing, congenital heart diseases and interventional correction). Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

VCS 7404: Topics in Emergency and Critical Care

Credits: 2. Contact Hours: Lecture 2.

Introduction of common topics in emergency and critical care in companion animals. General learning goals for students in this course include developing the ability to utilize physical exam skills and historical findings to triage patients and assess stability. (Typically Offered: Spring)

VCS 7405: Pet Bird and Exotic Species Medicine

Credits: 2. Contact Hours: Lecture 1, Laboratory 3.

Elective course in management and diseases of pet birds and exotic species. (Typically Offered: Spring)

VCS 7406: Introduction to Captive Wild Animal Medicine

Credits: 1. Contact Hours: Lecture 1.

Topics covering the health and welfare of non-domestic animals in captivity. Regulations specific to exotic animal ownership and exhibition will be covered. Students will discuss diseases which affect multiple taxon groups, and learn about interface diseases. Specific topics regarding the veterinary care of exotic canids, felids, ungulates, primates, Old-World Camelids, exotic equids and avian species will be discussed. Laboratories will introduce remote-delivery and restraint devices, dangerous animal handling techniques (including venomous snake handling techniques), contraception for non-domestic animals, and extra-label use of medications and vaccines in non-domestic species. (Typically Offered: Spring)

VCS 7407: Feline Internal Medicine

Credits: 1. Contact Hours: Lecture 1.

Elective course in feline internal medicine. (Typically Offered: Fall)

VCS 7409: Oncology

Credits: 2. Repeatable, maximum of 4 credits.

Elective clinical assignment in oncology.

VCS 7414: Companion Animal Nutrition

Credits: 1. Contact Hours: Lecture 1.

Elective course in small animal and equine nutrition. (Typically Offered: Spring)

VCS 7415: Advanced Small Animal Dermatology

Credits: 2. Contact Hours: Lecture 1, Laboratory 2.

Elective course in dermatology. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

VCS 7419: Preceptorship in Companion Animal/Equine Veterinary Medical Practice

Credits: 2-6. Contact Hours: Laboratory 12.

Repeatable, maximum of 6 credits.

Elective course in veterinary practice under the guidance of veterinarians in approved practice settings. Maximum of 6 credits in 2 credit increments. Instructor Permission needed if not a VM4 classification. (Typically Offered: Fall, Spring, Summer)

VCS 7420: Practicum

Credits: Required. Repeatable.

External practical experiences in the fourth year curriculum for additional professional development of the veterinary student. Instructor Permission needed if not a WM4 classification. Offered on a satisfactory-fail basis only.

VCS 7423: Zoo Preceptorship

Credits: 2-12. Repeatable, maximum of 12 credits.

Elective course in veterinary practice under the guidance of trained zoo veterinarians in approved practice settings. Maximum of 12 credits. (Typically Offered: Fall, Spring, Summer)

VCS 7425X: Rotation in Exotic Pet & Wildlife Medicine Clinical and Surgical Skills

Credits: 2.

Opportunity for 4th year veterinary students to learn appropriate restraint techniques, radiographic positioning and interpretation, emergency triage, physical examination, and surgical skills for exotic companion animals (birds, rodents, rabbits, ferrets and pet reptiles) and wildlife. The course will also include rabbit dentistry techniques. The purpose of this course is to give students the tools to be more comfortable in the handling, diagnostics, and treatment of exotic animals and native wildlife species. (Typically Offered: Summer)

VCS 7436: Small Animal Internal Medicine

Credits: 3. Contact Hours: Lecture 3.

Clinical diagnosis and treatment of diseases of small animals. (Typically Offered: Fall)

VCS 7437: Small Animal Shelter Medicine

Credits: 2. Contact Hours: Lecture 2.

Repeatable.

A 2-week elective rotation at an animal shelter/humane society that works with the public to place pets in homes. This rotation will encompass population medicine (medicine, surgery, intake, adoption, behavior and temperament, neglect and cruelty) that animal shelters deal with on a daily basis. The selected animal shelter/humane society must have a veterinarian(s) on staff and be approved by the course coordinator. More than one VCS 7437 may be taken upon approval of the course coordinator.

VCS 7440: Introduction to Clinics

Credits: Required. Contact Hours: Laboratory 4.

Rotating assignments through multiple sections within the Veterinary Medical Center. (Typically Offered: Spring)

VCS 7441: Canine Rehabilitation

Credits: 2.

Elective clinical assignment in rehabilitation.

VCS 7443: Equine Lameness

Credits: 2. Contact Hours: Lecture 1, Laboratory 2.

Orthopedic diseases of the equine. (Typically Offered: Spring)

VCS 7444: Small Animal Medicine

Credits: 4. Contact Hours: Lecture 4.

Clinical diagnosis and treatment of diseases of small animals. (Typically Offered: Fall, Spring)

VCS 7445: Equine Medicine

Credits: 2. Contact Hours: Lecture 2.

Clinical diagnosis and treatment of diseases of equine. (Typically Offered: Fall)

VCS 7446: Clinical Neurology

Credits: 2. Repeatable.

Clinical rotation in neurology with an emphasis on neurolocalization, disease processes, use of diagnostics in medical and surgical neurology and treatment options. Exposure to neurosurgical techniques.

VCS 7447: Equine Veterinary Diagnostic Skills

Credits: 2. Repeatable.

Hands on experience with equine veterinary diagnostic skills related to theriogenology, medicine, surgery, radiology, and ophthalmology. Preference to equine track student. (Typically Offered: Spring)

VCS 7448: Diagnostic Imaging and Radiobiology

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Essentials of diagnostic image interpretation. Essentials of radiobiology, radiation therapy and protection from radiation. (Typically Offered: Fall, Spring)

VCS 7449: Surgery, Anesthesia, and Community Outreach

Credits: 3. Contact Hours: Lecture 1, Laboratory 6.
Repeatable.

This laboratory introduces the student to anesthetic and surgical principles and techniques that can be applied to all animal species. Provides a broader range of surgical experiences throughout the laboratory. (Typically Offered: Fall, Spring)

VCS 7451B: Advanced Junior Surgery Laboratory: Traditional Curriculum

Credits: 2. Contact Hours: Lecture 1, Laboratory 6.
Repeatable.

8 weeks. Continuation of surgical laboratory experience. Techniques and advanced principles learned are applicable to all animal species. Exposure to more advanced surgical techniques with most surgical principles. (Typically Offered: Spring)

VCS 7451C: Advanced Junior Surgery Laboratory: Traditional Curriculum

Credits: 2. Contact Hours: Lecture 1, Laboratory 6.
Repeatable.

8 weeks. Continuation of surgical laboratory experience. Techniques and advanced principles learned are applicable to all animal species. A second repeat for students with a special interest in small animal surgery. (Typically Offered: Spring)

VCS 7452: Clinical Dermatology

Credits: 2. Repeatable.

Study of clinical dermatological problems via computer-aided instruction, case simulations, and/or lectures. Clinical management of cases presented to Veterinary Medical Center. Instructor Permission needed if not a VM4 classification.

VCS 7453: Small Animal Medicine I

Credits: 2. Contact Hours: Laboratory 6.

Repeatable, maximum of 6 credits.

Clinical assignment in small animal medicine.

VCS 7455: Small Animal Soft Tissue Surgery

Credits: 2. Contact Hours: Laboratory 6.

Repeatable.

Clinical assignment in soft tissue surgery.

VCS 7456: Small Animal Orthopedic Surgery

Credits: 2. Contact Hours: Laboratory 6.

Repeatable.

Clinical assignment in orthopedic surgery.

VCS 7457: Equine Medicine

Credits: 2. Contact Hours: Laboratory 4.

Repeatable.

Clinical assignment in equine medicine.

VCS 7458: Equine Surgery

Credits: 2. Contact Hours: Laboratory 4.

Repeatable.

Clinical assignment in equine surgery.

VCS 7459A: Small Animal Overpopulation Medicine and Surgery :Nebraska Humane Society, Omaha NE

Credits: 2. Contact Hours: Laboratory 4.

A 2-week surgical emphasis, elective rotation at a humane society that addresses the issues facing veterinarians and non-veterinary humane society personnel who deal with small animal overpopulation issues. Each section can be taken for credit once.

VCS 7459C: Small Animal Overpopulation Medicine and Surgery: WaySide Waifs, Kansas City MO

Credits: 2. Contact Hours: Laboratory 4.

A 2-week surgical emphasis, elective rotation at a humane society that addresses the issues facing veterinarians and non-veterinary humane society personnel who deal with small animal overpopulation issues. Each section can be taken for credit once.

VCS 7459D: Small Animal Overpopulation Medicine and Surgery: Boulder Humane Society, Boulder, CO

Credits: 2. Contact Hours: Laboratory 4.

A 2-week surgical emphasis, elective rotation at a humane society that addresses the issues facing veterinarians and non-veterinary humane society personnel who deal with small animal overpopulation issues.

Each section can be taken for credit once.

VCS 7459E: Small Animal Overpopulation Medicine and Surgery: ASPCA Spay/Neuter Alliance, Ashville, NC

Credits: 2. Contact Hours: Laboratory 4.

A 2-week surgical emphasis, elective rotation at a humane society that addresses the issues facing veterinarians and non-veterinary humane society personnel who deal with small animal overpopulation issues.

Each section can be taken for credit once.

VCS 7459F: Small Animal Overpopulation Medicine and Surgery: Capital City Humane Society, Lincoln, NE

Credits: 2. Contact Hours: Laboratory 4.

Small Animal Overpopulation Medicine and Surgery: Capital City Humane Society, Lincoln NE.

VCS 7460: Radiology

Credits: 2. Contact Hours: Laboratory 6.

Repeatable.

Clinical assignment in veterinary radiology.

VCS 7463: Primary Care

Credits: 2. Contact Hours: Laboratory 6.

Repeatable, maximum of 4 credits.

Clinical experience in hospital based general practice.

VCS 7464: Equine Field Services

Credits: 2. Contact Hours: Laboratory 4.

Repeatable.

Clinical assignment in equine ambulatory practice.

VCS 7465: Farrier

Credits: 2. Contact Hours: Laboratory 4.

Elective clinical assignment on the principles and practices of normal and therapeutic horseshoeing and equine foot care.

VCS 7466: Anesthesiology

Credits: 2. Contact Hours: Laboratory 6.

Repeatable.

Clinical assignment in small animal and large animal anesthesiology.

VCS 7468: Intensive Care

Credits: 4. Contact Hours: Laboratory 12.

Repeatable.

Clinical assignment to provide supervision of hospital cases requiring intensive care and including emergency cases.

VCS 7469: Ophthalmology

Credits: 2. Contact Hours: Laboratory 6.

Repeatable.

Clinical assignment in ophthalmology.

VCS 7475: Cardiology Rotation

Credits: 2. Contact Hours: Laboratory 4.

Repeatable.

Elective clinical assignment in cardiology.

VCS 7476E: Equine Anesthesiology

Credits: 2. Contact Hours: Laboratory 4.

Repeatable.

Assignments in equine, small animal, and large animal anesthesiology.

Experience includes case work-up, management and recovery.

Understanding of the unique physiology and potential complications of anesthetized patients. Pharmacology of commonly used drugs. Specific protocols and management for both field and general anesthesia.

VCS 7476S: Small Animal Anesthesiology

Credits: 2. Contact Hours: Laboratory 4.

Repeatable.

Assignments in equine, small animal, and large animal anesthesiology.

Experience includes case work-up, management and recovery.

Understanding of the unique physiology and potential complications of anesthetized patients. Pharmacology of commonly used drugs. Specific protocols and management for both field and general anesthesia.

VCS 7478: Intensive and Critical Care

Credits: 2. Contact Hours: Lecture 2.

Repeatable, maximum of 4 credits.

Elective clinical assignment in intensive care. (Typically Offered: Fall, Spring, Summer)

VCS 7480: Veterinary Dentistry

Credits: 1. Contact Hours: Lecture 1.

All aspects of veterinary dentistry, prophylaxis, endodontics, and orthodontics. This course is an on-line course. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

VCS 7481: Advanced Equine Dentistry

Credits: 2. Contact Hours: Laboratory 4.

Clinical rotation in equine dentistry with an emphasis on routine equine dental examinations, specialized equipment, and corrective procedures. Offered only offered for one 2-week rotation. Enrollment is limited. (Typically Offered: Spring)

VCS 7484X: Clinical Practice in Diverse Communities

Credits: 2.

Two week rotation for fourth year veterinary students working with equine patients both in the hospital and field settings. This rotation includes a community service component, which will include lecture time on relevant topics and a veterinary service trip to the Crow Creek Tribal Reservation in Fort Thompson, SD. Five-day trip, providing experience in preparing, setting up, and running an equine and small animal veterinary clinic to serve the tribal community.

VCS 7490: Independent Study

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Independent Study in veterinary medicine focusing on basic / translational research or learning issues. Enrollment in this course is not appropriate for clinical experiences in the Veterinary Medical Center or extramural experiences in clinical veterinary practice (i.e., preceptorships).

VCS 7492: Orientation for International Experience

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

8 weeks. Predeparture orientation for group study abroad. Cultural considerations for the study abroad experience and a conversational language introduction. Out of class work may be assigned. (Typically Offered: Spring)

VCS 7495: Grand Rounds Presentations

Credits: Required. Contact Hours: Lecture 1.

Seminars and case presentations on selected subjects by fourth year students of the College of Veterinary Medicine. Completion of a seminar presentation is required for graduation. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

VCS 7496: International Experience

Credits: 1-12. Repeatable, maximum of 12 credits.

International Preceptorships and Study Abroad Group programs. Opportunities for students to be involved in applied clinical, production, and/or research experiences in international locations. The course consists of 40 hour per week experiential learning opportunities.

Veterinary Diagnostic and Production Animal Medicine (VDPAM)

Courses primarily for professional curriculum students:

VDPAM 4280: Principles of Epidemiology and Population Health

(Dual-listed with VDPAM 5280/ VMPPM 5280). (Cross-listed with MICRO 4280/ VMPPM 4280).

Credits: 3. Contact Hours: Lecture 3.

Epidemiology of disease in populations. Disease causality, observational study design and approaches to epidemiologic investigations. This course is available on campus and by distance. (Typically Offered: Spring)

VDPAM 4870: Livestock Disease Prevention

Credits: 3. Contact Hours: Lecture 3.

The course is designed for both the pre-veterinary and animal science majors who have an interest in production animal health, disease prevention methods, epidemiology of economically important agents, and the ecology of currently important pathogens found in North American livestock industries. It will focus on disease prevention principles for individuals and large production population systems. (Typically Offered: Fall)

Courses primarily for graduate students, open to qualified undergraduates:

VDPAM 5070: Evidence Based Clinical Decision Making

(Dual-listed with VDPAM 7407).

Credits: 1. Contact Hours: Lecture 1.

Prereq: Graduate Standing or Permission of Instructor

Discussion, lectures and laboratories to assess the quality and significance of medical evidence in making informed decisions about the treatment of individual animals and animal populations. (Typically Offered: Spring)

VDPAM 5080: Poultry Diseases

(Dual-listed with VDPAM 7408).

Credits: 2. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Discussion, lectures and laboratories to assess the quality and significance of medical evidence in making informed decisions about the treatment of individual animals and animal populations. Offered even-numbered years. (Typically Offered: Spring)

VDPAM 5140: Veterinary Practice Entrepreneurship

(Dual-listed with VDPAM 7414).

Credits: 2-3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Formal exposure to the entrepreneurial and business skills necessary to own and operate a successful veterinary practice or other small business opportunity. Personal finance, marketing, human resource management, general accounting, site assessment, location demographics, practice valuation, and a host of other issues which must be considered when purchasing or starting a new business are covered. Class instruction will be delivered by successful practice and business owners with examples from real world experience. (Typically Offered: Spring)

VDPAM 5260: Veterinary Toxicology

(Dual-listed with Dual Listed Course: VDPAM 7426).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Study of toxicological diseases of animals emphasizing clinical recognition, circumstances of poisoning, differential diagnosis with clinical and laboratory data, therapeutic procedures, preventive management and public health implications. Supplemented with case-based materials. (Typically Offered: Spring)

VDPAM 5270: Applied Statistical Methods in Population Studies

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

ANOVA, Linear Regression, Model Selection, Mixed Models, ANCOVA, Repeated Measurement Analysis, MANOVA, Nonparametric Methods, Diagnostic Test Evaluation, ROC Curve Aylsis, Generalized Linear Models, Logistic Regression, Survival Analysis, Cox Proportional Hazards Regression, Count Data Analyses. This course is available on campus and by distance. Offered odd-numbered years. (Typically Offered: Fall)

VDPAM 5280: Principles of Epidemiology and Population Health

(Dual-listed with VDPAM 4280/ VMPPM 4280/ MICRO 4280). (Cross-listed with VMPPM 5280).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Epidemiology of disease in populations. Disease causality, observational study design and approaches to epidemiologic investigations. This course is available on campus and by distance. (Typically Offered: Spring)

VDPAM 5290: Epidemiological Methods in Population Research

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Train students on selecting the proper statistical model to conduct statistical analysis in the context of epidemiological studies. Train students to report and interpret data collected from experimental (clinical trials), observational (cross-sectional, case-control, cohort) or field-based studies incorporating the information covered in previous epidemiology/biostatistics courses and this course, and how to communicate the findings with the end-users. Introduce other methods that can be used when analyzing epidemiological studies. This course is available on campus and by distance. Offered even-numbered years. (Typically Offered: Fall)

VDPAM 5420A: Introduction to Molecular Biology Techniques: DNA Techniques

(Cross-listed with BMS 5420A/ EEOB 5420A/ FSHN 5420A/ GDCB 5420A/ HORT 5420A/ NREM 5420A/ NUTRS 5420A/ BBMB 5420A/ VMPPM 5420A).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes genetic engineering procedures, sequencing, PCR, and genotyping. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

VDPAM 5420B: Introduction to Molecular Biology Techniques: Protein

(Cross-listed with BMS 5420B/ EEOB 5420B/ FSHN 5420B/ GDCB 5420B/ HORT 5420B/ NREM 5420B/ NUTRS 5420B/ BBMB 5420B).

Credits: 1. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. Offered on a satisfactory-fail basis only. (Typically Offered: Spring, Summer)

VDPAM 5420C: Introduction to Molecular Biology Techniques: Cell Techniques

(Cross-listed with BMS 5420C/ EEOB 5420C/ FSHN 5420C/ GDCB 5420C/ HORT 5420C/ NREM 5420C/ NUTRS 5420C/ VMPPM 5420C/ BBMB 5420C).

Credits: 1. Contact Hours: Laboratory 2.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. ular biology techniques and related procedures. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

VDPAM 5420D: Introduction to Molecular Biology Techniques: Plant Transformation

(Cross-listed with BMS 5420D/ EEOB 5420D/ FSHN 5420D/ GDCB 5420D/ HORT 5420D/ NREM 5420D/ NUTRS 5420D/ VMPPM 5420D/ BBMB 5420D).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.
Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: Agrobacterium and particle gun-mediated transformation of tobacco, Arabidopsis, and maize, and analysis of transformants. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

VDPAM 5420E: Introduction to Molecular Biology Techniques: Proteomics

(Cross-listed with BMS 5420E/ EEOB 5420E/ FSHN 5420E/ GDCB 5420E/ HORT 5420E/ NREM 5420E/ NUTRS 5420E/ VMPPM 5420E/ BBMB 5420E).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.
Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: two-dimensional electrophoresis, laser scanning, mass spectrometry, and database searching. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

VDPAM 5420F: Introduction to Molecular Biology Techniques: Metabolomics

(Cross-listed with BMS 5420F/ EEOB 5420F/ FSHN 5420F/ GDCB 5420F/ HORT 5420F/ NREM 5420F/ NUTRS 5420F/ VMPPM 5420F/ BBMB 5420F).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.
Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: metabolomics and the techniques involved in metabolite profiling. For non-chemistry majoring students who are seeking analytical aspects into their biological research projects. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

VDPAM 5420G: Introduction to Molecular Biology Techniques: Genomic

(Cross-listed with BMS 5420G/ EEOB 5420G/ FSHN 5420G/ GDCB 5420G/ HORT 5420G/ NREM 5420G/ NUTRS 5420G/ VMPPM 5420G/ BBMB 5420G).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.
Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

VDPAM 5460: Clinical and Diagnostic Toxicology

(Cross-listed with TOX 5460).

Credits: 1-3. Contact Hours: Laboratory 3.
Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Advanced study of current problems and issues in veterinary toxicology. Emphasis on problem solving and interpreting clinical cases while utilizing clinical, epidemiological, and laboratory resources. Course consists highly of clinical case based material. (Typically Offered: Fall, Spring, Summer)

VDPAM 5510: Advanced Veterinary Diagnostic Pathology

Credits: 1-3. Contact Hours: Laboratory 3.
Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Laboratory diagnosis of animal diseases with emphasis on gross and microscopic lesion description. Caseload is focused heavily on infectious diseases of food animals. (Typically Offered: Fall, Spring, Summer)

VDPAM 5600: Ecology of Infectious Diseases

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Topics of applied ecology of infectious diseases. Specific objectives include: a) understanding dynamics of pathogen transmission within and between population; b) how to reduce risk of pathogen introduction in populations; c) how to early detect pathogens and classify herds according to disease status; d) how to quantify pathogen transmission and impact in animal populations; e) applying and measure the effect of interventions to manipulate disease transmission dynamics within and between populations. Develop skills to prevent, detect and/or significantly control/eliminate animal health issues from animal populations. Learn how to quantify health issues and estimate the value of interventions to influence and mitigate health problems. Offered odd-numbered years. (Typically Offered: Spring)

VDPAM 5620X: Applied Diagnostic Technologies and Medicine for Infectious Disease

Credits: 3. Contact Hours: Lecture 3.
Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Veterinary diagnostics and diagnostic medicine for infectious diseases in animal populations, mostly livestock, and clinical applications. Specific objectives include: understanding diagnostic process; mechanics of laboratory diagnostic methods; test development and validation; optimizing diagnostic outcomes; and applying diagnostic data to disease investigation and/or intervention. Additionally, students are expected to present a diagnostic relevant subject and participate in case review and discussion. On-line and can be asynchronous from time to time. Offered even-numbered years. (Typically Offered: Fall)

VDPAM 5640: Animal Welfare Science and Research

Credits: 3. Contact Hours: Lecture 2, Discussion 1.

Prereq: Graduate Standing or Permission of Instructor

Animal welfare is increasingly a key component of societal decisions about animal use, sustainable development and human-animal relationships. Understanding animal welfare as a scientific discipline, with primary focus on veterinary, biomedical and animal science disciplines. Explore fundamental and applied approaches to animal welfare science, including experimental design, data analysis and interpretation of results. Topics selected will reflect student interests, and may include animal welfare assessment and assurance, animal cognition, pain assessment and mitigation, and animal models used in biomedical research. Offered even-numbered years. (Typically Offered: Spring)

VDPAM 5670X: Design, Implementation and Analysis of Field Studies in Food Animals

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Design of field trials to test hypotheses related to biological outcomes in food animal production. Topics include field trial designs and how-to implement these trials under field/commercial conditions; and how to calculate sample size given different type of outcomes and covers the proper statistical analyses, interpretation, and communication of the results. Invited speakers will share how they use field trials in their daily practice. Case studies. (Typically Offered: Fall)

VDPAM 5700: Risk Assessment for Food, Agriculture and Veterinary Medicine

(Cross-listed with TOX 5700/ AGRON 5700).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Risk assessment principles as applied to biological systems. Exposure and effects characterization in human and animal health and ecological risk assessment. Risk analysis frameworks and regulatory decision-making. Introduction to quantitative methods for risk assessment using epidemiological and distributional analysis. Uncertainty analysis. Offered odd-numbered years. (Typically Offered: Fall)

VDPAM 5810: Advanced Cow/Calf Production Medicine

(Dual-listed with VDPAM 7481).

Credits: 2. Contact Hours: Lecture 1.5, Laboratory 1.5.

Prereq: Graduate Standing or Permission of Instructor

Two-week senior elective that will focus on the economics of animal disease in cow/calf operations. Evidence based medicine and epidemiological principles will be used in investigation of disease outbreaks. Extensive partial budgeting used. Students will complete at least two disease investigations involving outbreaks in commercial cow/calf operations and communicate their findings to the class, the herd owner, and local practitioner. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel. (Typically Offered: Spring)

VDPAM 5900: Special Topics

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Topics in medicine, surgery, theriogenology; beef, swine, dairy, or sheep production medicine. (Typically Offered: Fall, Spring, Summer)

VDPAM 5960: International Experience

(Dual-listed with VDPAM 7496).

Credits: 1-12. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

International Preceptorship. (Typically Offered: Fall, Spring, Summer)

VDPAM 5990: Creative Component

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

Courses for graduate students:**VDPAM 6500: Swine Diagnostic Medicine**

Credits: 4. Contact Hours: Lecture 4.

A detailed study of swine diseases emphasizing the pathogenesis and diagnosis of swine respiratory, enteric, reproduction, metabolic, and septicemic diseases. Course activities include interpretation of diagnostic case reports and development of diagnostic plans for specific disease objectives. (Typically Offered: Fall)

VDPAM 6540: Comparative Antimicrobial Clinical Pharmacology

Credits: 2. Contact Hours: Lecture 2.

Initial antimicrobial selection for infectious diseases of domestic animals. The antimicrobial drug groups will be examined, stressing pharmacokinetics, minimal inhibitory concentrations, and the use of these parameters to select appropriate compounds and dosages for maximum efficacy. Offered odd-numbered years. (Typically Offered: Fall)

VDPAM 6550: Advanced Swine Production Medicine

Credits: 4. Contact Hours: Lecture 4.

Detailed overview of applied techniques used in swine production medicine; production modeling and record analysis, facility design and management, analysis of competing intervention options, design and evaluation of therapeutic and vaccination strategies, quality control procedures and food safety. Course activities include interpretation of diagnostic case reports and development of diagnostic plans for specific disease objectives. Offered odd-numbered years. (Typically Offered: Spring)

VDPAM 6990: Research

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Courses primarily for professional curriculum students:

VDPAM 7308: Spanish for Veterinarians

Credits: 2. Contact Hours: Lecture 2.

This course is designed to meet the needs of veterinary students who will practice in an environment in which the use of Spanish for accurate client communication is essential which includes much of our food animal industry in the state of Iowa. This is not a traditional Spanish language course. To be successful, students taking the course should have a basic knowledge of Spanish pronunciation, grammar and syntax. (Typically Offered: Spring)

VDPAM 7309: Introduction to Production Animal Informatics

Credits: 1. Contact Hours: Lecture 1.

The fundamentals of how clinical, diagnostic, production and financial information is obtained and used by production animal operations will be presented. Students will acquire skills to create and use spreadsheets for manipulating and summarizing data. They will also acquire knowledge of where to find inexpensive and readily available resources with information on how to use spreadsheets and other software. Students will also have the opportunity to work with record keeping programs used by food animal operations. (Typically Offered: Spring)

VDPAM 7310: Introduction to Production Medicine

Credits: 2. Contact Hours: Lecture 2.

The role of the veterinarian in the management of animal health and production in populations including evaluation tools in dairy and beef cattle herds, beef feedlots and swine herds will be described. Provides veterinary students with a starting point to understand the principles and techniques that are the basis of food-animal population health diagnosis management programs. Course available on-line, attendance is not required. (Typically Offered: Spring)

VDPAM 7312: Introduction to Animal Welfare

Credits: 1. Contact Hours: Lecture 1.

A continuation of the Veterinarian in Society series. The objective of this course is to develop knowledge of the fundamental principles of animal welfare, in terms of science, ethics and cultural components. (Typically Offered: Spring)

VDPAM 7340: Clinical Foundations

Credits: 1. Contact Hours: Laboratory 2.

One week, hands-on course at Iowa State University; introduction to food supply veterinary medicine covering overviews of major animal agriculture species (beef, dairy, swine, small ruminants, and camelid), production systems, behavior, welfare, handling and restraint, examination techniques, biosecurity, epidemiology and food safety. Students will visit farms owned by Iowa State University and private clients of Food Animal and Camelid Field Services to perform hands-on clinical skills. Attendance is mandatory. Biosecurity: All students must follow current college policies regarding animal contact following foreign travel. Additionally, no swine contact is allowed within 48 hours of the swine farm visit. Required equipment includes coveralls, rubber boots, thermometer and stethoscope. (Typically Offered: Spring)

VDPAM 7351: Bovine Embryo Transfer and Related Technology

Credits: 2. Contact Hours: Lecture 2.

This course will meet for two hours once each week of the Spring Semester. The first hour will be traditional lecture and the second hour will be a combination of student projects, labs and demonstrations of applied clinical procedures. Bovine embryo transfer and closely related topics such as: female reproductive physiology, estrus synchronization, semen sexing and reproductive disease will be emphasized. In addition, several class periods will be devoted to the use of ultrasound for diagnosis of reproductive and non-reproductive conditions. (Typically Offered: Spring)

VDPAM 7365: Animal Welfare Judging and Assessment

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Preparation for competition in the Intercollegiate Animal Welfare Judging Contest. Development of critical appraisal and oral communication skills in regard to animal welfare. Animal behavior, physiology, health and performance parameters, basic husbandry, housing and preventive care will be explored for select farmed, companion and exotic species. Optional field trips. Course is open to Vet Med, Undergraduate and Graduate students. (Typically Offered: Fall)

VDPAM 7402A: Advanced Dairy Production Informatics: Lecture Series

Credits: 2. Contact Hours: Lecture 2.

Advanced coverage of concepts related to collection, manipulation, analysis and reporting of information used by dairy farms and their consultants. Hands on experience with Dairy Comp 3050 and PCDart as well as other dairy management and information software. (Typically Offered: Spring)

VDPAM 7402B: Advanced Dairy Production Informatics: Experience I

Credits: 2. Contact Hours: Lecture 2.

Independent records analysis and reporting of information used by dairy farms and their consultants. Hands on experience with Dairy Comp 3050 and PCDart. (Typically Offered: Fall, Spring)

VDPAM 7402C: Advanced Dairy Production Informatics: Experience II

Credits: 2. Contact Hours: Lecture 2.

Independent records analysis and reporting of information used by dairy farms and their consultants. Hands on experience with Dairy Comp 3050 and PCDart. (Typically Offered: Fall, Spring)

VDPAM 7402D: Advanced Dairy Production Informatics: Experience III

Credits: 2. Contact Hours: Lecture 2.

Independent records analysis and reporting of information used by dairy farms and their consultants. Hands on experience with Dairy Comp 3050 and PCDart. (Typically Offered: Fall, Spring)

VDPAM 7407: Evidence Based Clinical Decision Making

(Dual-listed with VDPAM 5070).

Credits: 1. Contact Hours: Lecture 1.

Discussion, lectures and laboratories to assess the quality and significance of medical evidence in making informed decisions about the treatment of individual animals and animal populations. (Typically Offered: Spring)

VDPAM 7408: Poultry Diseases

(Dual-listed with VDPAM 5080).

Credits: 2. Contact Hours: Lecture 2.

Bacterial, viral, parasitic, and nutritional diseases of domestic poultry and gamebirds; biosecurity, immunization, and management procedures to prevent poultry diseases. This course includes wet labs. Additional assignments required for graduate level credit. (Typically Offered: Spring)

VDPAM 7409: Veterinary Practice Management and Organization

Credits: 2. Contact Hours: Lecture 2.

An A to Z introduction to proven veterinary practice management methods and strategies. The student will follow a detailed hands-on workbook describing most of the processes and procedures of day to day veterinary practice. Class content will be delivered via online modules. (Typically Offered: Fall)

VDPAM 7414: Veterinary Practice Entrepreneurship

(Dual-listed with VDPAM 5140).

Credits: 2-3. Contact Hours: Lecture 3.

Formal exposure to the entrepreneurial and business skills necessary to own and operate a successful veterinary practice or other small business opportunity. Personal finance, marketing, human resource management, general accounting, site assessment, location demographics, practice valuation, and a host of other issues which must be considered when purchasing or starting a new business are covered. Class instruction will be delivered by successful practice and business owners with examples from real world experience. (Typically Offered: Spring)

VDPAM 7416: Bovine Reproduction Evaluation Laboratory

Credits: 1. Contact Hours: Laboratory 4.

Repeatable.

Bovine rectal palpation techniques will be repetitively taught in 7 four-hour sessions. Students will also learn techniques of epidural anesthesia, artificial insemination, pregnancy staging and ultrasonic imaging. University-owned cattle will be used. Spring semester only offered one section. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel. (Typically Offered: Fall, Spring)

VDPAM 7419: Advanced Swine Production Informatics

Credits: 1. Contact Hours: Lecture 1.

Advanced coverage of concepts related to the collection, manipulation, analysis, and reporting of information used by swine production companies. A quick review of modern swine production and measures of productivity ensures students have a firm base for applying the informatics. This course introduces students to one of the most commonly used swine record-keeping systems in the industry and gives them access to actual production data with which to work. Students then learn how to generate and interpret regularly used reports and will use pivot tables and budgeting models in Excel. The importance of data entry and validation and how to transform data into useful knowledge are then addressed. Fundamentals of financial information, cost-benefit analysis and using budgeting models to assess the economics of animal health interventions are then applied. (Typically Offered: Fall)

VDPAM 7420A: Applied Production Animal Medicine Preceptorship: Food Animal Emphasis

Credits: 1-6. Repeatable.

Advanced course in mixed animal production medicine with a food animal emphasis in veterinary practice settings. Requires 40 hours of clinical experience per week. Assignments will be preceptorships with a practicing veterinarian, governmental agency and/or production unit. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel. (Typically Offered: Fall, Spring, Summer)

VDPAM 7420B: Applied Production Animal Medicine Preceptorship: General Mixed Animal Practice

Credits: 1-6. Repeatable.

Advanced course in production animal medicine in general mixed animal veterinary practice settings. Requires forty hours clinical experience per week. Assignments will be preceptorships with a practicing veterinarian, governmental agency and/or production unit. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel. (Typically Offered: Fall, Spring, Summer)

VDPAM 7420C: Applied Production Animal Medicine Preceptorship: Government Agency or Food Processing Company

Credits: 1-6. Repeatable.

Advanced course in production animal medicine with emphasis on government agency or food processing company in veterinary practice settings. Forty hours clinical experience per week. Assignments will be preceptorships with a governmental agency and/or production unit. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel. (Typically Offered: Fall, Spring, Summer)

VDPAM 7420P: Applied Poultry Production Medicine Preceptorship

Credits: 1-6. Repeatable, maximum of 6 credits.

Unique, highly relevant, hands-on veterinary experience for participating students. Development of poultry-specific practice skill sets. Documented experience that is highly valued by future poultry employers. Enhanced cultural and professional awareness for participating students through interaction with active poultry practitioners. Exposure to diverse poultry practice and production environments. (Typically Offered: Fall, Spring, Summer)

VDPAM 7421A: Great Plains Veterinary Educational Center: Calving

Credits: 1.

The Calving Elective provides an opportunity to expand knowledge and experience in all phases of calving management. The program is structured around normal calving operations at USMARC including emergency duties. Activities that take place during the Calving Elective including the diagnosis, treatment, and management of many commonly encountered conditions in the dam and calf, necropsies, and daily discussions. Participation in a caesarian section is not guaranteed. Student must be able to provide own transportation to each site. (Typically Offered: Spring)

VDPAM 7421B: Great Plains Veterinary Educational Center: Bull Breeding Soundness

Credits: 1.

The Bull Breeding Soundness Examination Elective involves training in all phases of the bull fertility examination as recommended by the Society for Theriogenology. Chuteside, hand-on experience is the primary training technique for this elective with informal discussions held during the performance of breeding soundness examinations on 350 or more bulls. Student must be able to provide own transportation to each site. (Typically Offered: Spring)

VDPAM 7421D: Great Plains Veterinary Educational Center: Feedlot Management

Credits: 1.

Evaluation of production techniques and production efficiency including ration and feeding management, health management program development and evaluation, environmental management, quality assurance and field necropsy techniques. Exposure to marketing and economic considerations in feed yard decision making. A strong emphasis on population medicine, trouble shooting and problem-solving skills in the beef industry, with exposure to harvest/food safety considerations. Discussions on pharmaceutical and feed additive usage and legal implications in food supply veterinary medicine. Student must be able to provide own transportation to each site. (Typically Offered: Fall, Summer)

VDPAM 7421E: Great Plains Veterinary Educational Center: Calf Weaning Management

Credits: 1.

This is a hands-on elective in which students participate in the weaning management at the USMARC. Students will be involved with processing, feeding, finding, and treating sick calves. Additionally, students will be introduced to developing weaning rations and managing feed delivery. Students will also learn how to develop vaccination and treatment protocols and each student will have as an objective the development of their own vaccination and treatment protocol template. As time allows, students will visit commercial feed yards and cover production management topics. Student must be able to provide own transportation to each site. (Typically Offered: Fall)

VDPAM 7421F: Great Plains Veterinary Educational Center: Pregnancy Examination

Credits: 1.

The Pregnancy Examination Elective involves rectal examinations for pregnancy, chuteside data collection and data entry into a computer software program to evaluate the reproductive performance of the herd. This elective is designed for students who have some palpation experience and are interested in honing their skills. Pregnancy Examination occurs during yearly fall herd work at the USMARC, therefore, speed and accuracy will be stressed, rather than basic technique. Student must be able to provide own transportation to each site. (Typically Offered: Fall)

VDPAM 7421J: Great Plains Veterinary Educational Center: Lambing

Credits: 1.

The Lambing Elective involves students working with the USMARC lambing crew and GPVEC faculty in observations, assistance with delivery when necessary, and routine lambing duties. Students will work with veterinary personnel in sheep necropsy and health surveillance. Self-study material will be provided covering topics such as pre-breeding and breeding, pregnancy diagnosis, pregnant ewe management, pre-lambing ewe/lambing management, feeder lamb health and nutrition management, and replacement ewe and ram management. Student must be able to provide own transportation to each site. (Typically Offered: Spring)

VDPAM 7421K: Great Plains Veterinary Educational Center: Equine Dentistry

Credits: 1.

The Equine Dentistry Elective provides the opportunity for students to expand their knowledge and experience related to equine dentistry. The rotation consists of lectures on topics relevant to equine dental care and hands-on laboratories during which students practice routine dental care procedures on USMARC horses. Equine Dentistry will involve both lecture and lab time at about equal shares. Student must be able to provide own transportation to each site. (Typically Offered: Spring)

VDPAM 7421P: Great Plains Veterinary Educational Center: Bovine Surgery

Credits: 1.

The Bovine Surgery Elective is designed to give students interested in food animal surgery an opportunity to practice their surgical skills by performing penile translocations and epididymectomies on USMARC teaser bull candidates. Lectures specific to gomer bull surgery as well as other topics related to food animal surgery will be presented during this elective. Student must be able to provide own transportation to each site. (Typically Offered: Fall)

VDPAM 7421Q: Great Plains Veterinary Educational Center: Swine Husbandry

Credits: 1.

This elective provides students the opportunity to gain hands-on experience related to the daily activities of an intensively managed confinement swine unit. Rotation participants will work closely with USMARC Swine Unit personnel as they complete their daily routines in the farrowing and breeding areas of the USMARC Swine Unit and will participate in piglet delivery, neonatal pig processing, artificial and natural breeding, necropsies, and other activities as they arise. Student must be able to provide own transportation to each site. (Typically Offered: Fall, Spring)

VDPAM 7421R: Great Plains Veterinary Educational Center: Lamb Weaning Management

Credits: 1.

This elective provides the opportunity for students to develop their skills in the area of health and nutritional management of sheep immediately before and after weaning. The rotation consists of lectures on pre- and post-weaning nutrition, clinical parasitology, and prevention and control of common ovine infectious diseases. Hands-on experience during the week will take place at the USMARC Sheep Unit and will consist of walk-through and hand-on examinations of recently weaned lambs, treatment of sick lambs, inspection of weaning pen environment, investigation of herd outbreaks, and post mortem examination of all sheep mortalities. Student must be able to provide own transportation to each site. (Typically Offered: Summer)

VDPAM 7421S: Great Plains Veterinary Educational Center: Ultrasound Pregnancy Examination

Credits: 1.

The Ultrasound Pregnancy Examination Elective involves transrectal ultrasonographic examinations for pregnancy, chuteside data collection and data entry into a computer software program to evaluate the reproductive performance of the herd. This elective is designed for students who have some ultrasound experience and are interested in honing their skills. This elective occurs during yearly fall herd work at the USMARC, therefore, speed and accuracy will be stressed, rather than basic technique. Didactic instruction may include several topics in cow herd health, nutrition, management and reproductive decision making. Student must be able to provide own transportation to each site. (Typically Offered: Summer)

VDPAM 7421T: Great Plains Veterinary Educational Center: Food Animal Clinical Care and Treatment (FACCT)

Credits: 1.

This course is designed to achieve hands-on and critical thinking skills necessary to provide clinical care to cattle and sheep. Student needs will be met through structured discussions and accompanying the veterinarians in daily care of the animals at USMARC. Student must be able to provide own transportation to each site. (Typically Offered: Fall, Spring)

VDPAM 7421U: Great Plains Veterinary Educational Center: Necropsy and Diagnostic Investigations

Credits: 1.

This course is designed to develop diagnostic and critical thinking skills necessary to investigate disease outbreaks in a herd health setting. Student needs will be met through daily necropsy procedures, in depth discussions of case examples, and thorough exposure to diagnostic tests and sampling procedures. Student must be able to provide own transportation to each site. (Typically Offered: Fall, Spring)

VDPAM 7422: Beef Cattle Calving

Credits: 2. Repeatable.

This elective provides students opportunity to assist cow-calf operations with calving in Nebraska, South Dakota or other locations. These operations typically calve 300-1,000 head each spring. Calving experience is not required, but a good understanding of working around cattle is necessary. Students will be actively participating in the day to day, normal calving routine including detecting and sorting off 'springers', calf 'watch', detecting when intervention is needed and assisting delivery, caring for and monitoring newborns and dams for good health and early disease detection, tagging/processing new calves, treating calves needing intervention and performing other routine calving chores. Students need to provide their own transportation to the site and overnight stays at or near the production sites are required. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel. (Typically Offered: Fall, Spring, Summer)

VDPAM 7424: Preceptorship in Diagnostic Pathology.

Credits: 1-6. Repeatable.

Advanced course in production animal medicine with emphasis on gross and diagnostic pathology. Forty hours clinical experience per week. Assignments will be preceptorships with a diagnostic laboratory, veterinary pathologist, governmental agency and/or production unit. Biosecurity policies require documentation of student's presence in the USA 5 days immediately prior to the start of class. (Typically Offered: Fall, Spring)

VDPAM 7426: Veterinary Toxicology

Credits: 3. Contact Hours: Lecture 3.

Study of toxicological diseases of animals emphasizing clinical recognition, circumstances of poisoning, differential diagnosis with clinical and laboratory data, therapeutic procedures, preventive management and public health implications. Supplemented with case-based materials. (Typically Offered: Spring)

VDPAM 7436A: Beef Records Analysis: Introduction

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Lectures will emphasize current production and evaluation techniques for beef cow/calf operations and students will learn to conduct and critically assess production and financial data using a standardized approach. Lab activities will allow students an opportunity to become Beef Quality Assurance (BQA) certified through the Iowa Beef Center. (Typically Offered: Fall)

VDPAM 7436B: Beef Records Analysis: Herd Management

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Lectures will emphasize current production and evaluation techniques for beef cow/calf operations and students will learn to conduct and critically assess production and financial data using a standardized approach. Lab activities will allow students an opportunity to work with individual beef cattle producers to identify areas for improving profitability, health, and sustainability. (Typically Offered: Spring)

VDPAM 7436C: Beef Records Analysis: Cow/Calf Preventive Medicine

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Lectures will emphasize current production and evaluation techniques for beef cow/calf operations and students will learn to conduct and critically assess production and financial data using a standardized approach. Emphasis will be on obtaining a better understanding of nutritional and reproductive management of cow herds. Lab activities will allow students an opportunity to work with individual beef cattle producers to identify areas for improving profitability, health, and sustainability. (Typically Offered: Fall)

VDPAM 7436D: Beef Records Analysis: Feedlot Production Medicine

Credits: 1. Contact Hours: Laboratory 2.

Repeatable.

Lectures will emphasize current production and evaluation techniques for feedlot production and students will develop a standard treatment protocol book. Topics include respiratory disease, receiving programs, nutrition, cattle handling and environmental issues. (Typically Offered: Spring)

VDPAM 7445: Production Animal Clinical Medicine

Credits: 3. Contact Hours: Lecture 3.

Clinical diagnosis and treatment of diseases of swine, beef and dairy cattle, and small ruminants. (Typically Offered: Spring)

VDPAM 7450: Disturbances of Reproduction

Credits: 4. Contact Hours: Lecture 4.

Repeatable.

General principles of normal reproductive functions in addition to environment, management and diseases causing disturbances in reproduction. Cattle, Swine, Equine, Small Ruminant, and Small Animal species will be covered. (Typically Offered: Fall)

VDPAM 7451: Clinical Embryo Transfer

Credits: 2. Contact Hours: Laboratory 4.

Repeatable.

Elective clinical assignment in techniques of embryo transfer. Primary species studied will be bovine but equine and small ruminant embryo transfer will be covered during discussions. Enrollment is limited to four students per two week session. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel. (Typically Offered: Fall, Spring, Summer)

VDPAM 7455: Diagnostic Laboratory Practicum

Credits: 1. Contact Hours: Laboratory 2.

Repeatable.

Prereq: VDPAM 7310

Practical experience and training in necropsy, recognition of gross lesions, diagnostic sample collection and test selection for the diagnosis of infectious, toxic, nutritional and metabolic diseases through exposure to diagnostic cases submitted to the ISU Veterinary Diagnostic Laboratory. The VDL accepts cases from all species; however, this course predominantly consists of porcine and bovine cases. (Typically Offered: Fall, Spring)

VDPAM 7456: Veterinary Diagnostic Lab Methods & Applications

Credits: 1. Contact Hours: Lecture 1.

An introduction to diagnostic medicine including strengths and weaknesses of various testing technologies, how to choose appropriate tests and technologies, sampling strategies in diseased and non-diseased populations and interpretation and integration of results of tests to achieve an accurate diagnosis are discussed. (Typically Offered: Fall)

VDPAM 7463: Feedlot Production Medicine

Credits: 1.

One-week VM4 elective focusing on Midwestern feedlot production. Addresses feedlot production practices common to Iowa and surrounding states, including feeding cattle on concrete or under roofs. Activities include participation and visitation to representative feedlots in Iowa. (Typically Offered: Spring)

VDPAM 7465: Animal Welfare Clinical Rotation

Credits: 2.

Two-week course for senior veterinary students to gain skills for collecting and interpreting animal welfare data, aid clients with identifying and achieving welfare goals, and assisting law enforcement with animal cruelty response. Field trips to food animal and companion animal facilities are mandatory. (Typically Offered: Fall, Summer)

VDPAM 7466X: Preceptorship in Animal Welfare

Credits: 1-6. Repeatable.

Preceptorship in animal behavior and welfare with emphasis on animal behavior and/or welfare assessment, problem solving, interventions to treat and prevent animal behavior and/or welfare cases. Mentors include practicing veterinarians, professionals consulting on animal behavior and welfare, and/or animal welfare organizations. Biosecurity: all students must follow current College of Veterinary Medicine policies regarding animal contact following foreign travel. (Typically Offered: Fall, Spring, Summer)

VDPAM 7471C: Animal Reproduction: Comparative

Credits: 2. Repeatable, maximum of 4 credits.

Elective comparative clinical assignment in Theriogenology with caseload management in Food Animal, Equine, Small Animal and Small Ruminants sections. Rotation through these different sections will depend on the caseload (by species) and include routine breeding management, semen collection and cryopreservation in different species, advanced laparoscopic and non-surgical procedures for insemination and embryo flushing/transfer, pregnancy diagnosis as well as management of reproductive emergencies. (Typically Offered: Fall, Summer)

VDPAM 7471E: Animal Reproduction: Equine Reproduction

Credits: 2. Repeatable, maximum of 4 credits.

Elective clinical assignment in Equine Theriogenology involving both mare and stallion breeding management, cool-shipped semen preparation and semen cryopreservation, embryo transfer, foaling of high-risk pregnant mares as well as normal mares, breeding soundness exams of the mare and stallion, treatment of retained fetal membranes and neonatal care. (Typically Offered: Spring, Summer)

VDPAM 7471F: Animal Reproduction: Food Animal Reproduction

Credits: 2. Repeatable, maximum of 4 credits.

Elective clinical assignment in Food Animal Theriogenology involving male and female breeding soundness exams, dystocia management, advanced diagnostic and surgical procedures, surgical and non-surgical insemination programs in small ruminants, and semen cryopreservation. Medical and surgical correction of reproductive disorders in cattle, swine and small ruminants. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel. (Typically Offered: Spring, Summer)

VDPAM 7471S: Animal Reproduction: Small Animal Reproduction

Credits: 2. Repeatable, maximum of 4 credits.

Primary reproductive management in the canine and feline involving breeding management of the bitch and stud dog, advanced surgical and non-surgical insemination using fresh, cooled or frozen semen, and infertility case management for the male and female. High risk pregnancy management, parturition and neonatal care of both canine and felines, as required. (Typically Offered: Fall, Spring, Summer)

VDPAM 7476: Food Animal and Camelid Field Service

Credits: 1-2. Contact Hours: Laboratory 4.

Repeatable.

Prereq: VDPAM 7310

Students will assist university veterinarians in delivering individual animal health care and herd-based production management services to the ISU livestock farms and other livestock farms in the local area. Focus on the establishment of best practices for herd management of production systems at the university and in the region. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel. (Typically Offered: Fall, Spring, Summer)

VDPAM 7477: Food Animal and Camelid Medicine and Surgery

Credits: 2. Contact Hours: Laboratory 4.

Repeatable.

Clinical assignment focused on the management of food animal and camelid medicine and surgery cases. Specific instruction in clinical evaluation of cases coupled with appropriate diagnostic testing and therapeutic intervention will be emphasized. Additional instruction will be provided in disease prevention, intensive care and management of food animal and camelid species. Particular emphasis will be placed on appropriate on-label and extra-label drug usage in food animal species. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel. (Typically Offered: Fall, Spring, Summer)

VDPAM 7478A: Swine Medicine Education Center: Swine Production Management and Consultation

Credits: 2. Repeatable.

Swine production management and consulting skills within a progressive swine production and management system. Time will be split approximately with half in-class discussion topics of finance and business of the swine industry and half on-farm learning opportunities where students will visit a breeding farm, nursery facility, finishing facility, wean-to-finish facility, gilt developer unit, and a truck wash facility. (Typically Offered: Fall, Spring)

VDPAM 7478B: Drug, Vaccination, and Treatment Management for Swine

Credits: 2. Repeatable.

Basic and applied information on swine treatment options, strategies to maximize efficacy, and skills to pursue judicious use of antimicrobials, reproductive interventions, and the entire spectrum of drug therapies. The course emphasizes case based application and decisions and is approximately 30% web-based and 70% on-site including farms of a variety of structures and functions. During the course, students prepare a thorough evaluation of the pharmacologic interventions that may occur on farms and then implement this evaluation in active production facilities to maximize efficacy, compliance and animal welfare as part of a comprehensive judicious use objective. (Typically Offered: Spring, Summer)

VDPAM 7478C: Swine Medicine Education Center: Swine Emerging Diseases and Emergency Response Management

Credits: 2. Repeatable.

Diagnostic tests, methods, approaches, analysis, and evaluation of emerging swine diseases and provide general knowledge of disease elimination and methods to manage herd losses and economic losses due to disease. Two-week, on-site module that combines structured site visits and classroom activities. (Typically Offered: Fall, Spring)

VDPAM 7479: Applied Swine Production Medicine Preceptorship

Credits: 1-6. Contact Hours: Laboratory 12.

Repeatable.

Preceptorship course in swine production medicine with emphasis on herd management, production analysis, and problem solving. Forty hours clinical experience per week. Assignments will be preceptorships with a practicing veterinarian and/or a production unit. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel. (Typically Offered: Fall, Spring, Summer)

VDPAM 7480: Swine Medicine

Credits: 2. Contact Hours: Lecture 1, Laboratory 2.

Repeatable.

Two week clinical rotation in swine production medicine. Students will be assigned to take the lead in investigating field based client cases with supervision of the instructors. Development of critical thinking skills that will allow students to apply concepts of herd management, production analysis, economic analysis, and disease prevention in addressing client cases. Variable amounts of travel to farm sites will be required with the potential for rare overnight stays. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel. (Typically Offered: Fall, Spring, Summer)

VDPAM 7481: Advanced Cow/Calf Production Medicine

(Dual-listed with VDPAM 5810).

Credits: 2. Contact Hours: Lecture 1.5, Laboratory 1.5.

Two-week senior elective that will focus on the economics of animal disease in cow/calf operations. Evidence based medicine and epidemiological principles will be used in investigation of disease outbreaks. Extensive partial budgeting used. Students will complete at least two disease investigations involving outbreaks in commercial cow/calf operations and communicate their findings to the class, the herd owner, and local practitioner. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel. (Typically Offered: Spring)

VDPAM 7482: Applied Beef Production Medicine Preceptorship

Credits: 1-6. Repeatable.

Advanced course in beef production medicine with emphasis on herd management, production analysis, and problem solving. Forty hours clinical experience per week. Assignments will include preceptorships with a practicing veterinarian and/or a production unit. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel. (Typically Offered: Fall, Spring, Summer)

VDPAM 7483: Beef Production Medicine

Credits: 2. Contact Hours: Lecture 1, Laboratory 2.

Two week advanced clinical rotation in beef production medicine. Fifteen hours recitation/discussion and 20 hours clinical experience per week. This course is designed to expose students to cow-calf and feedlot production concepts. The activities scheduled for the rotation depend greatly on the time of year. Whenever possible, the class incorporates field trips to better understand how commercial cow/calf and feedlots operate and the veterinarian's role in their management. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel. (Typically Offered: Fall)

VDPAM 7484: Dairy Production Medicine

Credits: 2. Contact Hours: Lecture 1, Laboratory 2.

Two week course in dairy production medicine combining class time with multiple on-farm visits to learn various management aspects (DHIA, DC305 & PC Dart record analysis, calf rearing through lactating cows, reproduction programs, udder health and milk quality, biosecurity, welfare, nutrition and cow comfort) for a wide variety of dairy operations. Students will learn the latest in dairy management by reviewing current topic articles and gain experience in farm evaluation through a group project. Fifteen hours recitation/discussion and 20 hours clinical experience per week. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel. (Typically Offered: Fall, Summer)

VDPAM 7485: Applied Dairy Production Medicine Preceptorship

Credits: 1-6. Contact Hours: Laboratory 12.

Repeatable.

Advanced course in dairy production medicine with emphasis on herd management, production analysis, and problem solving. Forty hours clinical experience per week. Assignments will include preceptorships with a practicing veterinarian and/or a production unit. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel. (Typically Offered: Fall, Spring, Summer)

VDPAM 7486: Introduction to Small Ruminant Production Medicine

Credits: 1. Contact Hours: Lecture 1.

Survey of small ruminant production systems, common management practices, and disease processes of small ruminants and camelids. This course is intended to give the student a background in small ruminant medicine. Herd health, disease monitoring and prevention, nutrition, and typical management systems will be emphasized in lecture. (Typically Offered: Spring)

VDPAM 7488: Laboratory in Clinical Microbiology

Credits: 1. Contact Hours: Laboratory 3.

Repeatable.

Prereq: VDPAM 7310

Application of microbiological procedures to the diagnosis of infectious diseases. (Typically Offered: Fall, Spring)

VDPAM 7490: Independent Study

Credits: 1-5. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

VDPAM 7491: Advanced Ruminant Nutrition

Credits: 2. Contact Hours: Lecture 2.6, Laboratory 0.8.

Focus on dairy nutrition and balancing rations from the calf to the adult, lactating cow. Introduction to different feedstuffs and forage varieties to determine those that are best suited to bovine diets. This course starts the week immediately prior to the start of the fall semester and continues throughout the fall semester. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel. (Typically Offered: Fall)

VDPAM 7494: Advanced Dairy Production Medicine

Credits: 2. Contact Hours: Lecture 1.3, Laboratory 1.3.

Advanced course in investigating dairy herd problems relating to milk quality or nutrition. Milk quality and nutrition troubleshooting will be taught through the combination of lecture and on-farm investigations. Students will combine lecture knowledge, data acquired from on-farm investigations and record analysis to generate management plans. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel. (Typically Offered: Spring)

VDPAM 7495: Advanced Small Ruminant Production Medicine

Credits: 2. Contact Hours: Laboratory 4.

Two week clinical rotation in small ruminant production medicine. Field trips (including overnight stays) will be incorporated when possible. Topics to be covered include small ruminant industries (milk, meat, and fiber), milk quality, nutrition, reproduction, and disease management of small ruminants. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel. (Typically Offered: Fall, Spring)

VDPAM 7496: International Experience

(Dual-listed with VDPAM 5960).

Credits: 1-12. Repeatable.

International Preceptorships and Study Abroad Group programs. Opportunities for students to be involved in applied clinical, production, and/or research experiences in international locations. The course consists of 40 hour per week experiential learning opportunities. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

VDPAM 7498: Poultry Medicine

Credits: 2.

Two-week senior elective to introduce students into poultry production medicine in the Midwest. Students will participate in routine flock monitoring, biosecurity reviews, disease investigations involving outbreaks in commercial and backyard poultry operations, and have a basic understanding of the poultry industry and poultry diseases. Involves didactic lectures in the classroom, field trips to poultry farms, and necropsies. (Typically Offered: Summer)

Veterinary Microbiology and Preventive Medicine (VMPM)

Courses primarily for undergraduates:

VMPM 3300: Global Health Disparities

(Cross-listed with GLOBE 3300).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior classification

Historical and contemporary factors contributing to disparities in health outcomes for persons disadvantaged by income, location, ethnicity, sexual orientation, and abilities. Analysis and evaluation of health promotional materials, such as campaigns, and community-based interventions focused on reducing global health disparities. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Spring)

VMPM 3600: Global Health

(Cross-listed with GLOBE 3600/ MICRO 3600).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2110

Explores human health across the world with particular emphasis on low- and lower-middle-income countries. Attention is given to the interconnectedness of health determinants, problems, and solutions found in global health, including the role of animals and the environment. Broad in scope, highlighting different cultures and the historical foundations of global health. Topics include colonialism, poverty, emerging diseases, climate change, biodiversity, one health, maternal and child health, HIV, malaria, urbanization, noncommunicable diseases and more. Current events will be a feature of all class meetings. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

VMPM 4280: Principles of Epidemiology and Population Health

(Dual-listed with VDPAM 5280/ VMPM 5280). (Cross-listed with MICRO 4280/ VDPAM 4280).

Credits: 3. Contact Hours: Lecture 3.

Epidemiology of disease in populations. Disease causality, observational study design and approaches to epidemiologic investigations. This course is available on campus and by distance. (Typically Offered: Spring)

VMPM 4500X: Introduction to a Research Career in Industry

(Cross-listed with BMS 4500X).

Credits: 1. Contact Hours: Lecture 2.

Explores research career paths in industry. Course will discuss ways students can prepare competitive applications and skill sets necessary for success. Concepts of regulatory constraints, quality management systems and intellectual property will also be introduced. Material will be presented by industry associates and leaders. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

Courses primarily for graduate students, open to qualified undergraduates:

VMPM 5010: Basic Principles of Microbiology

Credits: 3. Contact Hours: Lecture 3.

Prereq: Biomedical Science Graduate Student or Permission of Instructor

The general principles of bacteriology, immunology and virology will be discussed. The structure and function of bacteria and viruses, the mechanisms of pathogenesis, and the host response to infectious agents will be reviewed. Vaccines, their failures, and new developments in vaccine development will be explored. (Typically Offered: Fall)

VMPM 5020: Microbial Genetics and Genomics

(Dual-listed with MICRO 4020/ GEN 4020). (Cross-listed with MICRO 5020).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (BIOL 3130 and MICRO 3020) or Graduate Classification

The fundamental concepts of bacterial and bacteriophage genetics including mutagenesis, mechanisms of vertical and horizontal genetic information transfer and gene regulation are covered, along with genetic and genomic-based approaches to study these and other cellular processes of microorganisms. Review and discussion of research literature to examine experimental design, methodology, and interpretation of both historical and contemporary relevance to microbial genetics and genomics. Offered even-numbered years. (Typically Offered: Fall)

VMPM 5170: Gut Microbiome: Implications for Health and Diseases

(Cross-listed with ANS 5170/ MICRO 5170/ FSHN 5170).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 2-3 credits in microbiology and/or immunology.

Explore current research on gut microbiome including modern tools used to study the gut microbiome. Examine the linkages between gut microbiome and health status, diseases, and manipulation of gut microbiome to improve health. (Typically Offered: Fall)

VMPM 5200: Principles of Immunology

Credits: 3. Contact Hours: Lecture 3.

Prereq: MICRO 3100 or Permission of Instructor

Nature of the immune system and its role in health and disease. Graduation Restriction: Credit for either VMPM 5200 or 5750, but not both may be applied toward graduation. (Typically Offered: Fall)

VMPM 5250: Intestinal Microbiology

(Cross-listed with MICRO 5250).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Overview of commensal microbiota in the health and well-being of vertebrates. Topics include diversity of intestinal structure, microbial diversity/function, innate immune development, community interactions and metabolic diseases associated with alterations of the intestinal microbiome. Offered even-numbered years. (Typically Offered: Spring)

VMPM 5280: Principles of Epidemiology and Population Health

(Dual-listed with VDPAM 4280/ VMPM 4280/ MICRO 4280). (Cross-listed with VDPAM 5280).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Epidemiology of disease in populations. Disease causality, observational study design and approaches to epidemiologic investigations. This course is available on campus and by distance. (Typically Offered: Spring)

VMPM 5360: Zoonoses and Environmental Health

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Pathogenesis and control of zoonotic diseases. Factors influencing transmission and survival of pathogenic microorganisms in the environment. Offered odd-numbered years. (Typically Offered: Spring)

VMPM 5400: Livestock Immunogenetics

(Cross-listed with MICRO 5400/ ANS 5400).

Credits: 2. Contact Hours: Lecture 2.

Prereq: ANS 5610 or MICRO 5750 or VMPM 5200 or Graduate Classification

Basic concepts and contemporary topics in genetic regulation of livestock immune response and disease resistance. Offered odd-numbered years. (Typically Offered: Spring)

VMPM 5420A: Introduction to Molecular Biology Techniques: DNA Techniques

(Cross-listed with BMS 5420A/ EEOB 5420A/ FSHN 5420A/ GDCB 5420A/ HORT 5420A/ NREM 5420A/ NUTRS 5420A/ VDPAM 5420A/ BBMB 5420A).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes genetic engineering procedures, sequencing, PCR, and genotyping. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

VMPM 5420C: Introduction to Molecular Biology Techniques: Cell Techniques

(Cross-listed with BMS 5420C/ EEOB 5420C/ FSHN 5420C/ GDCB 5420C/ HORT 5420C/ NREM 5420C/ NUTRS 5420C/ BBMB 5420C/ VDPAM 5420C).

Credits: 1. Contact Hours: Laboratory 2.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. ular biology techniques and related procedures. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

VMPM 5420D: Introduction to Molecular Biology Techniques: Plant Transformation

(Cross-listed with BMS 5420D/ EEOB 5420D/ FSHN 5420D/ GDCB 5420D/ HORT 5420D/ NREM 5420D/ NUTRS 5420D/ BBMB 5420D/ VDPAM 5420D).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: Agrobacterium and particle gun-mediated transformation of tobacco, Arabidopsis, and maize, and analysis of tranformants. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

VMPM 5420E: Introduction to Molecular Biology Techniques: Proteomics

(Cross-listed with BMS 5420E/ EEOB 5420E/ FSHN 5420E/ GDCB 5420E/ HORT 5420E/ NREM 5420E/ NUTRS 5420E/ BBMB 5420E/ VDPAM 5420E).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: two-dimensional electrophoresis, laser scanning, mass spectrometry, and database searching. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

VMPM 5420F: Introduction to Molecular Biology Techniques: Metabolomics

(Cross-listed with BMS 5420F/ EEOB 5420F/ FSHN 5420F/ GDCB 5420F/ HORT 5420F/ NREM 5420F/ NUTRS 5420F/ BBMB 5420F/ VDPAM 5420F).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Includes: metabolomics and the techniques involved in metabolite profiling. For non-chemistry majoring students who are seeking analytical aspects into their biological research projects. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

VMPM 5420G: Introduction to Molecular Biology Techniques: Genomic

(Cross-listed with BMS 5420G/ EEOB 5420G/ FSHN 5420G/ GDCB 5420G/ HORT 5420G/ NREM 5420G/ NUTRS 5420G/ BBMB 5420G/ VDPAM 5420G).

Credits: 1. Contact Hours: Lecture 0.5, Laboratory 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

VMPM 5500X: Introduction to a Research Career in Industry

(Dual-listed with BMS 4500/ VMPM 4500). (Cross-listed with BMS 5500X).

Credits: 1. Contact Hours: Lecture 2.

Prereq: Graduate Standing or Permission of Instructor

Explores research career paths in industry. Course will discuss ways students can prepare competitive applications and skill sets necessary for success. Concepts of regulatory constraints, quality management systems and intellectual property will also be introduced. Material will be presented by industry associates and leaders. Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

VMPM 5750: Immunology

(Dual-listed with MICRO 4750). (Cross-listed with MICRO 5750).

Credits: 3. Contact Hours: Lecture 3.

Prereq: MICRO 3100 or Graduate Classification

An examination of humoral and cellular immune function as well as the interaction of the cells and factors of the immune system that result in health and disease. MICRO 4750L optional. Graduation Restriction: Credit for either MICRO 4750 or VMPM 5200, but not both, may be applied to graduation. (Typically Offered: Spring)

VMPM 5860: Medical Bacteriology

(Cross-listed with MICRO 5860).

Credits: 4. Contact Hours: Lecture 4.

Prereq: MICRO 3100 or Graduate Classification

Bacteria associated with diseases of vertebrates, including virulence factors and interaction of host responses. Concurrent students need to register for 5860L. (Typically Offered: Fall)

VMPM 5860L: Medical Bacteriology Laboratory

Credits: 2. Contact Hours: Laboratory 6.

Prereq: Graduate Standing or Permission of Instructor

Laboratory in clinical bacteriology and mycology. Credit or enrollment in VMPM 5860 or VMPM 6250. (Typically Offered: Fall)

VMPM 5870: Animal Virology

Credits: 4. Contact Hours: Lecture 4.

Prereq: Instructor Permission for Course

Principles of animal virology. Biology of viruses associated with diseases of veterinary importance, including mechanisms of pathogenesis.

(Typically Offered: Spring)

VMPM 5900: Special Topics

Credits: 1-5. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

VMPM 5990: Creative Component

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

A written report based on laboratory research, library reading, or topics related to the student's area of specialization and approved by the student's advisory committee. (Typically Offered: Fall, Spring, Summer)

Courses for graduate students:**VMPM 6040: Seminar**

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Offered on a satisfactory-fail basis only. (Typically Offered: Fall)

VMPM 6080: Molecular Virology

(Cross-listed with MICRO 6080/ PLP 6080).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BBMB 4050 or GDCB 5110

Advanced study of virus host-cell interactions. Molecular mechanisms of viral replication and pathogenesis. Offered even-numbered years.

(Typically Offered: Fall)

VMPM 6150: Molecular Immunology

(Cross-listed with MICRO 6150/ BBMB 6150).

Credits: 3. Contact Hours: Lecture 3.

Current topics in molecular aspects of immunology: T and B cell receptors; major histocompatibility complex; antibody structure; immunosuppressive drugs and viruses; and intracellular signaling pathways leading to expression of genes that control and activate immune function. Offered odd-numbered years. (Typically Offered: Fall)

VMPM 6250: Mechanisms of Bacterial Pathogenesis

(Cross-listed with MICRO 6250).

Credits: 3. Contact Hours: Lecture 3.

Review of current concepts in specific areas of microbial pathogenesis including the genetic basis for bacterial disease, genetic regulation and control of virulence factors and their mechanisms of action, and host-pathogen interactions at the cellular and molecular levels. The application of microbial genetics to understanding pathogenesis will be included. Offered odd-numbered years. (Typically Offered: Spring)

VMPM 6290: Advanced Topics in Cellular Immunology

Credits: 2. Contact Hours: Lecture 2.

Prereq: VMPM 5200 or VMPM 5750

Current topics and literature in cellular immunology. Topics include thymocyte development and selection, T cell interactions with antigen presenting cells, and lymphocyte effector functions. Offered even-numbered years. (Typically Offered: Spring)

VMPM 6600: Pathogenesis of Persistent Infections

(Cross-listed with VPTH 6600).

Credits: 2. Contact Hours: Lecture 2.

Study of current knowledge related to host pathogen interactions during persistent and chronic infections by bacteria, viruses and parasites.

Offered odd-numbered years. (Typically Offered: Spring)

VMPM 6900A: Current Topics: Immunology

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Instructor Permission for Course

Colloquia or advanced study of specific topics in a specialized field. (Typically Offered: Fall, Spring, Summer)

VMPM 6900B: Current Topics: Infectious Diseases

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Instructor Permission for Course

Colloquia or advanced study of specific topics in a specialized field. (Typically Offered: Fall, Spring, Summer)

VMPM 6980: Seminar in Molecular, Cellular, and Developmental Biology

(Cross-listed with BBMB 6980/ GDCB 6980/ MICRO 6980/ MCDB 6980).

Credits: 1-2. Contact Hours: Lecture 2.

Repeatable.

Student and faculty presentations. (Typically Offered: Spring)

VMPM 6990: Research

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

Courses primarily for professional curriculum students:

VMPM 7378: Case Study IV

Credits: 2. Contact Hours: Lecture 2.

Case-based applied learning that relates to the basic science courses. Emphasis on early integration of basic and clinical science concepts. (Typically Offered: Spring)

VMPM 7380: Veterinary Immunology

Credits: 2. Contact Hours: Lecture 2.

Structure and function of the immune system in animals. (Typically Offered: Spring)

VMPM 7386: Veterinary Microbiology

Credits: 5. Contact Hours: Lecture 3, Laboratory 5.

Bacteria and fungi of veterinary importance with emphasis on mechanisms of disease production and laboratory diagnostic procedures. (Typically Offered: Fall)

VMPM 7387: Veterinary Virology

Credits: 3. Contact Hours: Lecture 3.

Basic principles of animal virology. Pathogenesis of viral infections. The nature and ecology of viruses of veterinary and zoonotic importance. (Typically Offered: Spring)

VMPM 7388: Public Health and the Role of the Veterinary Profession

Credits: 3. Contact Hours: Lecture 3.

Fundamental epidemiology, zoonotic diseases, occupational health, food safety, other public health topics. (Typically Offered: Spring)

VMPM 7390: Topics in Veterinary History

Credits: 1. Contact Hours: Lecture 1.

An overview of the history of veterinary medicine focused primarily on disease-specific events. A review of the historical aspects of the veterinary profession's accomplishments in the discovery of the etiological origins of disease and their subsequent control will provide students with insights that are applicable to understanding and solving today's animal and human health challenges. (Typically Offered: Fall, Spring)

VMPM 7437: Infectious Diseases and Preventive Medicine

Credits: 3. Contact Hours: Lecture 3.

Etiology, epidemiology, laboratory diagnosis, regulatory control and preventive medicine aspects of the infectious diseases of swine, sheep, goats, cattle, horses, poultry, and honeybees. (Typically Offered: Spring)

VMPM 7486: Laboratory in Public Health

Credits: 2. Contact Hours: Laboratory 5.

Repeatable.

Discussions, lectures, exercises and field trips related to veterinary public health. (Typically Offered: Fall, Spring, Summer)

VMPM 7490: Independent Study

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

VMPM 7491: CDC Epidemiology Elective Preceptorship

Credits: 6.

Introduction to preventive medicine, public health and the principles of applied epidemiology within the working atmosphere of the Centers for Disease Control and Prevention. (Typically Offered: Fall, Spring, Summer)

VMPM 7496: International Experience

Credits: 1-12. Repeatable.

International Preceptorships and Study Abroad group programs. Opportunities for students to be involved in applied clinical, production, and/or research experiences in international locations. The course consists of 40 hour per week experiential learning opportunities. (Typically Offered: Fall, Spring, Summer)

Veterinary Pathology (VPTH)

Courses primarily for undergraduates:

VPTH 3530: Introductory Parasitology

(Cross-listed with BIOL 3530/ MICRO 3530).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2120

Biology and host-parasite relationships of major groups of animal parasites, and techniques of diagnosing and studying parasites. (Typically Offered: Spring)

VPTH 4010: Basics of Medical Terminology

Credits: 1. Contact Hours: Lecture 1.

Discussion of prefixes, suffixes, and roots (mostly from Latin and Greek) that comprise medical terms. (Typically Offered: Fall)

VPTH 4020: Introduction to Pathology

(Cross-listed with BIOL 4020).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2110, BIOL 2110L, BIOL 2120, and BIOL 2120L

Introductory exploration of pathology as a medical discipline. This includes study of disease mechanisms via an introduction to general pathology topics (cell degeneration, necrosis, disturbances of growth, disturbances of blood flow, inflammation, neoplasia) and organ system-specific response to injury. (Typically Offered: Fall)

VPTH 4030: Introduction to Pathology II

(Cross-listed with BIOL 4030).

Credits: 3. Contact Hours: Lecture 3.

Prereq: VPTH 4020 and BIOL 4020

Continuation of pathology topics begun in VPTH/BIOL 4020. How specific organ systems respond to injury using principles and information covered in VPTH 4020/ BIOL 4020. Study of a set of prototypical diseases that affect humans and animals. (Typically Offered: Spring)

Courses primarily for graduate students, open to qualified undergraduates:

VPTH 5030: Principles of Pathology

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introductory exploration of pathology as a medical discipline. This includes study of disease mechanisms via an introduction to general pathology topics (cell degeneration, necrosis, disturbances of growth, disturbances of blood flow, inflammation, neoplasia) and organ system-specific response to injury. (Typically Offered: Spring)

VPTH 5300: Teaching and Learning in Veterinary Medical Education

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Study of principles of teaching and learning as they relate to veterinary medical education. These include: theories of learning, analyzing content/learners/context, identifying goals, identifying appropriate instructional strategies (specific to medical education), matching assessment processes to goals and strategies, common curricular approaches and decision-making processes in medical education, and the scholarship of teaching and learning for veterinary medical educators. Offered even-numbered years. (Typically Offered: Fall)

VPTH 5420: Anatomic Pathology I

(Dual-listed with VPTH 7342).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Graduate Standing or Permission of Instructor

Basic pathology with emphasis on disease in animals and introduction to disease by system. (Typically Offered: Spring)

VPTH 5480: Diagnostic Parasitology Laboratory

Credits: 1-3. Contact Hours: Laboratory 9.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Contact hours are (0-3 to 0-9). A laboratory experience in the technical and applied aspects of veterinary parasitology. (Typically Offered: Fall, Spring, Summer)

VPTH 5490: Clinical Pathology Laboratory

Credits: 1. Contact Hours: Laboratory 3.

Repeatable, maximum of 1 credits.

Prereq: Graduate Standing or Permission of Instructor

Laboratory procedures and clinical interpretations with emphasis on hematology, cytology, and clinical chemistry. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

VPTH 5500: Surgical Pathology Laboratory

Credits: 1-3. Contact Hours: Laboratory 9.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Contact hours are (0-3 to 0-9). Diagnosis of lesions in biopsy specimens; classification of neoplasms. Course includes rotation through departmental biopsy service and review of selected cases from departmental archives. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

VPTH 5510: Postmortem Pathology Laboratory

Credits: 1-3. Contact Hours: Laboratory 9.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Contact hours are (0-3 to 0-9). Necropsy techniques of animals with emphasis on gross and microscopic lesions and diagnosis. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

VPTH 5540: Ethics in Scientific Research and Writing

Credits: 1. Contact Hours: Lecture 1.

Prereq: Graduate Standing or Permission of Instructor

Ethical conduct in biomedical research, criticism, writing, and adherence to regulations. Offered even-numbered years. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

VPTH 5700: Systemic Pathology I

Credits: 4. Contact Hours: Lecture 4.

Prereq: [Graduate Classification and (VPTH 3420 or VPTH 5420)] OR Instructor Permission

Pathology of the respiratory, reproductive, endocrine, musculoskeletal, and cardiovascular systems. Emphasis on pathogenesis and histopathology correlated with interpretive clinical pathology where appropriate. DVM degree required. Offered even-numbered years. (Typically Offered: Fall)

VPTH 5710: Systemic Pathology II

Credits: 4. Contact Hours: Lecture 4.

Prereq: Graduate Standing or Permission of Instructor

Pathology of the integumentary, urinary, digestive, lymphoid, and nervous systems and special senses. Emphasis on pathogenesis and histopathology correlated with interpretive clinical pathology where appropriate. DVM degree required. Offered odd-numbered years. (Typically Offered: Fall)

VPTH 5720: Anatomic Pathology II

(Dual-listed with VPTH 7372).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Response to injury by each body system. (Typically Offered: Fall)

VPTH 5760: Veterinary Parasitology

(Dual-listed with VPTH 7376).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: Graduate Standing or Permission of Instructor

Parasitic diseases of domestic animals and their control. (Typically Offered: Fall)

VPTH 5900A: Special Topics: Veterinary Pathology

Credits: 1-4. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

VPTH 5900B: Special Topics: Veterinary Parasitology

Credits: 1-4. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

VPTH 5900C: Special Topics: Veterinary Toxicology

Credits: 1-4. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

(Typically Offered: Fall, Spring, Summer)

VPTH 5900D: Special Topics: Veterinary Clinical Pathology

Credits: 1-4. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

VPTH 5900E: Special Topics: Other

Credits: 1-4. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

VPTH 5960: International Preceptorship

Credits: 1-12. Repeatable, maximum of 12 credits.

Prereq: Graduate Standing or Permission of Instructor

International Preceptorships and Study Abroad Group programs.

This course will provide opportunities for students to be involved in applied clinical, production, and/or research experiences in international locations. The course consists of 40 hour per week experiential learning opportunities. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

VPTH 5990A: Creative Component Research: Veterinary Pathology

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Course for departmental graduate research. (Typically Offered: Fall, Spring, Summer)

VPTH 5990B: Creative Component Research: Veterinary Parasitology

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Course for departmental graduate research. (Typically Offered: Fall, Spring, Summer)

VPTH 5990C: Creative Component Research: Veterinary Toxicology

Credits: 1-30. Repeatable.

Course for departmental graduate research. (Typically Offered: Fall, Spring, Summer)

VPTH 5990D: Creative Component Research: Veterinary Clinical Pathology

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Course for departmental graduate research. (Typically Offered: Fall, Spring, Summer)

Courses for graduate students:

VPTH 6040: Pathology Case Seminar

Credits: 1-2. Contact Hours: Lecture 2.

Repeatable.

Description and interpretation of microscopic lesions and clinical pathology data collected from cases of natural and experimental disease. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

VPTH 6050: Current Topics Seminar

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Prereq: Instructor Permission for Course

A seminar of graduate research at the time of thesis or dissertation defense. (Typically Offered: Fall, Spring, Summer)

VPTH 6060A: Diagnostic Interpretation: Veterinary Pathology

Credits: Required. Contact Hours: Lecture 1.

Prereq: VPTH majors only

A comprehensive examination in the diagnostic description and interpretation of case materials relevant to veterinary pathology and areas of specialization for the graduate degree preliminary examination. (Typically Offered: Fall, Spring, Summer)

VPTH 6060B: Diagnostic Interpretation: Veterinary Parasitology

Credits: Required. Contact Hours: Lecture 1.

Prereq: VPTH majors only

A comprehensive examination in the diagnostic description and interpretation of case materials relevant to veterinary pathology and areas of specialization for the graduate degree preliminary examination. (Typically Offered: Fall, Spring, Summer)

VPTH 6060C: Diagnostic Interpretation: Veterinary Toxicology

Credits: Required. Contact Hours: Lecture 1.

Prereq: VPTH majors only

A comprehensive examination in the diagnostic description and interpretation of case materials relevant to veterinary pathology and areas of specialization for the graduate degree preliminary examination. (Typically Offered: Fall, Spring, Summer)

VPTH 6060D: Diagnostic Interpretation: Veterinary Clinical Pathology

Credits: Required. Contact Hours: Lecture 1.

Prereq: VPTH majors only

A comprehensive examination in the diagnostic description and interpretation of case materials relevant to veterinary pathology and areas of specialization for the graduate degree preliminary examination. (Typically Offered: Fall, Spring, Summer)

VPTH 6550: Cellular and Molecular Pathology I

Credits: 3. Contact Hours: Lecture 3.

Cellular and molecular mechanisms of cell injury, cellular responses to injury, and inflammation. Graduate course in biochemistry, genetics, or cell biology recommended. Offered odd-numbered years. (Typically Offered: Spring)

VPTH 6560: Cellular and Molecular Pathology II

(Cross-listed with TOX 6560).

Credits: 3. Contact Hours: Lecture 3.

Cellular and molecular mechanisms of carcinogenesis. Offered even-numbered years. (Typically Offered: Spring)

VPTH 6600: Pathogenesis of Persistent Infections

(Cross-listed with VMPP 6600).

Credits: 2. Contact Hours: Lecture 2.

Study of current knowledge related to host pathogen interactions during persistent and chronic infections by bacteria, viruses and parasites. Offered odd-numbered years. (Typically Offered: Spring)

VPTH 6610: Comparative Immunology and Infectious Disease

(Cross-listed with IMBIO 6610).

Credits: 2. Contact Hours: Lecture 2.

Discuss and define similarities and differences of varied host responses to infectious challenge. Learning will focus on comparative aspects of the host response and the unique aspects of immunity from different organisms, while highlighting molecular and mechanistic similarities of pathogen recognition, response and resolution. Offered odd-numbered years. (Typically Offered: Spring)

VPTH 6790: Histopathology of Laboratory Animals

Credits: 2.

Prereq: VPTH 5700 or VPTH 5710; Permission of Instructor

Study of microscopic lesions in laboratory animals with emphasis on description, etiology, pathogenesis, and diagnosis.

VPTH 6990A: Research: Veterinary Pathology

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Course restricted to graduate program within the department. (Typically Offered: Fall, Spring, Summer)

VPTH 6990B: Research: Veterinary Parasitology

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Course restricted to graduate program within the department. (Typically Offered: Fall, Spring, Summer)

VPTH 6990C: Research: Veterinary Toxicology

Credits: 1-30. Repeatable.

Course restricted to graduate program within the department. (Typically Offered: Fall, Spring, Summer)

VPTH 6990D: Research: Veterinary Clinical Pathology

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Course restricted to graduate program within the department. (Typically Offered: Fall, Spring, Summer)

Courses primarily for professional curriculum students:

VPTH 7342: Anatomic Pathology I

(Dual-listed with VPTH 5420).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Basic pathology with emphasis on disease in animals and introduction to disease by system. (Typically Offered: Spring)

VPTH 7372: Anatomic Pathology II

(Dual-listed with VPTH 5720).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Response to injury by each body system. (Typically Offered: Fall)

VPTH 7376: Veterinary Parasitology

(Dual-listed with VPTH 5760).

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Parasitic diseases of domestic animals and their control. (Typically Offered: Fall)

VPTH 7377: Case Study III

Credits: 2. Contact Hours: Lecture 1, Laboratory 2.

Clinical applications of the basic sciences taught concurrently in the fall semester of the second year curriculum in veterinary medicine. (Typically Offered: Fall)

VPTH 7409: Introduction to Veterinary Cytology and Laboratory Techniques

Credits: 1. Contact Hours: Laboratory 2.

Description, interpretation, and techniques for cellular preparations from tissues and body fluids. (Typically Offered: Spring)

VPTH 7425: Clinical Pathology

Credits: 4. Contact Hours: Lecture 2, Laboratory 4.

Principles of clinical hematology, clinical chemistry, and urinalysis in domestic animals. (Typically Offered: Spring)

VPTH 7456: Necropsy Laboratory Practicum

Credits: 1. Contact Hours: Laboratory 2.5.

Repeatable.

Practicum in postmortem examination and diagnosis.

VPTH 7457: Clinical Pathology Laboratory Practicum

Credits: 1. Contact Hours: Laboratory 1.

Repeatable.

Methodology in clinical chemistry, hematology and cytology; practice in interpretation of laboratory data.

VPTH 7476X: Clinical Veterinary Parasitology

Credits: 1-2. Repeatable.

Two week clinical rotation in clinical veterinary parasitology. Students will investigate parasitic disease with supervision of the instructors. Variable amount of travel to farm or sites will be required. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel.

VPTH 7490: Independent Study

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

(Typically Offered: Fall, Spring, Summer)

VPTH 7492: Orientation for International Experience

Credits: 1. Contact Hours: Lecture 1.

Repeatable, maximum of 1 credits.

8 weeks. Predeparture orientation for group study abroad. Cultural considerations for the study abroad experience and a conversational language introduction. Out of class work will be assigned. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

VPTH 7495: Clinical Competency Skills Checklist/Remediation

Credits: Required. Contact Hours: Lecture 1.

In order to graduate, all 4th year veterinary students are required to complete a checklist of clinical procedures and complete any assigned remediation (based on evaluation in core clinical rotations). These requirements are tied to the college's AVMA COE accreditation, and this course is used to document completion of those requirements. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

VPTH 7496: International Experience

Credits: 1-12. Repeatable.

International Preceptorships and Study Abroad Group programs.

Opportunities for students to be involved in applied clinical, production, and/or research experience in international locations. The course consists of 40 hour per week experiential learning opportunities. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

Wind Energy Science, Engineering and Policy (WESEP)

Courses primarily for graduate students, open to qualified undergraduates:

WESEP 5010: Wind Energy Resources

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Forecasting, wind measurement and analysis, site placement, aerodynamic principles associated with blade design, power generation technologies, power electronic topologies used in wind energy conversion, collection circuits, and grid operation with high wind penetration.

WESEP 5020: Wind Energy Systems

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Systems approach to wind turbine design, manufacturing, installation, integrated with wind economics and policy issues. Topics include manufacturing practices used to produce wind turbines, construction practices, sensing and inspection technologies used in monitoring wind farm health, and the impact of policy making on the wind energy industry.

WESEP 5110: Wind Energy System Design

(Cross-listed with AERE 5110).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Advanced design, control, and operation of wind plants. Topics include electromechanical energy conversion systems, aerodynamic and aeroelastic loads, optimal control of wind farms, life cycle management strategies, tall tower design, and prediction of component residual life.

WESEP 5900: Special Topics

Credits: 1-3. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Advanced study of a research topic in the field of wind energy, science, engineering, and policy.

WESEP 5940: Wind Energy Real-Time Research Collaborative Seminar

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Identifying current wind energy research issues and conducting components of the research cycle in real-time, including proposal development, investigation/analysis/discovery, publication and presentation, ethical behavior, and leadership. (Typically Offered: Fall, Spring)

Women in Science and Engineering (WISE)

Courses primarily for undergraduates:

WISE 2010: Foundations in Development for Women* in STEM

Credits: 3. Contact Hours: Lecture 1.5, Discussion 1.5.

Foundation for developing skills and attitudes needed for responsible citizenship and complex problem solving in STEM. Exploration of experiences of diverse women* leaders in STEM fields. Development of an awareness that experiences in STEM cultures vary among women and intersecting identities and becoming open to diverse perspectives. Across multiple disciplinary perspectives in STEM, engagement with peers across STEM fields, development of community in small groups with peer leaders, and building of relationships with university leadership, industry professionals, and company executives. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall)

WISE 3070: Women in Science and Engineering

(Cross-listed with WGS 3070/ BIOL 3070).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500; Sophomore classification

The interrelationships of women and science and engineering examined from historical, sociological, philosophical, and biological perspectives. Factors contributing to under-representation; feminist critiques of science; examination of successful strategies. Does not satisfy biology major advanced credit requirements. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall)

WISE 4010: Be WiSE: Life After Graduation

Credits: 1. Contact Hours: Laboratory 2.

Overview of financial and professional skills that will prepare you for success in your postgraduate STEM journey. Exploring opportunities that may lead to your life and career purpose in STEM. Establishing a diverse professional network, identifying mentors, and navigating STEM work environments. Learn about intergenerational communication, maintaining health in your personal and work life, and cultivating your authenticity as a professional. Offered on a satisfactory-fail basis only. (Typically Offered: Spring)

Women's and Gender Studies (WGS)

Courses primarily for undergraduates:

WGS 1600: Gender Justice

Credits: 1. Contact Hours: Lecture 0.5, Discussion 0.5.

Half semester course. Examines the socialization process in the United States and how our perspectives are formed. An introduction to patriarchy, sexism, and ally development are explored. Skills to enhance communication and understanding among women and men will be developed. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

WGS 2010: Introduction to Women's and Gender Studies

Credits: 3. Contact Hours: Lecture 3.

Introduction to the interdisciplinary field of Women's and Gender Studies. Contemporary status of women in the U.S. and worldwide from social, economic, historical, political, philosophical and literary perspectives. Analysis of intersection of gender, race, class, and sexuality. Subject matter includes work, health, sexuality, and violence. Foundation for the other courses in the program. Meets U.S. Cultures and Communities Requirement.

WGS 2030: Introduction to Lesbian Communities

Credits: 3. Contact Hours: Lecture 3.

Study of contemporary and historic lesbian cultures and communities from a US and international perspective. Addresses issues of race, class, gender and sexuality as they intersect with the formation of lesbian identities. Explores who identifies as lesbian and how that dis/enables political resistance and formation of community. Meets U.S. Cultures and Communities Requirement.

WGS 2050: Introduction to Queer Studies

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 1500

Interdisciplinary study of issues relating to lesbian, gay, bisexual, transgender, and queer identities in the U.S. Attention will be given to race and socioeconomic class. Meets U.S. Cultures and Communities Requirement.

WGS 2100: Gender and Sexuality in American Pop Culture

Credits: 3. Contact Hours: Lecture 3.

Introduction to research and theory examining the ways gender and sexuality are conveyed through popular culture texts. Analysis of codes and their influence on the development of identities that shape how we view the world. Discussion of intersectional topics including race and class.

WGS 3010: International Perspectives on Women and Gender

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: WGS 2010 or 3 credits in WGS at 3000 level or above

Study of women in a range of cultures, depending on faculty specialization. Special emphasis on women in development seen in postcolonial context. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

WGS 3070: Women in Science and Engineering

(Cross-listed with BIOL 3070/ WISE 3070).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500; Sophomore classification

The interrelationships of women and science and engineering examined from historical, sociological, philosophical, and biological perspectives. Factors contributing to under-representation; feminist critiques of science; examination of successful strategies. Does not satisfy biology major advanced credit requirements. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall)

WGS 3080: Write Like a Woman

(Cross-listed with ENGL 3080).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500

Writing and reading interpretive fiction written by women. Emphasis on stories that embody a female literary life, gender-specific ways of creating characters and conflicts, analytical reading and writing, workshop criticism and shared commentaries. Includes multi-modal projects. (Typically Offered: Fall)

WGS 3200: Ecofeminism

(Cross-listed with ENVS 3200).

Credits: 3. Contact Hours: Lecture 3.

Prereq: WGS 2010 or 3 credits in WGS at 3000 level or above

Women's relationships with the earth, non-human nature, and other humans. The course explores the connections between society's treatment of women and nature; origins of ecofeminism and how it relates to the science of ecology, conventional and sustainable agriculture as well as how ecofeminism relates to other branches of feminist philosophy. Evaluation and critique of modern science, technology, political systems and SOLUTIONS will be included.

WGS 3210: Economics of Discrimination

(Cross-listed with ECON 3210).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 1010

Economic theories of discrimination. Analysis of the economic problems of women and minorities in such areas as earnings, occupations, and unemployment. Public policy concerning discrimination. Poverty measurement and antipoverty programs in the U.S. Meets U.S. Cultures and Communities Requirement.

WGS 3230: Gender and Communication

(Cross-listed with SPCM 3230).

Credits: 3. Contact Hours: Lecture 3.

Examination of how understanding and enactment of gender identity is shaped by communication. Verbal and nonverbal communication across various contexts including personal relationships and the media. Explores discourse of social movements aiming to transform cultural definitions of gender. Meets U.S. Cultures and Communities Requirement.

WGS 3250: Portrayals of Gender and Sexualities in the Media

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Survey of how the media and popular culture portray gender and sexualities and the impact on individuals and society. Images of women, men, transgender as well as heterosexual, non-heterosexual and others. Studies both historical and emerging images in the media in terms of stereotypes and positive images.

WGS 3270: Gender and Sexualities in Society

(Cross-listed with SOC 3270).

Credits: 3. Contact Hours: Lecture 3.

Develop a foundational understanding of the role of gender and sexuality in society. Students will explore the biological, social, and cultural meanings of gender and sexuality and their intersections with class, race/ethnicity, ability, socioeconomic status and other identities. Contemporary social science research, theories, and feminist perspectives as they relate to gender and sexuality, and explores gender and sexuality within families, education, the media, politics, and the economy. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Fall, Spring, Summer)

WGS 3280: Sociology of Masculinities and Manhood

(Cross-listed with SOC 3280).

Credits: 3. Contact Hours: Lecture 3.

Examination of socially constructed and idealized images of manhood, the nature of social hierarchies and relations constructed on the basis of imagery, ideologies, and norms of masculinity. Theories on gender (sociological, psychological, and biological). Particular attention given to theory and research on gender variations among men by race, class, ethnicity, sexual orientation, physical ability and age. (Typically Offered: Spring)

WGS 3330: Women, Gender, and Leadership

(Cross-listed with LDST 3330).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

An intersectional approach to understanding gender and leadership as it relates to women from various races, ethnicities, gender identities, sexual orientations and abilities. Meets U.S. Cultures and Communities Requirement.

WGS 3360: Religion, Sex and Gender

(Cross-listed with RELIG 3360).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (3 credits in RELIG or WGS) or Permission of Instructor

Gender and sexuality in the historical and contemporary contexts of various religious traditions. Meets International Perspectives Requirement. (Typically Offered: Fall)

WGS 3380: Feminist Philosophy

(Cross-listed with PHIL 3380).

Credits: 3. Contact Hours: Lecture 3.

A critical, theoretical examination of the philosophical and intellectual commitments that underlie feminist projects. Questions of identity, knowledge, and ethics will be considered from both historical and contemporary perspectives. Topics will include sex and gender, self and other, nature and nurture, masculinity and femininity, equity and justice, patriarchy, oppression, and intersectionality. 3 credits in PHIL or WGS recommended. (Typically Offered: Fall)

WGS 3390: Goddess Religions

(Cross-listed with RELIG 3390).

Credits: 3. Contact Hours: Lecture 3.

Focal study of selected global Goddess traditions in context, including American Goddess spirituality. Historical and cross-cultural images, identities, and discourses of female divinity.

WGS 3420: Culture, Sex, and Gender

(Cross-listed with ANTHR 3420).

Credits: 3. Contact Hours: Lecture 3.

Cross-cultural examination of gender and sexuality. Emphasis on global and transnational perspectives. Topics will include varied gender and sexual expressions, status and roles, intersectionality in global or transnational contexts, and the examination of systems of oppression cross-culturally. ANTHR 2010 or WGS 2010 recommended. Meets International Perspectives Requirement. (Typically Offered: Spring)

WGS 3440: Human Reproduction

(Cross-listed with BIOL 3440).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2120

Biology of human reproduction, including reproductive systems, hormones, and endocrinology of pregnancy, presented from a clinically-oriented perspective. Reviews health-related conditions such as infertility, sexually-transmitted diseases, and complicated pregnancy. (Typically Offered: Spring)

WGS 3450: Women's Literature

(Cross-listed with ENGL 3450).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500

Focused study of literature by women and about women that focuses on a particular genre (fiction, non-fiction, poetry, film, drama, media), author, or theme.

WGS 3460: Psychology of Women

(Cross-listed with PSYCH 3460).

Credits: 3. Contact Hours: Lecture 3.

Prereq: PSYCH 1010; 1 additional PSYCH course

Survey of theory and research related to major biological, interpersonal, and cultural issues affecting girls' and women's psychological development and behavior. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Spring)

WGS 3490X: Psychology of Sexual Orientation

(Cross-listed with PSYCH 3490X).

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: PSYCH 1010; 3 additional credits in PSYCH

Development of major human sexual orientation identities (e.g., bisexual, gay, heterosexual, and lesbian) from a research perspective. How persons navigate life contexts (e.g., family, work, relationships) in connection with their sexual identity. Factors that enhance positive sexual orientation identity development. (Typically Offered: Spring)

WGS 3500: Women of Color in the U.S

(Cross-listed with AFAM 3500).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 3 credits in WGS or AFAM

Economic, social, political and cultural roles of Women of Color in the U.S. Includes literary, philosophical, and artistic expressions. Myths and realities explored.

WGS 3520: Queer Literature

(Cross-listed with ENGL 3520).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500

Focused study of literary portrayals of queer lives and relationships from many different genres. Attention to changing definitions and representations of sexual orientation and LGBTQ identities over time.

WGS 3700F: Studies in English Translation: French Topics on Women and Gender Studies

(Cross-listed with FRNCH 3700F).

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Topics vary according to faculty interest. Readings, discussions, and papers in English. Meets International Perspectives Requirement.

WGS 3700G: Studies in English Translation: German Topics on Women or Feminism

(Cross-listed with GER 3700G).

Credits: 3-4. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: Sophomore classification

Topics vary according to faculty interest. Author, genre or period study, women writers, cinema, or contemporary theory. Three credits: English, open to all students. Four credits: Required for German concentration credit, supplementary readings and compositions in German. For enrollment in fourth credit, 6 credits in GER at the 3000-level. Meets International Perspectives Requirement.

WGS 3700R: Studies in English Translation: Russian Topics on Women or Feminism

(Cross-listed with RUS 3700R).

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Topics vary according to faculty interest. Author, genre or period study, women writers, cinema, or contemporary theory. Readings, discussions, and papers in English. Meets International Perspectives Requirement.

WGS 3700S: Studies in English Translation: Hispanic Topics on Women or Feminism

(Cross-listed with SPAN 3700S).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Topics vary according to faculty interest. Author, genre or period study, women writers, cinema, or contemporary theory. Readings, discussions, and papers in English. May not be counted as a prerequisite. Meets International Perspectives Requirement.

WGS 3740: Sex, Gender, and Culture in the Ancient Mediterranean World

(Cross-listed with HIST 3740/ CLST 3740).

Credits: 3. Contact Hours: Lecture 3.

Survey of the roles of women and others on the margins and the issues that impacted them in the ancient Greek and Roman worlds. Evidence from literature, the visual arts, and archaeology. Contemporary approaches to studying women, gender, and sexuality in ancient history. Intersections of gender categories with ideas of slave and free status, citizenship, and ethnicity. Readings from ancient and modern sources. Meets International Perspectives Requirement.

WGS 3800: History of Women in Science, Technology, and Medicine

(Cross-listed with HIST 3800).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

History of women's relationship to the fields of science, technology, and medicine, as students and professionals, consumers, subjects and patients, family members, workers and citizens. Concentrates especially on 19th and 20th century United States, concluding with an examination of current issues of special interest to women in science, technology, and medicine. Meets U.S. Cultures and Communities Requirement.

WGS 3850: Women in Politics

(Cross-listed with POLS 3850).

Credits: 3. Contact Hours: Lecture 3.

Entry and participation of women in politics in the United States and other countries. Contemporary issues and strategies for change through the political process. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Spring)

WGS 3860: History of Women in America

(Cross-listed with HIST 3860).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

A survey of social, economic, and political aspects of women's role from colonial era to present; emphasis on employment, education, concepts of sexuality, and changing nature of the home. Meets U.S. Cultures and Communities Requirement.

WGS 3870: First Ladies in U.S. History

(Cross-listed with POLS 3870/ HIST 3870).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

Evolution of the role and office of the First Lady in U.S. history, including her political activism, social impact, and international influence. Analysis of the authority, intersectionality and agency of First Ladies in the aggregate and exploration of how individual First Ladies have interpreted and adapted this unique public position. Offered even-numbered years. (Typically Offered: Fall)

WGS 4010: Feminist Theories

Credits: 3. Contact Hours: Lecture 3.

Prereq: 3 credits in WGS at the 3000 level or above

Current theories of feminism, the feminine and sexual difference. Topics in race, class, sexuality, and ethnicity as they are addressed in diverse feminisms. May include readings in lesbian, Black, postcolonial, psychoanalytic and postmodern thought. Meets U.S. Cultures and Communities Requirement.

WGS 4020: Feminist Research in Action

Credits: 3. Contact Hours: Lecture 3.

Prereq: WGS 2010; WGS 3010

Feminist research methods and scholarship. Class collaborates on a community research and action project to improve women's lives. (Typically Offered: Spring)

WGS 4100: Human Trafficking

(Dual-listed with SOC 5100/ WGS 5100). (Cross-listed with SOC 4100).

Credits: 3. Contact Hours: Lecture 3.

Prereq: WGS 2010 or 3 credits in WGS at 3000 level or above

Issues related to human trafficking and modern-day slavery in the US and world. History of and concepts defining forms of violence experienced by trafficking victims and methods used to recruit and control victims. Students will learn how to educate others about this crime against humanity. Examines international, federal, and state legislation to prevent human trafficking. Graduation Restriction: Only one of WGS 4100 may count toward graduation.

WGS 4220: Women, Men, and the English Language

(Cross-listed with LING 4220/ ENGL 4220).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2190 or LING 2190

The ways men and women differ in using language in varied settings and the ways in which language both creates and reflects gender divisions. (Typically Offered: Spring)

WGS 4250: Intersections of Race, Class and Gender

(Dual-listed with WGS 5250).

Credits: 3. Contact Hours: Lecture 3.

Race, ethnicity, class and gender distinctions and intersections lead to inequitable distributions of power, social well-being, and resources. Explores how inequities are institutionalized and how multiple identities are experienced by women in daily life. Meets U.S. Cultures and Communities Requirement.

WGS 4300: Gender and Consumer Culture

Credits: 3. Contact Hours: Lecture 3.

Prereq: WGS 2010 or 3 credits in WGS at 3000 level or above

Historical roots of consumer culture, political economy, technology, and how the rise of the mass-market intersects with cultural ideas of gender, race, class, and sexuality. How gender, as well as personal and group identities, is formed through all forms of consumption. Examination of gendered advertising, material goods, and lifestyles created around specific acts of consumption.

WGS 4350: Gender, Globalization and Development

(Dual-listed with WGS 5350).

Credits: 3. Contact Hours: Lecture 3.

Prereq: WGS 3010

Cross-cultural study of historical and contemporary dimensions of gender, globalization and development. Explores the interdependence of socio-economic and political aspects of globalization using feminist postcolonial and transnational frameworks. Analyses of case studies and activism in contexts of economic livelihoods, environmental justice, and cross-border migrations.

WGS 4400: Gender Issues in Sports

Credits: 3. Contact Hours: Lecture 3.

Prereq: WGS 2010 or 3 credits in WGS at 3000 level or above

Social, economic, political, and cultural variables that influence and shape sports, especially for girls and women. Topics include Title IX, coaching and administrative challenges for women, media and gender, and issues related to eating disorders, homophobia, and gender identity in sport.

WGS 4500: Topics in Women's and Gender Studies

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: WGS 2010 or 3 credits in WGS at 3000 level or above

Advanced research and theory related to special topics and issues in women's and gender studies. Specific topics indicated in the schedule of classes. Graduation Restriction: A maximum of 6 credits of WS / WGS 4500 can count toward graduation.

WGS 4570: History of American Sexualities

(Cross-listed with HIST 4570).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore classification

The social construction of American sexualities from the colonial era to the present with particular emphasis on how ideas about sex and sexuality have shaped American public life, including education, public policy, party politics, and racial justice. Meets U.S. Cultures and Communities Requirement.

WGS 4580: Queer Fashions: History, Culture, and the Industry

(Dual-listed with AMD 5580/ WGS 5580). (Cross-listed with FDM 4580).

Credits: 3. Contact Hours: Lecture 3.

Focus on analyzing the dressed and undressed body of individuals in the queer and trans communities in various cultural contexts with a focus on material culture. Examine concepts related to gender and sexuality and the changing definitions and representations of individuals who identify in the queer and trans communities focusing on appearance, fashion, and the body. Historic and current representations of fashion, styles, and appearances will be analyzed and discussed. Attention to how sexuality and gender intersect with and shape other identities including race, ability, body size, and class. Examine the complex structures, systems, and ideologies that uphold discrimination and inequitable distribution of power and resources as related to the course material. Attention will mostly be given to North American perspectives. We will use material culture to explore how objects related to fashioning the body reveal lived experiences about the owners and consumers. Offered even-numbered years. Meets U.S. Cultures and Communities Requirement. (Typically Offered: Spring)

WGS 4600: Seminar in Gender and Ethnicity

(Cross-listed with ENGL 4600).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: Junior standing

Selected readings of various authors, movements, eras, or genres. Readings in criticism; required research paper.

WGS 4900: Independent Study

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: Instructor Permission for Course

Independent study on a topic in Women's Studies. No More Than 6 Credits Of WS 4900 May Be Applied Toward Requirements For The Women's Studies Major. (Typically Offered: Fall, Spring, Summer)

WGS 4910: Internship

Credits: 1-3. Repeatable, maximum of 6 credits.

Prereq: Junior or senior classification; permission of department

Internship designed to provide an application of Women's and Gender Studies principles and methods in a workplace. To be arranged with an internal or external employer and conducted under the supervision of a member of the Women's Studies faculty. (Typically Offered: Fall, Spring, Summer)

WGS 4940: Women/Gender in Art

(Cross-listed with ARTH 4940).

Credits: 3. Contact Hours: Lecture 3.

Issues of gender related to cultural environments from the Middle Ages to contemporary times in Europe and America. Feminist movement beginning in the 1970s and specifically gender issues in art that are becoming widespread in the artistic culture.

WGS 4990: Senior Thesis

Credits: 3.

Prereq: Senior classification; Permission of Instructor

Senior thesis to be independently researched and written under the supervision of a member of the Women's Studies faculty. (Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

WGS 5010: Contemporary Feminist Theories

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Advanced study of current theoretical developments in Women's Studies in the U.S. and around the world. Examination of the epistemological bases of feminist scholarship. (Typically Offered: Fall)

WGS 5020: Advanced Seminar in Feminist Research Methods

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Focus on feminist interdisciplinary research methods. Analysis of contemporary issues facing feminist scholars. Students conduct original research. (Typically Offered: Spring)

WGS 5100: Human Trafficking

(Dual-listed with SOC 4100/ WGS 4100). (Cross-listed with SOC 5100).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Issues related to human trafficking and modern-day slavery in the US and world. History of and concepts defining forms of violence experienced by trafficking victims and methods used to recruit and control victims. Students will learn how to educate others about this crime against humanity. Examines international, federal, and state legislation to prevent human trafficking. Graduation Restriction: Only one of WGS 4100 may count toward graduation.

WGS 5250: Intersections of Race, Class and Gender

(Dual-listed with WGS 4250).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Race, ethnicity, class and gender distinctions and intersections lead to inequitable distributions of power, social well-being, and resources. Explores how inequities are institutionalized and how multiple identities are experienced by women in daily life.

WGS 5350: Gender, Globalization and Development

(Dual-listed with WGS 4350).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Cross-cultural study of historical and contemporary dimensions of gender, globalization and development. Explores the interdependence of socio-economic and political aspects of globalization using feminist postcolonial and transnational frameworks. Analyses of case studies and activism in contexts of economic livelihoods, environmental justice, and cross-border migrations.

WGS 5450: Women's Literature

(Cross-listed with ENGL 5450).

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 6 credits.

Prereq: Graduate Standing or Permission of Instructor

Primary texts by women writers; historical, thematic, formal, or theoretical approaches; secondary readings; e.g., Nineteenth-Century Women Writers; American Women's Personal Narratives; Southern Women Writers of the U.S.

WGS 5580: Queer Fashions: History, Culture, and the Industry

(Dual-listed with AMD 4580/ WGS 4580). (Cross-listed with AMD 5580).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Focus on analyzing the dressed and undressed body of individuals in the queer and trans communities in various cultural contexts with a focus on material culture. Examine concepts related to gender and sexuality and the changing definitions and representations of individuals who identify in the queer and trans communities focusing on appearance, fashion, and the body. Historic and current representations of fashion, styles, and appearances will be analyzed and discussed. Attention to how sexuality and gender intersect with and shape other identities including race, ability, body size, and class. Examine the complex structures, systems, and ideologies that uphold discrimination and inequitable distribution of power and resources as related to the course material. Attention will mostly be given to North American perspectives. We will use material culture to explore how objects related to fashioning the body reveal lived experiences about the owners and consumers. Offered even-numbered years. (Typically Offered: Spring)

WGS 5860: Readings Seminar in Women's and Gender History

(Cross-listed with HIST 5860).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Readings in women's and gender history.

WGS 5900: Special Topics

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Independent study on a topic in Women's Studies. (Typically Offered: Fall, Spring, Summer)

WGS 5940: Women/Gender in Art

(Cross-listed with ARTH 5940).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Issues of gender related to cultural environments from the Middle Ages to contemporary times in Europe and America. Feminist movement beginning in the 1970s and specifically gender issues in art that are becoming widespread in the artistic culture.

Courses for graduate students:

WGS 6210: Pedagogies of Dissent

(Cross-listed with ELPS 6210).

Credits: 3. Contact Hours: Lecture 3.

Critical examination of the theoretical foundations of contemporary and historical pedagogical traditions that seek to challenge the status quo, expand justice, and deepen democracy. (Typically Offered: Spring)

World Film Studies (WFS)

Courses primarily for undergraduates:

WFS 2370X: French and Francophone Animation

(Cross-listed with ARTH 2370X/ FRNCH 2370X).

Credits: 3. Contact Hours: Lecture 3.

Survey of French and Francophone cinematic animation and introduction to the principles of motion and French and Francophone decorative arts. Emphasis on interdisciplinary practices. (Typically Offered: Fall, Spring)

WFS 2780: Introduction to Global Film

Credits: 3. Contact Hours: Lecture 3.

Introduction to the cinema of non-English speaking regions and cultures of the world through representative subtitled films, lectures, and readings. Topics vary according to faculty interest. Emphasis on selected national cinemas and film as a mode of cultural expression as well as on diverse cultural contexts of cinema. Meets International Perspectives Requirement. (Typically Offered: Fall)

WFS 3780X: The Ancient Mediterranean World in Film and Popular Culture

(Cross-listed with CLST 3780X).

Credits: 3. Contact Hours: Lecture 3.

Examination of the representation of ancient Greece, Rome, Egypt, and other Mediterranean cultures in film and popular culture, in the U.S. and internationally; and methods of interpretation and analysis. (Typically Offered: Fall)

World Languages and Cultures (WLC)

Courses primarily for undergraduates:

WLC 1070: Introduction to Swahili

Credits: 1. Contact Hours: Lecture 1.

Basics of grammar and vocabulary within the context of the cultures where Swahili is spoken. For students whose native language is not Swahili. Taught in Swahili. Offered on-line. Offered irregularly. (Typically Offered: Spring)

WLC 1190: Introduction to World Languages

(Cross-listed with LING 1190).

Credits: 3. Contact Hours: Lecture 3.

Study of language diversity and the personal, social and political effects of diversity. Language families, attitudes toward language and language use, language and culture, multilingualism, foreign language learning, written codes, official languages, and language policy. Meets International Perspectives Requirement.

WLC 2030X: The Global Professional: Building an International Career

Credits: 1. Contact Hours: Lecture 1.

This course equips students in all fields of study with the knowledge, skills, and mindset to pursue international careers. Asynchronous online modules cover topics including global career research, intercultural competency for the job market, international networking strategies, language study for global careers, cross-cultural negotiation, resume and cover letter adaptation, and personal branding for the global market. Students who successfully complete this course will be equipped with the knowledge, skills, and job market materials to execute international internship and job searches. (Typically Offered: Fall, Fall, Spring, Spring)

WLC 2050: World Religions

(Cross-listed with RELIG 2050).

Credits: 3. Contact Hours: Lecture 3.

An introduction to religious studies - the academic study of religion. Religions from around the world will be discussed, including their myths, rituals, beliefs, values, and social forms. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

WLC 2100: Introduction to Asian American Studies

(Cross-listed with ANTHR 2100).

Credits: 3. Contact Hours: Lecture 3.

An interdisciplinary and chronological examination of Asian American immigration experiences from the early 19th century to the 21st century. Focus on how these immigration histories are accompanied by changing racial constructions. Discussion of racial stereotyping, the model minority myth, identity development, and efforts for social justice. Meets U.S. Cultures and Communities Requirement.

WLC 2700: Cultures in Transition

Credits: 3. Contact Hours: Lecture 3.

An interdisciplinary introduction to a world region in a state of rapid social and cultural transition. Discussion of the history, social and political institutions, arts, economy, agriculture, and environment of the new nations. Meets International Perspectives Requirement.

WLC 3520: Religions of India

(Cross-listed with RELIG 3520).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500 or Permission of Instructor

Study of texts, practices, beliefs, historical development, and mutual influence of a variety of the religious traditions of India. Emphasis on Vedic religion and the diversity of traditions of Classical Hinduism; survey of Buddhist, Jain, Sikh, and South Asian Islamic traditions. Meets International Perspectives Requirement.

WLC 3580: Islam

(Cross-listed with RELIG 3580).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500 or Permission of Instructor

An introduction to Islamic religion, culture, and society from its origins to the present. Topics include the Quran, the Prophet Muhammad, Islamic theology and philosophy, Islamic history, and Islam in America. Meets International Perspectives Requirement.

WLC 3590: The Quran

(Cross-listed with RELIG 3590).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENGL 2500 or Permission of Instructor

A study of the Quran, the sacred text of Islam, with attention to its history, its major themes, and the diverse ways it is interpreted and applied. Meets International Perspectives Requirement.

WLC 3700A: Topics in World Languages and Cultures in English

Translation: Global Sustainability

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Topics vary according to faculty interest. Author, genre or period study, women's writing, cinema, or cultural studies of a non-English speaking world culture or cultures. Readings, discussion, and written work in English. Meets International Perspectives Requirement.

WLC 3700B: Topics in World Languages and Cultures in English

Translation: Middle East

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Topics vary according to faculty interest. Author, genre or period study, women's writing, cinema, or cultural studies of a non-English speaking world culture or cultures. Readings, discussion, and written work in English. Meets International Perspectives Requirement.

WLC 3700C: Topics in World Languages and Cultures in English

Translation: Global Urban Cultures

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 9 credits.

Topics vary according to faculty interest. Author, genre or period study, women's writing, cinema, or cultural studies of a non-English speaking world culture or cultures. Readings, discussion, and written work in English. Meets International Perspectives Requirement.

WLC 3710: The Arabian Nights

(Cross-listed with ARABC 3710).

Credits: 3. Contact Hours: Lecture 3.

Focus on the tales of the famous '1001 Arabian Nights' book.

Discussions of the narrative tools, supernatural elements, and the culture of the Medieval Middle East. Readings, discussions, and papers in English. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

WLC 4170G: Student Teaching: World Language

(Dual-listed with EDUC 5170G/ WLC 5170G). (Cross-listed with EDUC 4170G).

Credits: 1-30. Repeatable.

Prereq: Admitted to the Educator Preparation Program

Evaluation of instruction, lesson planning, and teaching in world languages, secondary grades. (Typically Offered: Fall, Spring)

WLC 4840: Technology, Globalization and Culture

(Dual-listed with WLC 5840/ ME 5840/ MKT 5840). (Cross-listed with ME 4840/ MKT 4840).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior or Senior Classification

Cross-disciplinary examination of the present and future impact of globalization with a focus on preparing students for leadership roles in diverse professional, social, and cultural contexts. Facilitate an understanding of the threats and opportunities inherent in the globalization process as they are perceived by practicing professionals and articulated in debates on globalization. Use of a digital forum for presenting and analyzing globalization issues by on-campus and off-campus specialists. Meets International Perspectives Requirement. (Typically Offered: Fall)

WLC 4860: Methods in Elementary School World Language Instruction

(Cross-listed with EDUC 4860/ LING 4860).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 25 credits in a World Language

Planning, implementation, and assessment of standards-based, student-centered, and thematic instruction in the elementary (K-8) classroom. Special emphasis on K-8 students' communicative skills, cultural knowledge, and content learning. (Typically Offered: Fall)

WLC 4870: Methods in Secondary School World Language Instruction

(Cross-listed with EDUC 4870/ LING 4870).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 25 credits in a world language; Department Permission

Theories and principles of contemporary world language learning and teaching. Special emphasis on designing instruction and assessments for active learning. Admission to teacher education required. (Typically Offered: Fall)

WLC 4910: Experiences Abroad: Learning to Think Globally

(Cross-listed with INTST 4910).

Credits: 1. Contact Hours: Lecture 1.

Repeatable, maximum of 2 credits.

Prereq: Minimum of 3 credits of study abroad and/or internship abroad

Students returning from study abroad gain perspective on the personal, academic, and professional impact of their time spent abroad through readings and discussions. Students will be expected to make one presentation about the culture they experienced to an audience outside ISU. Offered on a satisfactory-fail basis only.

Courses primarily for graduate students, open to qualified undergraduates:

WLC 5170G: Student Teaching: World Language

(Dual-listed with EDUC 4170G/ WLC 4170G). (Cross-listed with EDUC 5170G).

Credits: 1-30. Repeatable.

Prereq: Admitted to the Educator Preparation Program

Evaluation of instruction, lesson planning, and teaching in world languages, secondary grades. (Typically Offered: Fall, Spring)

WLC 5840: Technology, Globalization and Culture

(Dual-listed with WLC 4840/ ME 4840/ MKT 4840). (Cross-listed with ME 5840/ MKT 5840).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate classification

Cross-disciplinary examination of the present and future impact of globalization with a focus on preparing students for leadership roles in diverse professional, social, and cultural contexts. Facilitate an understanding of the threats and opportunities inherent in the globalization process as they are perceived by practicing professionals and articulated in debates on globalization. Use of a digital forum for presenting and analyzing globalization issues by on-campus and off-campus specialists. Meets International Perspectives Requirement. (Typically Offered: Fall)

Youth (YTH)

Courses primarily for graduate students, open to qualified undergraduates:

YTH 5020: Foundations of Positive Youth Development

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Fundamentals of positive youth development, theories, and principles utilized in the youth development profession. Ethical, professional, and historical elements of youth development as it has evolved toward professionalization. (Typically Offered: Fall, Spring, Summer)

YTH 5100: Adolescents and Their Families

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Adolescent development as it is related to and intertwined with family development; reciprocal influences between adolescents and their families are examined. Working with youth vis a vis the family system will be highlighted. (Typically Offered: Fall, Spring)

YTH 5200: Positive Youth Development in Community Settings

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Focus on the national emphasis of a strength-based or asset approach to community youth development, encompassing individual development (i.e., positive youth development) and adolescent interrelationships with environments. Emphasis is placed upon research, theory, and practice applied in communities throughout the U.S. Students will explore existing models, read theoretical and applied literature, and examine current community efforts as a basis for understanding community youth development. (Typically Offered: Fall, Spring)

YTH 5300: Youth in Cultural Contexts

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Examination of the cultural context factors that affect youth from a holistic perspective within and outside the family unit. The course will provide an understanding of the cultural heritage of differing family structures and types. Students will explore the social and educational processes experienced by youth through in-depth reading, writing, discussion, critical listening, viewing of contemporary videos, and informal interviews with youth. Students will be encouraged to think critically about society and culture, gain further knowledge of how ethnic groups fit historically into society, and examine the results of how history has shaped the current cultural climate of the U.S. (Typically Offered: Fall, Spring)

YTH 5400: Youth Professionals as Consumers of Research

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

This course will help youth development professionals understand and evaluate research reports to reduce anxiety about applying research results and theories to practice. Specific emphasis will be on research and theory reports related to youth development. (Typically Offered: Fall, Spring)

YTH 5500: Youth Policy

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Various federal and state policies designed specifically for youth. Students will examine how and why policies for youth are constructed. A guiding question that will be used to evaluate existing state and national policies is whether they contribute to, or act as, barriers to desired developmental outcomes. (Typically Offered: Fall, Spring)

YTH 5600: Youth-Adult Relationships

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

The role of youth-adult relationships in promoting the positive development of youth. Attitudes and activities that support youth engagement and agency. Research and practice of mentorship, youth-adult partnerships, and youth leadership. (Typically Offered: Fall, Spring)

YTH 5700JX: Contemporary Youth Issues: Adolescent Sexuality, Pregnancy, and Parenthood

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

This course explores adolescent sexuality development, sexual behaviors, and pregnancy/parenthood. These topics will be explored with respect to normative development and the reciprocal influences of the youth's ecology (i.e., family, school, community). Implications for professionals working with youth sexuality, pregnancy, and parenthood will be explored and highlighted.

YTH 5700L: Contemporary Youth Issues: Mental Health

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Understand optimal mental health in youth and how it can be promoted. Current theories and research related to optimal mental health and how promoting positive development is both similar to and different from preventing negative outcomes. Learn to assess a given youth development program in terms of its potential to promote positive mental health. Offered odd-numbered years. (Typically Offered: Summer)

YTH 5700M: Contemporary Youth Issues: Working with Adolescents with Difficulties

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Examines cognitive, self, and social transitions during adolescence. Topics include issues of identity, society's understanding of adolescents, and how adolescents and their parents, siblings, peers, teachers, and society interact. Offered odd-numbered years. (Typically Offered: Summer)

YTH 5700N: Contemporary Youth Issues: Understanding Normative Behavior in Immigrant & Minority Youth

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Explores the etiology of adolescent deviance using a positive, cross-national/crosscultural perspective. Includes implications of theory, empirical research, current prevention programs and needs assessments. Offers a look at deviance from different perspectives as well as a comparison of normative and non-normative development of youth. (Typically Offered: Fall)

YTH 5700P: Contemporary Youth Issues: Youth, Families & Technology

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Understand the interconnectedness of technology and youth/family. Formulate constructive and realistic strategies to enrich the life of a family or a youth in a society heavily dependent on technology. Topics of the course include identity formation, privacy, race, class, gender, subculture, risky behavior, policing, education, globalization, health, and policies. Offered odd-numbered years. (Typically Offered: Summer)

YTH 5700R: Contemporary Youth Issues: Sports, Youth and Society

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Examination of how sports and society help us better understand what we value, how we become who we are, and how we may be able to realize social justice in a larger social context. Offered even-numbered years. (Typically Offered: Summer)

YTH 5700TX: Contemporary Youth Issues: Systems of Care for Youth at Risk

Credits: 3. Contact Hours: Lecture 3.

Repeatable, maximum of 3 times.

Prereq: Graduate Standing or Permission of Instructor

CYI: Issues faced by youth today and associated risk and resiliency factors. A different topic will be presented each year, with the course rotating among participating universities. Topics have included Adolescent Health and Sexuality, Systems of Care for Youth at Risk, Mental Health, Immigrant and Minority Youth, Sports, Technology, etc. The course may be taken more than once, as long as the content is different each time. Offered odd-numbered years. (Typically Offered: Spring)

YTH 5700UX: Contemporary Youth Issues: Adolescent Health & Sexuality

Credits: 3. Contact Hours: Lecture 3.

Repeatable.

Prereq: Graduate Standing or Permission of Instructor

CYI: Issues faced by youth today and associated risk and resiliency factors. A different topic will be presented each year, with the course rotating among participating universities. Topics have included Adolescent Health and Sexuality, Systems of Care for Youth at Risk, Mental Health, Immigrant and Minority Youth, Sports, Technology, etc. The course may be taken more than once, as long as the content is different each time. (Typically Offered: Fall)

YTH 5800: Youth Development Personnel and Program Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Introduction to the development, administration and management of youth-serving organizations. (Typically Offered: Fall, Spring)

YTH 5850: Design and Evaluation of Youth Programs

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Theoretical, methodological, and pragmatic issues involved in conducting programs and scholarship. Overview of the program development process and outcome evaluation of children and family programs. Modes of outcome scholarship and their implications for community-based programs are discussed. Students will develop knowledge through participating in a community-based project involving the practical application of program design and evaluation methods. (Typically Offered: Fall, Spring)

YTH 5890: Grant Development and Management.

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor

Grant-getting process and an overview of what happens after a project is funded. The following topics will be covered: researching funding sources, generating cutting edge ideas, assessing needs, planning a project, establishing credibility, formulating a sustainable budget, designing an evaluation plan, managing the funded project, and disseminating project results. (Typically Offered: Fall)

YTH 5990: Creative Component

Credits: 1-30. Repeatable.

Prereq: Graduate Standing or Permission of Instructor

Nonthesis students creative component (e.g., a special report, capstone course, integrated field experience, annotated bibliography, research project, design, or other creative endeavor). A minimum of five credits of independent work is required on the programs of study (POS). Creative component format determined cooperation with the POS committee. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

Courses for graduate students:**YTH 6340: Youth Development**

Credits: 3. Contact Hours: Lecture 3.

Introduction to the developmental period of adolescence. The theory and research of positive youth development will be the lens through which this developmental period is examined. The course will emphasize how the developmental tasks of this life stage are influenced by (and influence) family and home, school, peers, and other contextual forces. The course will help students recognize and become familiar with the major issues and transitions adolescents face as they successfully navigate this developmental stage by critically examining the theoretical and research literature. (Typically Offered: Fall, Spring)

YTH 6900: Advanced Topics

Credits: 1-30. Contact Hours: Lecture 30.

Repeatable.

Advanced topics. (Typically Offered: Fall, Spring, Summer)

YTH 6910: Internship

Credits: 1-30. Repeatable.

Supervised practice and experience in college teaching, research, professional experience. Offered on a satisfactory-fail basis only.

(Typically Offered: Fall, Spring, Summer)

IOWA STATE FACULTY

A

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allen, benjamin

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